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THE NEW INTERNATIONAL ENCYCLOPÆDIA

SECOND EDITION

VOLUME XXI

NEW YORK
DODD, MEAD AND COMPANY
1916

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Boston Bookbinding Co., Cambridge, U.S.A.

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KEY TO PRONUNCIATION

For a full explanation of the various sounds indicated, see the KEY TO PRONUNCIATION in Vol. I.

ā as in ale, fate.
ǡ " " senate, chaotic.
â " " glare, care, and as *e* in there.
ă " " am, at.
ä " " arm, father.
ȧ " " ant, and final *a* in America, armada, etc.
a " " final, regal, pleasant.
a̤ " " all, fall.
ē " " eve.
ė̄ " " elate, evade.
ĕ " " end, pet.
ẽ " " fern, her, and as *i* in sir, etc.
e " " agency, judgment.
ī " " ice, quiet.
ī̇ " " quiescent.
ĭ " " ill, fit.
ō " " old, sober.
ō̇ " " obey, sobriety.
ô " " orb, nor.
ŏ " " odd, forest, not.
o " " atom, carol.
oi " " oil, boil.
o͞o " " food, fool, and as *u* in rude, rule.
ou " " house, mouse.
ū " " use, mule.
ū̇ " " unite.
ŭ " " cut, but.
ụ " " full, put, or as *oo* in foot, book.
û " " urn, burn.
y " " yet, yield.
B " " Spanish Habana, Córdoba, where it is like English *v* but made with the lips alone.
ch as in chair, cheese.
D " " Spanish Almodovar, pulgada, where it is nearly like *th* in English then.
g " " go, get.
G " " German Landtag = *ch* in Ger. ach, etc.
H " *j* in Spanish Jijona, *g* in Spanish gila; like English *h* in hue, but stronger.
hw " *wh* in which.
K " *ch* in German ich, Albrecht = *g* in German Arensberg, Mecklenburg, etc.
n̲ " in sinker, longer.
ng " " sing, long.
N " " French bon, Bourbon, and *m* in the French Étampes; here it indicates nasalizing of the preceding vowel.
sh " " shine, shut.
th " " thrust, thin.
TH " " then, this.
zh " *z* in azure, and *s* in pleasure.

An apostrophe ['] is sometimes used as in tā'b'l (table), kăz″m (chasm), to indicate the elision of a vowel or its reduction to a mere murmur.

For foreign sounds, the nearest English equivalent is generally used. In any case where a special symbol, as G, H, K, N, is used, those unfamiliar with the foreign sound indicated may substitute the English sound ordinarily indicated by the letter. For a full description of all such sounds, see the article on PRONUNCIATION.

A PARTIAL LIST OF THE LEADING ARTICLES IN VOLUME XXI

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Captain Lewis Sayre Van Duzer, U.S.N., Ret.

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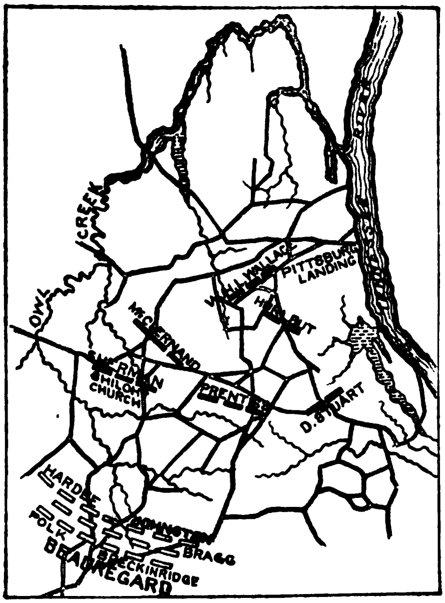
* Deceased.

THE NEW INTERNATIONAL ENCYCLOPÆDIA

SHI'LOH (Heb. *Shilôh*). A city of Ephraim, 12 miles south of Shechem, where Joshua is said to have divided that part of the land of Canaan west of the Jordan. (Josh. xviii. 10.) Its historical importance is due chiefly to its having been a sacred place where a festival was held annually in honor of Yahwe (Judg. xxi. 19–21) and to which annual pilgrimages were made by the Hebrews till the days of Samuel. (Cf. 1 Sam. i. 3.) The sanctuary at the place was a permanent structure (*hekal*, or temple), the destruction of which, possibly by the Philistines, made so deep an impression that it is referred to in the later literature. (Ps. lxxviii. 60; Jer. vii. 12.) Jeremiah distinctly speaks of it as having been once the dwelling place of Yahwe, and this historical significance of the place is illustrated in the narrative which makes Shiloh the depository of the ark of the Covenant and the abode of the tabernacle from the time of the conquest until the capture of the ark by the Philistines. (1 Sam. i–iv. 11.) Ahijah, the prophet, was a native of this place. The ancient name is preserved in the modern village of Seilun, which shows traces of various ancient buildings. Consult V. Guérin, *Samarie*, vol. ii, pp. 20 et seq. (Paris, 1875), and Benzinger, in Baedeker, *Palestine and Syria* (5th ed., Leipzig, 1912).

SHILOH, BATTLE OF, frequently called the BATTLE OF PITTSBURG LANDING. A battle of the Civil War fought at Pittsburg Landing in Tennessee, on the west bank of the Tennessee River, about 20 miles north of Corinth, Miss., on April 6 and 7, 1862, between the Federal Army of the Tennessee, reënforced by the Federal Army of the Ohio, in all about 62,500 men, under General Grant, and the Confederate army of Mississippi, about 40,500 men, under Generals A. S. Johnston and Beauregard. It takes its name from Shiloh Church, near Pittsburg Landing. On March 17, 1862, General Grant took command of the Federal forces stationed at Pittsburg Landing, and by April 1 he had an army of about 45,000 men. On March 15 General Buell, commanding the Army of the Ohio, began his march from Nashville to effect a junction with Grant, a combined offensive being planned for the two armies. General Johnston, with a large Confederate force at Corinth, determined to strike Grant before Buell could arrive and on April 3 ordered a general advance. Owing, however, to rains and bad roads, the Confederate army was not ready for action at Pittsburg Landing until late on April 5, and the attack was not delivered until early the following morning. Meanwhile the Federal officers seem not to have anticipated an attack in force and to have made no provision for such an attack nor even to have maintained cavalry scouts between Pittsburg Landing and Corinth.



SHILOH.

On the night of April 5 Grant went as usual to his headquarters at Savannah, 9 miles down the river, on the east side, where he expected to meet Buell the next morning. The positions of the two armies on the morning of April 6 are shown on the map. Of the Army of the Tennessee the only division at that time not on the field was Gen. Lew Wallace's division, stationed at Crump's Landing, 5 miles below Pittsburg Landing and on the same river bank.

At 7 A.M. Sunday, April 6, the engagement began with an attack on the Federal right under Sherman. Soon the whole Federal line was forced back, taking successive positions, gradually withdrawing before the Confederates—parts of the army acting more or less independently of one another—until the Confederates had secured the field and the Federals had formed a new line diagonally from Pittsburg Landing to Snake River. The most stubborn fighting of the day occurred at what the Confederates called the Hornet's Nest—a position assumed by W. H. L. Wallace, Hurlbut, and Prentiss about 10 A.M. and held by them against repeated assaults for five or six hours. It was here that about 2.30 P.M. General Johnston on the Confederate side was killed, Beauregard then assuming command. About 4 o'clock Hurlbut, attacked in front and flank, was forced to withdraw, and an hour later the divisions of Wallace and Prentiss were attacked in front and on both flanks. General Prentiss with about 2200 men was forced to surrender, and though Gen. W. H. L. Wallace's division managed to withdraw without being surrounded, General Wallace himself was killed. Grant arrived on the battlefield from Savannah about 8 A.M., but apparently exercised little control over the movements of the Federal troops during this first engagement. Late in the afternoon the Federal army was reënforced on its left by a division of Buell's army under General Nelson, which took part in the last fighting of the day. Before the battle was renewed on the 7th the Federal right had been reënforced by Gen. Lew Wallace, with his division from Crump's Landing, and its left by a large part of Buell's army. The Federals attacked vigorously early on the 7th and by 4 P.M. had driven the Confederates back beyond Shiloh Church, where Sherman had been originally stationed. Some pursuit of the Confederates was made, but it was effectually checked by Forrest; Beauregard withdrew to Corinth (q.v.), whither soon after he was followed by Halleck, who had assumed command in person of the Federal army. In the battle of Shiloh the Federal loss in killed, wounded, and prisoners was about 13,000; that of the Confederates about 10,700. By their defeat at Shiloh the Confederates lost all their hold on Tennessee west of the mountains, except two or three forts of the Mississippi, which were soon taken from them. Consult: *Official Records*, vol. x, parts i, ii; Swinton, *Twelve Decisive Battles of the War* (New York, 1867); Force, *From Fort Henry to Corinth* (ib., 1881); Johnson and Buel (eds.), *Battles and Leaders of the Civil War*, vol. i (ib., 1887); Nicolay and Hay, *Abraham Lincoln: A History* (ib., 1890); Grant, *Personal Memoirs* (2 vols., ib., 1895); Ropes, *Story of the Civil War*, vol. ii (ib., 1898); Steele, *American Campaigns* (Washington, 1909).

SHILOH NATIONAL MILITARY PARK. See PARK, NATIONAL MILITARY.

SHIMABARA, shē′mȧ-bä′rȧ. A city of Japan, situated on a small peninsula in the west of Kiushu, opposite Kumamoto (Map: Japan, B 7). It is famous on account of the rebellion of the peasants in 1637–38. Excited by misgovernment, they revolted, defeating the troops of their lords and seizing the ruined castle at Shimabara, which they fortified. The Shogun sent an army to put down the revolt. Meanwhile companies of Christians, who had been persecuted for 20 years by the government of the Shogun, joined the rebels. The siege lasted for 102 days, the castle yielding on April 12, 1638. All within it were massacred. The assailants, however, suffered at least an equal loss. The Dutch in Nagasaki sent their guns and ships to be used against the insurgents. Pop., about 20,000.

SHIMODA, shē′mō̇-dȧ. A seaport of Japan, situated at the extremity of the Idzu Peninsula, in central Hondo, over 60 miles south of Yokohama (Map: Japan, F 6); the first Japanese port opened to American trade. It was visited by Commodore Perry in 1854 and became in 1857 the residence of the first American Minister to Japan. The present population is about 1000.

SHIMONOSEKI, shē′mō̇-nō-sȧ′kė, or, more correctly, **AKAMAGASEKI**, ä′kȧ-mä-gȧ-sȧ′kė, or, in Sinico-Japanese, **BAKAN**, bä′kän′. A fortified maritime town of Japan, in the old Province of Choshu and Prefecture of Yamaguchi, situated at the southwestern extremity of the main island (Map: Japan, B 6). It is the southern terminus of the railway system of Hondo and stands directly opposite the town of Moji, which has sprung up in connection with the development of the railway system of Kiushu. The two form a single consular district. Pop., 1908, 58,254.

Here occurred what is known as the Shimonoseki affair, in which in 1864 by a combined naval force of 17 warships—United States, British, Dutch, and French—the Choshu clan was chastised for having fired in 1863 without provocation on foreign vessels flying the United States, French, and Dutch flags, and an indemnity of $3,000,000 was exacted. The last installment of this sum was paid in 1874. At a later date, however, the United States government refunded its share, and the money was used by the Japanese for educational purposes. Here in April, 1895, was concluded by Li Hung Chang, acting for China, and Marquis Ito, for Japan, the treaty of peace which ended the Japanese-Chinese-Korean War.

SHI′NAR. An Old Testament designation of Babylonia (q.v.).

SHINER. A name applied to many small fishes of a silvery lustre belonging mainly to the minnows. They are found in the streams of North America. A few species have received popular names, as a dace, the redfin (*Notropis cornutus*), and the golden shiner or bream (*Abramis chrysoleucas*). For the blunt-nosed shiner, see MOONFISH. See Plate of DACE AND MINNOWS.

SHINGKING, shĭng′kĭng′, **SHENGKING**, or FENGTIEN (Map: China, M 3). The wealthiest and the most important, though the smallest, of the three provinces which compose Manchuria (q.v.). Area, about 56,000 square miles. It is roughly triangular in shape, the apex pointing southward and ending in the peninsula of Lao-t'ieh Shan and Port Arthur (q.v.). The northeastern part of the province is occupied by the Shan-a-lin mountain system, whose extensions form the Ts'ien Shan ranges, a long spur of which extends southwest through the peninsula. The western portion is drained by the Liao, and the eastern by the Tayang, and partly by the Yalu Kiang. The soil is fertile, producing abundant crops of wheat, barley, millet, maize, pulse, potatoes, cotton, hemp, indigo, tobacco, opium, sesamum and other oil-producing plants, etc. Cattle raising is an extensive industry, and much wild silk is produced. Gold is found, coal and iron occur in many places and are worked, and there are large areas of valuable peat. Two railways—the Chinese from Peking via Shanhaikwan and the Russian from Port Arthur northward to Harbin—traverse the province, but communication is chiefly by roads. The chief ports are Yingtse (commonly spoken of in connection with Niuchwang), Port Arthur (q.v.), Talienwan (q.v.), Pitsewe, and Takushan, all dominated by Japan under the conditions of the treaty between that country and Russia, Dec. 22, 1905.

The population is estimated at 5,500,000, almost exclusively Chinese.

For centuries Shingking was held by the Chinese, who made Shinyang (Mukden) the capital. In 1894–95 the southern part from the Yalu to the Liao was captured by the Japanese, but was later relinquished under pressure from Russia, Germany, and France. After 1898, when Russia leased the southern portion of the peninsula and secured a neutral zone reaching to the middle of the Tayang River and including the village of Takushan, Russian influence prevailed until Japanese interests succeeded Russian. See Sir Alexander Hosie, *Manchuria: Its People, Resources, and Recent History* (London, 1910). See Manchuria.

SHINGLES. See Herpes.

SHIN′-GON′ (Jap., True Word). A Japanese sect of Buddhists. It was founded in the beginning of the ninth century A.D. by Kobo Daishi. Dissatisfied with Buddhism as taught in Japan, he visited China in 802–804 and returning formed his sect. The worship centres in Vairocana, a quasi-divine being, who is a greater Buddha; he is truth, and his emblem is the sun. He is represented as surrounded by four planets, Gautama being one of them, and these again by smaller satellites, and these again by others forming a complete system. This represents the unchanging universe of pure ideas, the "diamond world," the true world, only intellectually conceived. Around Vairocana is arranged, like the petals of a lotus, also the phenomenal world, so that all things centre in him. There are two ways of approach, by the intellect and by morality. He who attains salvation perceives the complete unity of both systems and becomes himself identical with Vairocana. The sect was eclipsed in popularity by the rise of the Shin Shu (q.v.) and the Nichiren sects and at present has comparatively little influence. Consult: Nanjo, *Short History of the Twelve Japanese Buddhist Sects* (Tokyo, 1887); Griffis, *The Religions of Japan* (New York, 1895); G. W. Knox, *The Development of Religion in Japan* (ib., 1907).

SHINN, Everett (1873–). An American painter and illustrator. He was born in Woodstown, N. J., and studied art at the Pennsylvania Academy of Fine Arts, Philadelphia, and in Paris, where he was influenced by the work of Degas. He first gained recognition with his pastels—street scenes in Paris and New York, cafés, and music halls, and also portraits—his style being somewhat reminiscent of Watteau and Fragonard, with harmonious yet daring color schemes, sure and rapid brushwork. Later he devoted himself to mural painting and magazine illustration. His mural decorations include two huge panels in the Trenton City Hall, depicting, with powerful realism, the chief industries of the city; the decorations in the Belasco and Stuyvesant theatres in New York and in private residences. He made his residence in New York and exhibited frequently.

His wife, Florence Scovel Shinn, became well known by her quaint book illustrations for *Lovey Mary, Mrs. Wiggs of the Cabbage Patch, Coniston,* etc.

SHIN′NECOCK. A remnant tribe of Algonquian stock (q.v.) residing about the bay of the same name near the southeast end of Long Island, N. Y. At the beginning of this century they numbered only about 150 persons, all more or less of negro admixture, and had entirely lost their language and all other primitive characteristics. They have no relations with the general government, but the State of New York supports a school at East Moriches for the benefit of them and the two other Long Island remnants, the Poospatuck or Unquachog, and the Montauk, numbering only a few families each. Consult Harrington, in *Journal of American Folk-Lore,* vol. xvi (Boston, 1903), and in *Southern Workman,* vol. xxxii (1903).

SHINNECOCK BAY. A large but shallow bay, on the southern shore of Long Island, N. Y., 28½ miles west of the eastern extremity of the island. It is about 8 miles long, from 3 to 4 miles wide, and is separated from the ocean by a narrow sand beach.

SHINNECOCK HILLS. A town in Suffolk Co., Long Island, N. Y., 85½ miles by rail east of Brooklyn, on the Long Island Railroad. It is a small summer resort, named after the Shinnecock (q.v.) Indians, a few of whom occupy a reservation in the vicinity.

SHIN-NUNG, shĕn′no͞ong′ (Chin., Divine Husbandman), or Shên-Nung. The second of the legendary rulers of China known as the Wu Ti, or Five Emperors. He succeeded Fuh-hi (q.v.) in 2737 B.C. and is said to have been the offspring of a certain princess who conceived under the influence of a dragon. He is credited with having introduced plows, discovered the Five Grains and the medicinal properties of plants, and to have instituted markets for the exchange of commodities. The Temple of Agriculture at Peking (q.v.) is dedicated to him. He was succeeded by Hwang-ti (q.v.) in 2697 B.C. Consult Friedrich Hirth, *Ancient History of China* (New York, 1911).

SHINNY. See Hockey, *Ice Hockey.*

SHIN′RAN SHO′NIN (1173–1262). A Japanese Buddhist theologian and the founder of the Shin Shu (q.v.), which he established when expelled from his monastery. He was of noble birth, of the great Fujiwara clan, and was educated in the monastery of the Jodo sect of Buddhists on Hiyei Zan, near Kyoto.

SHIN SHU (Jap., True Sect, full name *Jodo Shin Shu,* True Sect of the Pure Land). A Japanese Buddhist sect. As its title indicates, it is a branch of the Jodo (Pure Land) sect. Like the other Buddhist bodies in Japan the Jodo derived its teaching from China. It believes in Amida (Skt., Amitabha) only, the Buddha of boundless light, life, and mercy, one of the many beings worshiped in the Great Vehicle. Raising himself to Buddhahood, he vowed to create a Pure Land, to be glorified forever as Buddha of Boundless Light, to save all who should put their faith in his vows. Hence the object of faith is not the historic Buddha, but the vow of Amitabha. Salvation being solely by faith in the vow, the believer needs neither knowledge nor works. Rites and ceremonies are without efficacy, though the believer as an expression of gratitude lives an upright life and constantly repeats "Glory to Amida the Buddha." The priest is simply the official of the sect and its teacher, all essential distinction from the layman being done away. The priests marry, eat meat, and practice no austerity. The sect is first in popularity with the masses. Its temples are the most magnificent and the most frequented. At present it is the most progressive sect in the Empire, adopting the methods of Christian missions and sending some of its priests as students to Europe and America. In the fifteenth and sixteenth centuries it took part in the feudal wars, armed its priests, and turned its monasteries into fortresses. For more than a century it ruled the great Province of Kaga. Shin Shu is Buddhist only in name, retaining nothing of the teaching of Gautama and according him no honor. Consult: Nanjo, *Short History of the Twelve Japanese Buddhist Sects* (London, 1887); Griffis, *The Religions of Japan* (New York, 1895); G. W. Knox, *The Development of Religion in Japan* (ib., 1907).

SHINTO, shĭn'tō', or **SHINTOISM** (Sinico-Jap. *shintō*, the way of the gods). The ancient religion and mythology of the Japanese. The history of the religion falls into three periods, the first terminating in the sixth century A.D., the second in the eighteenth century A.D., and the third continuing until the present time. In the first period the religion had no name and was perhaps undifferentiated from other rites. It had neither dogmas, moral precepts, nor sacred writings. The objects worshiped were called *kami* (superior). Some gods were good and some were bad, some were mortal, and some were wedded to women. From one of the latter class of gods is descended the Emperor. There were deities also of the caldron and kettle and saucepan, gods of the kitchen and of the gate, as well as gods of pestilence, storms, and heavenly bodies. In fact there was no distinctive class of gods, but everything was worshiped which excited fear or admiration. The rites were purifications by water from crimes and defilement; the offerings were anything of value, swords, armor, spears, and especially cloth, which has become the peculiarly cut strips of paper called go-hei which hang before the shrines. The prayers were thanksgivings and lists of offerings.

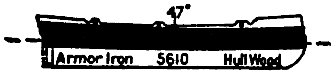
The second period begins with the sixth century, when Buddhism and Chinese civilization were introduced. Shinto soon yielded to its rival, the native gods being regarded as incarnations of Buddha. (See Kobo Daishi.) Buddhist priests became the custodians of the shrines and introduced their own ornaments, images and ritual. The two religions were united under the name *Ryobu-Shinto* (the Shinto of two kinds), a mongrel system in which Buddhism was the active partner. The mythology was written down with the ancient prayers. Only in the palace of the emperors, who were themselves Buddhists, and at a few of the great shrines were attempts made to preserve something of the ancient usage. The distinctively Shinto priests became fortune tellers and magicians.

In the eighteenth century a succession of great scholars (Mabuchi, 1697–1769; Motoöri, 1730–1801; Hirata, 1776–1843), animated by a love for antiquity and a hatred of all things foreign, attacked Buddhism and Confucianism and sought the reëstablishment of pure Shinto. They taught that its essence was obedience to nature and to the Emperor. They produced marked effects in literature and in politics, but Shinto was too shadowy and ill-defined to gain religious hold of the people. The sentiment aroused was utilized by the revolutionists of 1865–68 when the western clans overthrew the government of the Shogun and restored the Emperor to the head of the government. At the restoration Buddhism was disestablished and Shinto put in its place. But Shinto could not maintain itself and became a code of ceremonies for court and officials. At present it represents the intense patriotism of the people and furnishes the rites for religious ceremonial at the court, all officials being obliged to observe its forms.

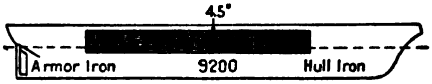
Consult: Rosny, *La religion des Japonais* (Paris, 1881); Chamberlain, *Translation of the Kojiki* (Yokohama, 1883); Cobbold, *Religion in Japan: Buddhism, Shintoism, Christianity* (London, 1894); Griffis, *The Religions of Japan from the Dawn of History to the Era of Meiji* (New York, 1895); Florenz, *Japanesische Mythologie* (Tokyo, 1901); Chamberlain, *Things Japanese* (4th ed., New York, 1902); Aston, *Shinto* (ib., 1905); Harada, *The Faith of Japan* (ib., 1914). See Japan, *Religion*.

SHIP, Armed. See Armed Ship.

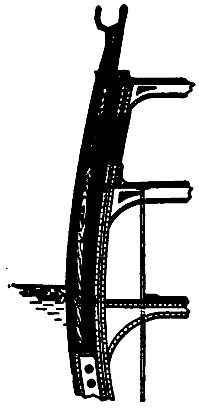
SHIP, Armored. The first real armored vessels were floating batteries used at the siege of Gibraltar in 1782, and the first proposal to build an armored steam vessel seems to have been made by Col. John Stevens of New Jersey, who in 1812 prepared plans for such a craft, but his proposals were rejected as chimerical. (See Armor Plate.) In 1841 his son, Robert L. Stevens, submitted plans to the United States Navy Department for the construction of an ironclad steamer of high speed in which all of the machinery, including the propellers, should be below water. The plans were accepted, but the construction of the vessel was deferred, as it was considered desirable to increase the thickness of armor carried from 4.5 to 6.75 inches. The necessary changes in the plans and delays, due to other causes, prevented the laying of the keel until 1854, only two months before the commencement of the Kinburn batteries (see Armor Plate), but it is to be noted that Stevens's vessel was a high-speed seagoing ship and not a floating battery. After the death of Stevens in 1856 the construction was continued by his brother, E. A. Stevens, but owing to lack of money and other difficulties it was never completed. In consequence of this failure the French were the first to produce a seagoing armor-clad; the work of Paixhans (q.v.), in France, called attention there to the armoring of ships. Four vessels



GLOIRE, FRANCE, 1858.

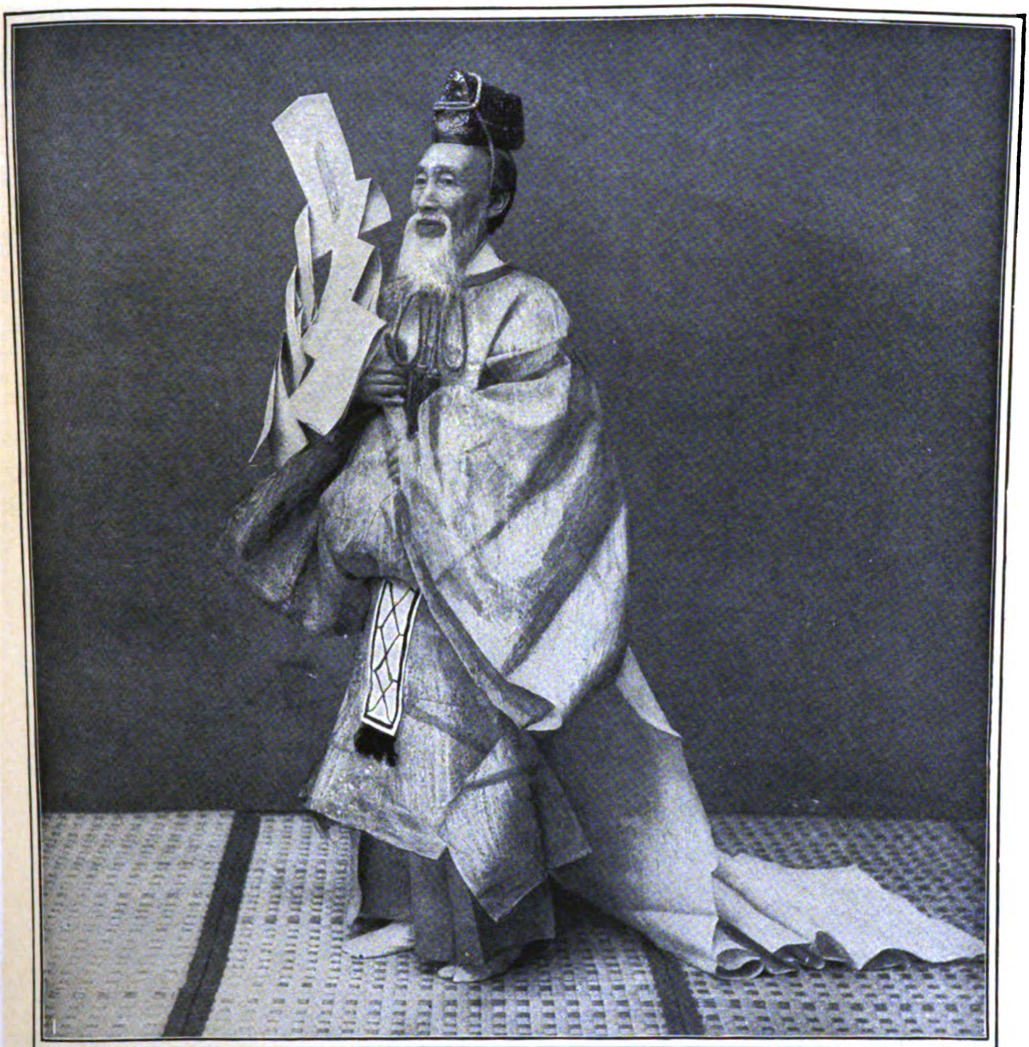


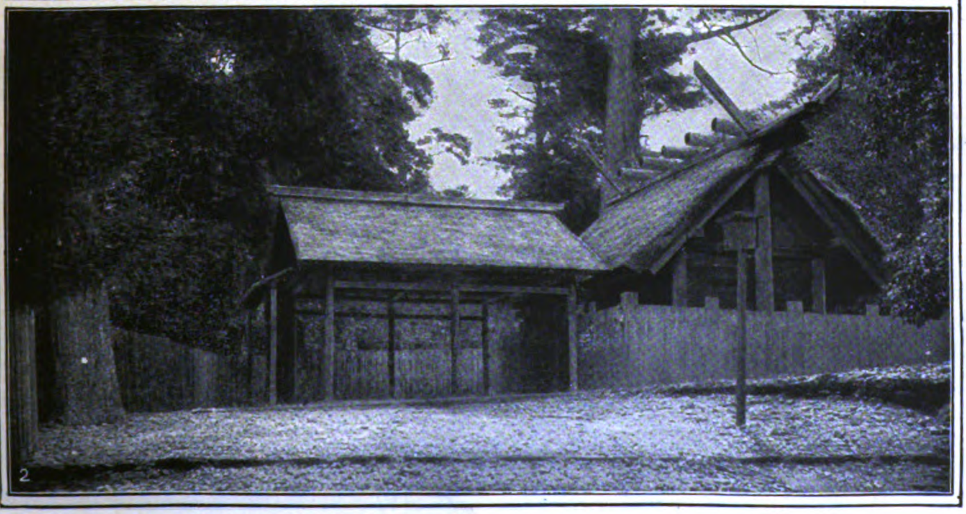
WARRIOR, ENGLAND, 1859.



ARMOR OF AN EARLY IRONCLAD, H. M. S. BLACK PRINCE, SISTER SHIP TO WARRIOR.

SHINTOISM

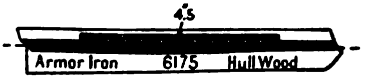




1. SHINTOIST PRIEST CARRYING GOHEI

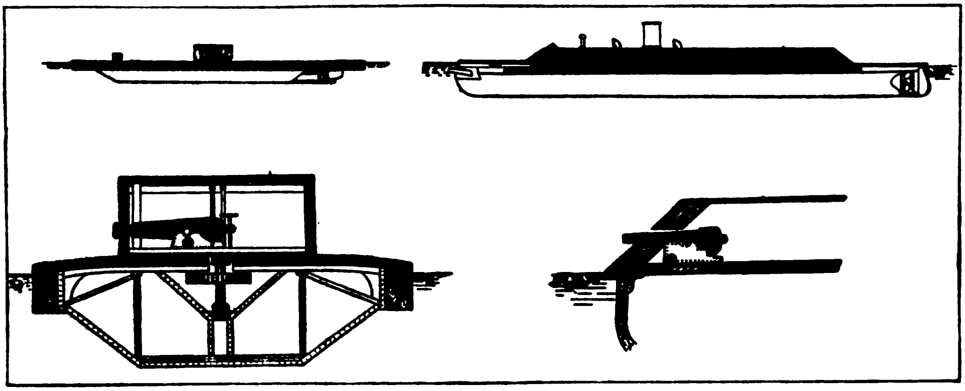
2. A SHINTOIST SHRINE AT YAMADA

were commenced in 1858. The hulls and machinery of the *Gloire*, *Invincible*, and *Normandie* were similar to that of the screw line-of-battle ship *Napoleon*, except as they were modified to receive the armor; the other vessel, the *Couronne*, had a hull of iron. The first to be completed was the *Gloire*. She was therefore the first seagoing armor-clad.



PETROPAVLOVSK, RUSSIA, 1861.

In 1859 the British commenced the broadside iron frigate *Warrior*. In 1860 the Italians ordered the armored frigates *Terribile* and *Formidabile* in France, and in the latter part of 1861 the Russians changed the plans of the wooden frigate *Petropavlovsk*, then building, and gave her a complete water-line belt and casemate of iron. Up to this time the application of armor had brought about no material change in ship design except to reduce the number of decks on which guns were carried, but it somewhat increased the calibre of the guns and caused the rifled gun to be generally adopted everywhere but in the United States. In 1861 the *Monitor*, *Merrimac*, and *Rolf Krake* (which will later be referred to) were designed. The *Monitor* and *Merrimac* differed from previous men-of-war in being mastless; each was completely armored; one mounted its guns in a revolving turret, the other in a central armored battery.

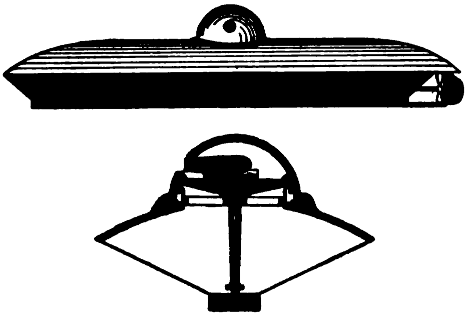


MONITOR AND MERRIMAC.

In 1861 the United States Congress passed an Act providing for armored vessels, and pursuant to its provisions the *Galena*, *New Ironsides*, and *Monitor* were built. The *Galena* was of ordinary type, except that her sides amidships tumbled home (i.e., inclined inward) at an angle of 45 degrees and were covered with 2.5 inches of armor. Her plating was found to be too thin to be of much use, and she was regarded as a failure. The *New Ironsides* was finished late in 1862 and attached to the blockading fleet off Charleston, where she remained for two years. Her hull was of wood, and her general plans were similar to those of an ordinary steam frigate of her day, except that she had a ram bow and a retreating stern like that of many recent battleships. Her sides tumbled home at an angle of about 30 degrees from the vertical for about two-thirds her length, and over this portion she was covered by 4.5-inch iron plates of large size, extending from some distance below the water line to the upper deck. The broadside armor was joined at the ends by thwartship plating of equal thickness, the whole forming a citadel protecting the battery, boilers, and engines. She was 232 feet long, 58 feet broad, and had a displacement of 4120 tons at her designed load draft. Her battery consisted of sixteen 11-inch Dahlgren smoothbores, two 220-pounder Parrott rifles, and four 24-pounder howitzers. She was the most successful armored ship of her day, was in action more times than any vessel ever built, and was struck by more projectiles than any other (so far as existing records show), yet her armor was never pierced, she was never put out of action, and she was never forced to go to a home port for repairs or to depend upon outside assistance; while, in some of the engagements in which she took the leading part, other ironclads were sunk, and several monitors were disabled and forced out of action. After the war, in 1866, she was accidentally destroyed by fire at the Philadelphia Navy Yard.

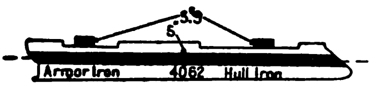
The third vessel was the far-famed *Monitor* (q.v.). The contract for her construction was signed Oct. 4, 1861, and she was launched Jan. 30, 1862. Her dimensions were: extreme length, 172 feet; length of hull proper, 124 feet; extreme beam, 41.5 feet; width of hull where it joined the overhang, 34 feet; width of hull at bottom, 18 feet; depth of hold, 11.33 feet; mean draft, 10.5 feet; inside diameter of turret, 20 feet; height of turret, 9 feet; displacement, 987 tons. The *Monitor* was remarkable in many ways, but she was not a seagoing vessel, but a floating battery, useful only in smooth water, and she was fortunate in meeting a craft equally unseaworthy. She was not even the first turret vessel to be commenced, nor was she the best. Early in 1861 Denmark had contracted with Capt. Cowper Coles for the building of the double-turreted, seagoing, ironclad *Rolf Krake*, and her keel was laid before the contract for the *Monitor* was signed, though she was not completed until 1863. The *Krake* was a very successful vessel and, although she was never in close action with another ship, silenced the Prussian batteries several times and held the whole Prussian fleet in check in 1864.

Ericsson, however, was probably the first to produce plans of a practical revolving turret mounted on board a vessel, as there seems to have been no design of one antedating that he sent to Napoleon III in 1854. Ericsson's *Monitor*, also, was the first completed vessel carrying a revolving turret, and while many of her details were faulty, others were successful, original, and ingenious in the highest degree.

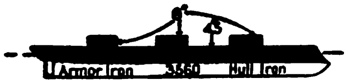


ERICSSON'S IRONCLAD CUPOLA VESSEL, 1854.

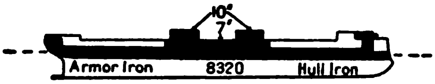
The fight between the *Monitor* and the *Merrimac* resulted in the retirement and neutralization of the *Merrimac* and complete protection of the unarmored fleet. Almost every nation in Europe also built vessels of the monitor type, but the evolution of the turret ship proceeded rapidly, though the value of broadside fire from numerous guns was never quite forgotten, and in a modified form it displaced the turret.



AFFONDATORE, ITALY, 1863.

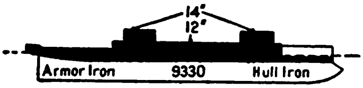


ADMIRAL LAZAREFF, RUSSIA, 1864.

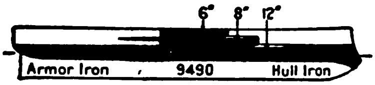


MONARCH, ENGLAND, 1866.

In 1863 the British converted several vessels into turret ships with four turrets (*Royal Sovereign* class). The North German Confederation ordered the *Arminius*, a turret ship of 1600 tons, similar to the *Rolf Krake*. France commenced a number of turret vessels of about 3000 tons (*Taureau* class). Italy, which was building a number of broadside and central-battery ships, ordered the turret ship *Affondatore*. Russia, the Netherlands, Norway, and Sweden began the construction of numerous monitors of the American low-freeboard type.

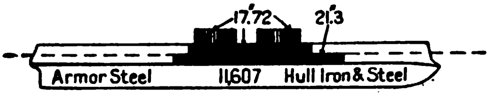


DEVASTATION, ENGLAND, 1869.

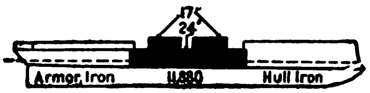


ALEXANDRA, ENGLAND, 1873.

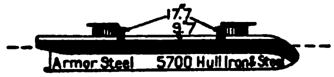
During the next dozen years nearly all the armor-clads built by England, France, Germany, and Italy were broadside or central-battery ships—usually the latter. The long row of guns on the broadside was soon given up, partly because of the difficulty of protecting so large an area by armor. The guns, decreased in number but increased in size, were gathered in a group amidships; to secure fire ahead and astern some were mounted in the angles of polygonal citadels or in circular barbette towers over the corners of the central battery. Of the Great Powers, Russia alone adhered chiefly to the turret. The British naval policy was exceedingly changeable during this period. The vessels built were about equally divided between turret ships and other types.



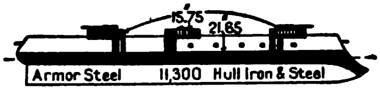
DUILIO, ITALY, 1873.



INFLEXIBLE, ENGLAND, 1874.

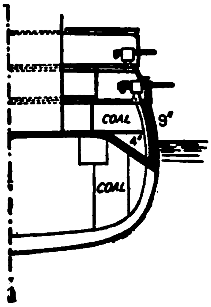


FURIEUX, FRANCE, 1875.



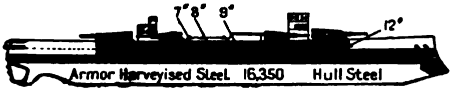
AMIRAL BAUDIN, FRANCE, 1878.

The definite return to turret ships was initiated by Italy in 1873 when she laid down the *Duilio* and *Dandolo* of 12,000 tons. In 1874 the British laid down the *Inflexible*. These ships were of unprecedented size; practically their whole battery was concentrated in four 100-ton guns (in the *Inflexible* four of 80 tons) behind very thick armor; the complete water-line belt was given up, and a central citadel extending less than half the length (in the *Inflexible* less than one-third), but of enormously thick armor, protected the vitals, but did not absolutely insure stability if the unarmored ends were destroyed; a submerged armor deck extended from the citadel to the bow and to the stern a few feet below water; and lastly their turrets, instead of being on the midship line, were arranged en echelon, the forward one close out to one side of the ship, and



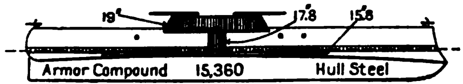
SECTION OF MAJESTIC, 1893 (*Magnificent* class).

the after one close out to the other. This method of mounting theoretically doubled the fire ahead and astern; practically fire ahead or astern was nearly destroyed by the interference of the upper works.

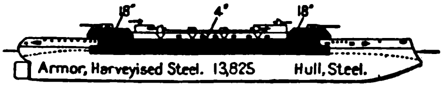


COMMONWEALTH, ENGLAND, 1901.

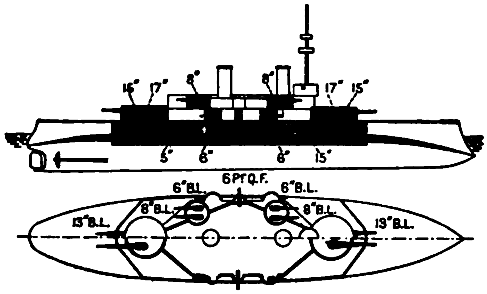
After 1875 no more broadside or central battery ships of importance were built for any navy, though the turret and auxiliary battery went through many changes before the advent of the *Royal Sovereign* class of 1889. From that time until 1902 the design of British battleships was little changed. In the United States navy the sea officers supported a development of the *Iowa* type in which the auxiliary battery should consist of many (12 to 16) 8-inch guns. The European practice reacted upon the designers of American ships, resulting in a momentary disappearance of the 8-inch gun, but in 1902 7.5-inch and 8-inch guns began to appear in European designs. The calibre of the auxiliary battery guns of the British navy grew steadily until in 1905 the British laid down the all-big-gun battleship *Dreadnought*. The advantages of a single calibre of large guns are numerous and important. In fighting at long range a ship with 12 large guns is about three times as powerful as one with four; a division of four such ships is therefore equal to a squadron of 12 ships of former types, and it may be more than equal through greater concentration of force and ease of handling.



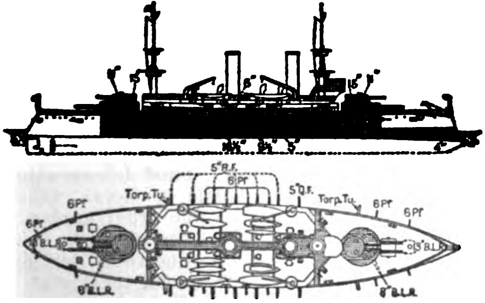
ITALIA, ITALY, 1876.



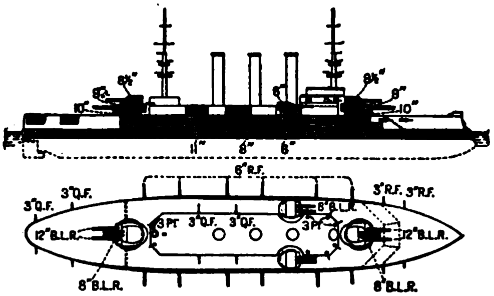
RE UMBERTO, ITALY, 1884.



U.S.S. OREGON, 1891.

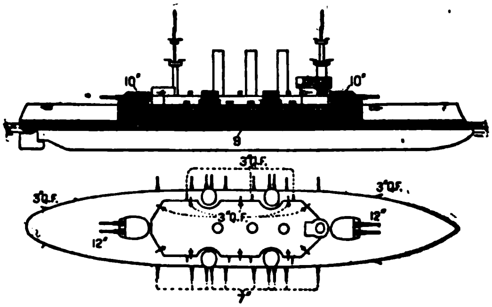


U.S.S. KEARSARGE, 1895.



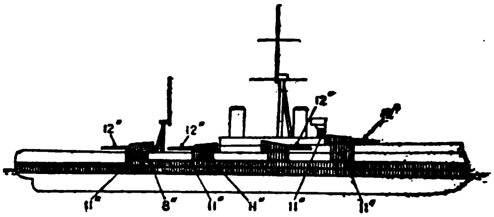
U.S.S. NEW JERSEY, 1902.

The changes in battleship design brought out in the *Dreadnought*, aside from the battery, were considerable. Turbine engines were fitted, the speed increased 2.5 knots, military masts of the old type were discarded, the quarters of officers were placed forward, and the displacement increased about 3000 tons (only about 1000 tons was intended) above that of the largest existing ships.



U.S.S. CONNECTICUT, 1902.

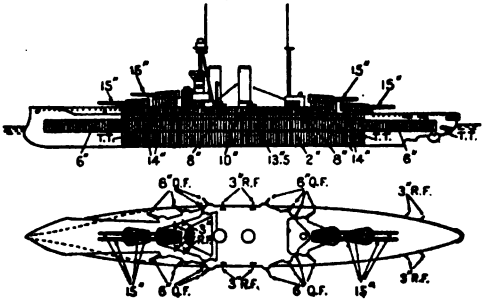
The appearance of the *Dreadnought* revolutionized battleship building. The single calibre of guns was accepted in all the major navies, but the details of armor, gun mounting, and speed were differently solved in each. As far as gun emplacement is concerned the American system has gradually superseded all others. This places all the turrets on the centre line; the second turret is high enough to fire over the first, and



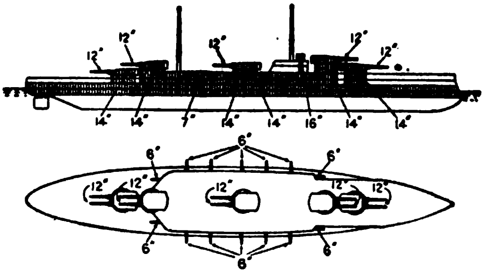
BRITISH BATTLESHIP DREADNOUGHT, COMPLETED 1906.

one of the afterturrets (not the aftermost) is high enough to fire over the others. This arrangement brings all guns into each broadside and gives a reasonably powerful and wholly unobstructed bow and stern fire.

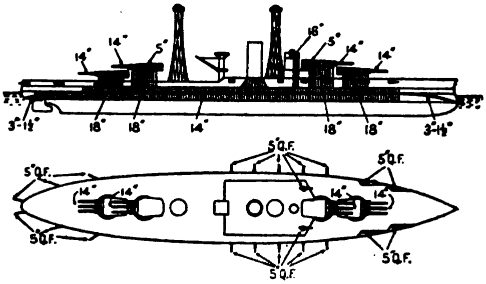
The size of battleships and the calibre of their guns have continued to increase, while their armor has changed in many ways. To reduce turret interference 3-gun and 4-gun turrets have been adopted—the latter in the French navy only. In the United States the 2-gun turret is preferred, but 3-gun mountings are accepted in view of the improved bow and stern fire and freedom from interference of fire between turrets. In the British, German, and Japanese navies only two guns are mounted in a single turret. In the ships of different navies in 1916 the calibres adopted were as follows: United States, 14-inch; Great Britain, 15-inch; Germany, 15-inch; France, 13.4-inch; Italy, 12-inch; Russia, 12-inch; Japan, 14-inch; Austria, 14-inch. The largest battleships under construction in 1916 were the vessels of the *California* class in the United States navy, which have a displacement of 32,000 tons. The average speed of battleships is about 21 knots, though the Italian vessels under construction in 1916 were to have 25 knots, the recent German battleships 23, and those of one class of British ships completed in 1915 have 25 knots.



BRITISH BATTLESHIP QUEEN ELIZABETH, COMPLETED 1914. Note submerged antitorpedo armor.



GERMAN BATTLESHIP KÖNIG, 1914.



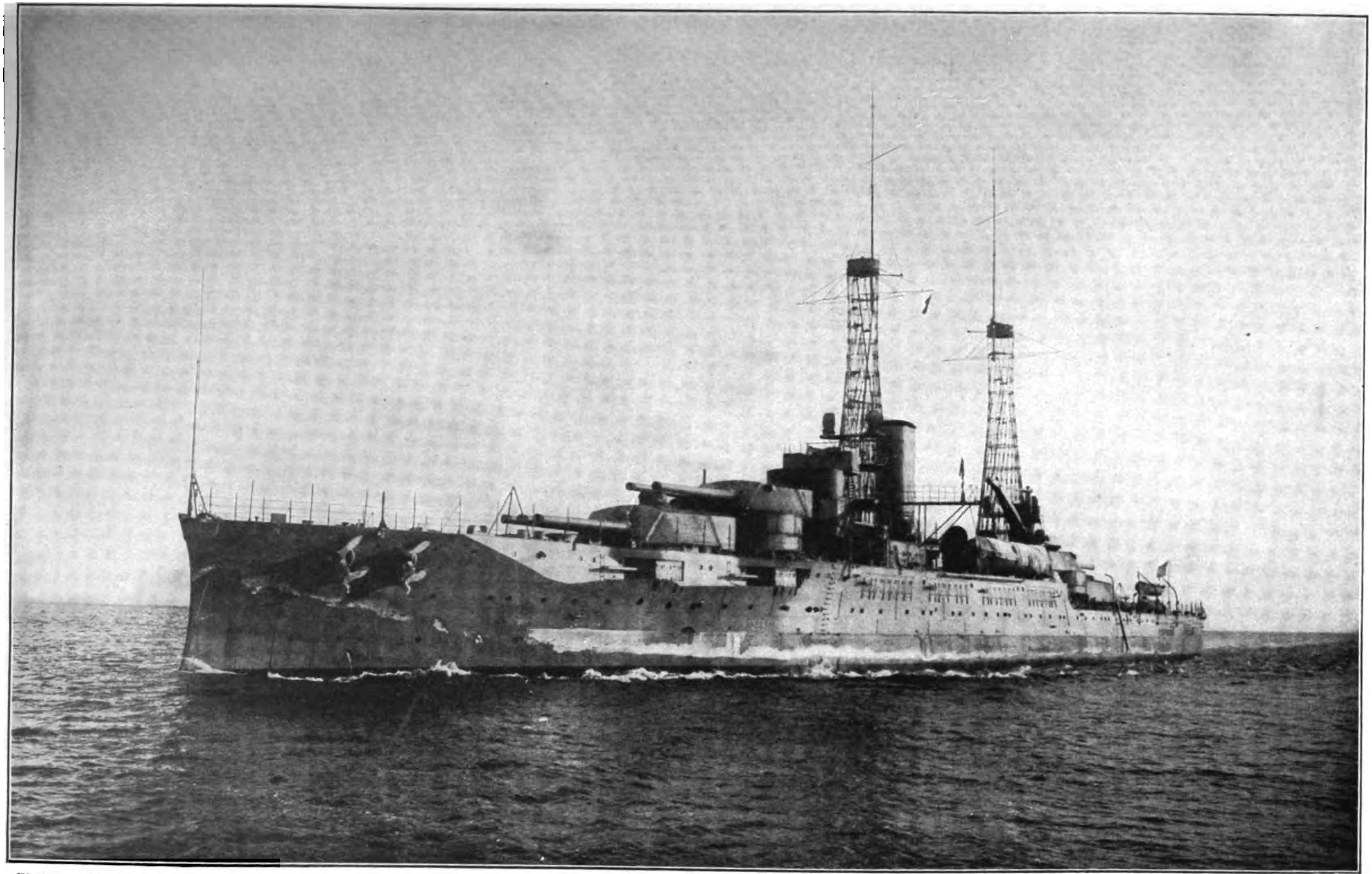
UNITED STATES BATTLESHIP CALIFORNIA, 1915.

The armor of battleships has tended to grow in thickness in recent years, owing to increasing calibres of guns carried. Much internal armor is now fitted. This consists of armored bulkheads and decks, which are designed to resist heavy shells and torpedo explosions. In United States ships about one-fourth the total weight of armor carried is internal. To provide for this additional weight without adding unduly to the displacement, all armor has been removed from over the auxiliary antitorpedo-boat battery, and the water-line belt is not carried to the stem.

The development of battleships in the United States navy has been nearly uniform. The first was the *Texas*, of 6300 tons, laid down in 1889. Her design was purchased in England and was not satisfactory. The vessels of the *Oregon* class, laid down in 1891, were highly approved except as regards freeboard. This was low, as Congress had appropriated for *coast-line* and *not seagoing* battleships. Their battery and armor made them the most powerful ships afloat. The *Iowa*, which followed in 1893, was a high-freeboard, seagoing vessel, and the glaring defect of the *Oregon* class was therefore corrected. The *Kearsarge* and the *Kentucky* (1896) were no great improvement on the *Iowa*, and the *Alabama* (1897) and the *Maine* (1899) classes were inferior to their predecessors in fighting ability, owing to the omission of the 8-inch gun in their auxiliary batteries, following European practice. The five ships of the *New Jersey* class were a distinct advance. Their armor was better, and the 8-inch gun again appeared in their batteries. The *Idaho* and the *Mississippi* were odd numbers, deficient in speed, and too small for their date. Their construction was forced on the Navy Department by Congress. Fortunately they were sold to Greece and are no longer in a position to hamper the movements of the second line of the fleet. The *Connecticut* (1902) class of six ships was excellent as to armor and machinery, but their guns should have been all 12-inch and 8-inch pieces—the 7-inch were a mistake. The vessels of the *Michigan* (1905) class were the first of American dreadnoughts and had the ideal gun arrangement, eight guns in four turrets on the midship line, the second and third turrets raised to permit their guns to fire over the first and fourth. In the later dreadnoughts, from the *Delaware* to the *California*, the improvement in armor and gun emplacement was uniform. The *California*, of 32,000 tons, twelve 14-inch guns, arranged to fire six ahead, six astern, twelve on each beam, oil fuel, direct electric drive, and a superior thickness and arrangement of armor, in 1916 had no superior in fighting capacity.

In addition to battleships three other classes of armored vessels are used—coast-defense ships, armored cruisers, and battle cruisers. Coast-defense ships are of no specific type; gunboats, monitors, and old battleships are utilized. They are of value under certain conditions, but are of too little importance for special consideration in this brief review. Armored cruisers once figured largely in the navies of the world, though the specific work for which they were suited was never very great and was much reduced by the increase of speed in battleships and the disappearance of the large protected cruisers. The

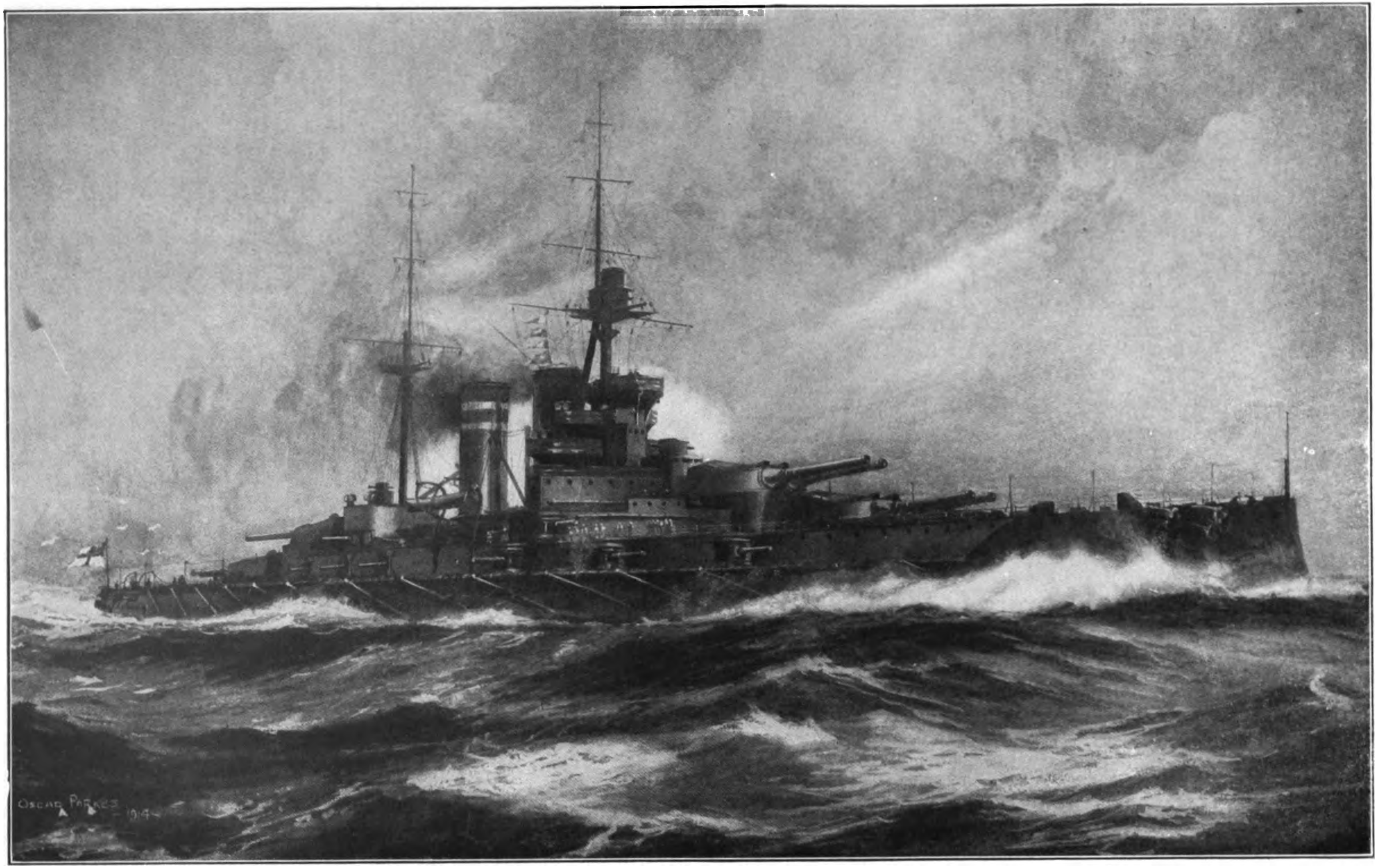
BATTLESHIP



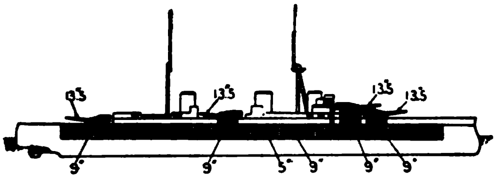
Photograph by New York Shipbuilding Co.

UNITED STATES BATTLESHIP "OKLAHOMA"
On Trial Trip. Speed 21.47 Knots. Built by New York Shipbuilding Co., Camden, N. J

BATTLESHIP



BRITISH SUPERDREADNOUGHT "QUEEN ELIZABETH" battle cruiser is not a development of the armored cruiser, but of the battleship. The theory of the armored cruiser was that guns and armor were sacrificed to speed. In the battle cruiser, guns of battleship size are retained, nor is the number much reduced. The greatly augmented speed is obtained at the expense of some reduction of armor and by increasing the displacement. Battle cruisers are therefore, as a rule, somewhat larger than battleships. Their rôle is a wide one. Their offensive powers enable them to coöperate with the first line of battle, to reënforce weak points quickly, to strike weak points in the enemy's line, to harry a fleeing enemy, to turn the enemy's flank, to obstruct the cruiser operations of the enemy and destroy his cruisers, to seize a distant base for fleet use before it can be reënforced, and to do other things for which their high speed and offensive powers especially fit them. The original prototypes of the battle cruiser were the *Italia* and the *Lepanto*, built for the Italian navy in 1878–83, but the superiority of speed was insufficient, and a full realization of their possible rôle was not then grasped; therefore the type languished until resurrected in the *Indomitable* class of the British navy, which was brought out immediately after the *Dreadnought*. The speed of the type has since risen from 27 knots in the *Indomitable* to 30 knots in the *Tiger*, and it was reported that battle cruisers building for the British and German navies in 1916 would have speeds of 32 knots or thereabouts. Up to 1916 no battle cruisers had been built for the United States, French, Italian, or Austrian service, but it was expected that the United States at least would probably add some to its fleet in the near future.



BRITISH BATTLE CRUISER LION, COMPLETED 1913.

For information on naval and other ships not discussed in the present article, see Armor Plate; Battleship; Cruiser; Frigate; Fuel Ship; Galley; Guns, Naval; Navies; Ram, Marine; Ship and Shipping; Shipbuilding; Sloop; Torpedo Boat (includes *Destroyers* and *Submarines*); and similar topics.

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SHIP, Cartel. See Cartel.

SHIP, General. See General Ship.

SHIP, Guard. See Guard Ship.

SHIP, Load-Line Marks of. See Load-Line Marks of Vessels.

SHIP, Measurement of, for Tonnage. See Measurement of Ships for Tonnage.

SHIP, Naval. See Armor Plate; Battleship; Cruiser; Frigate; Fuel Ship; Galley; Ram, Marine; Ship, Armored; Shipbuilding; Sloop; Torpedo Boat.

SHIP AND SHIPPING (AS. *scip*, ship). The subject is treated in this article under separate heads in the following order: sailing ships; power navigation; development of the steamship and other forms of power-propelled vessels; classification of ships for marine insurance; merchant shipping; tables showing tonnage of ships in the mercantile navies of the world, etc.

SAILING SHIPS

In strictly nautical nomenclature, during the latter days of the sailing-ship era, the term "ship" was used to designate a large vessel with three or more masts, of which at least three were square-rigged. It is now quite generally used to designate any vessel large enough for the crew (and passengers if any) to live on board.

Among the earliest builders of ships were the Egyptians, Chaldæans, Hindus, and Chinese. The oldest existing records were left by the Egyptians. These indicate that Egyptian vessels large enough to carry 50 or more persons were in use more than 6000 years ago. So far as merchant vessels were concerned 30 centuries made but little change in them except a slight increase in size. From the days of the Phœnician ascendancy to the time of Columbus the improvement in size, speed, or seaworthiness was very slight. The high bows and sterns of the earliest-known designs were still retained. Few if any ships of the time were much over 100 feet in length.

The next three and a half centuries were an era of development, largely brought about by the discovery of America and the way to India around Good Hope, because the long voyages to America and India demanded vessels that were larger and more seaworthy. But, although the models were improved, the largest sailing ships, until after the advent of steam, rarely exceeded 200 feet in length, and the proportion of length to beam was about 4 to 1. The bows and sterns were still high; though no longer castle-like, the external shape forward was very bluff, at the stern hardly less so. This was particularly the case in merchant vessels and line-of-battle ships. Frigates and some trading craft were somewhat sharper. These full lines and broad beams gave great handiness in battle, in crowded harbors, and in narrow passages, also carrying power for a heavy freight or many guns and men, but they did not conduce to speed.

The advent of steam changed conditions materially. Sailing vessels soon ceased to be used as fighting ships; in the merchant service they had to compete with steamers. Handiness was therefore sacrificed to speed and the spread of canvas much increased. The famous clipper ships were intended for long voyages and frequently made such fast passages as to rival the best steamer records. The *Dreadnaught* made the passage from Liverpool to New York in 13 days, 8 hours and the *Red Jacket* in 13 days, 11 hours, 25 minutes. The ordinary fast mail-steamer passage was then about 10 days.

Modern sailing ships are built on lines similar to those of the old clippers. Their speed under sail is somewhat inferior, but they are designed for greater proportional carrying capacity, and the numerous small and light sails, which added slightly to the speed and much to the cost of maintenance, are no longer fitted. A very large majority of existing sailing ships are built of wood, but steel is being used for many of the newer ones, as steel ships require less extensive repairs and carry more cargo on the same exterior dimensions. The lower masts and, in some cases, the upper masts and yards are of iron, while wire has almost entirely displaced hemp for standing rigging.

The sails, masts, and spars of sailing vessels are arranged in many different ways—in nautical language, the vessels have different rigs—and each particular style of arrangement has its own distinguishing name. The more common forms are ship rig, bark rig, barkentine rig, brig rig, brigantine rig, schooner rig, etc. Each principal type of rig has variations; thus, we have four-masted ships, four-masted barks and barkentines, schooners with topsail yards and others with as many as seven masts. The accompanying plate shows in detail the rigging of a modern full-rigged ship.

In the coasting trade of the United States large schooners (q.v.) have almost wholly displaced square-rigged vessels. They carry two to seven masts (two to four are most common), and the larger ones exceed in length and carrying capacity any of the old square riggers. The primary advantage of the schooner is the ease of handling her sails, whereby the size of the crew is reduced. Furthermore she lies closer to the wind than a square rigger. In nearly all large sailing vessels steam or other power, usually internal-combustion engines, is fitted to assist in handling sails and cargo.

Notwithstanding the improvement in sailing vessels, they are gradually being driven out of business by the steamer, which is able to handle freight more quickly, with greater certainty, and in many trades more cheaply. The sole hope that remains to the sailing ship lies in auxiliary propulsion by heavy oil engines. See BARK; BRIG; CLIPPER; DECK; FRIGATE; GALLEY; LOAD-LINE MARKS OF VESSELS; MAST; MEASUREMENT OF SHIPS; NAVIES; NAVIGATION; RAM, MARINE; SAIL; SCHOONER.

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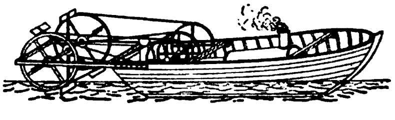
POWER NAVIGATION

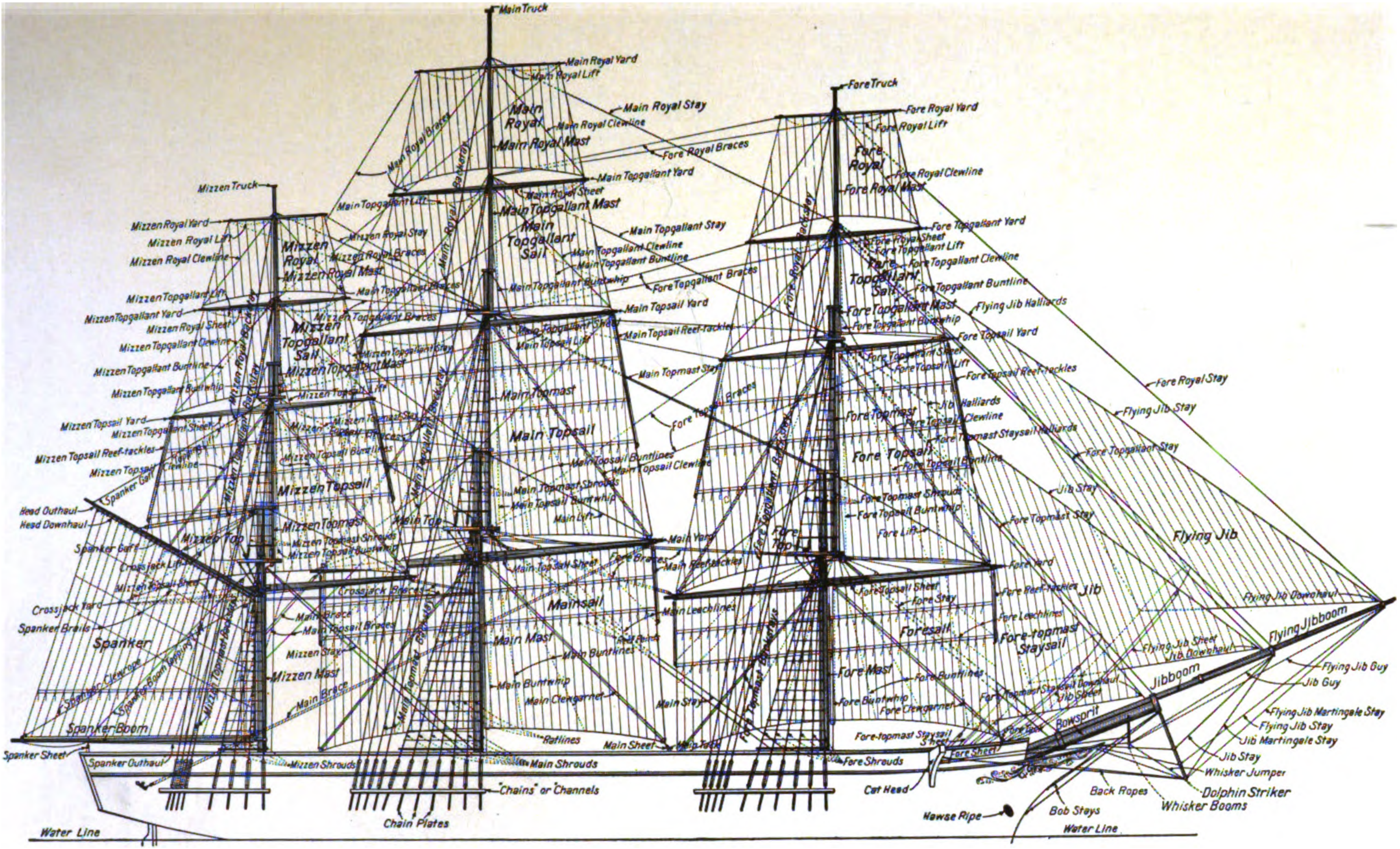
Development of Power-Propelled Vessels. In a statement which was published in 1825 Tomás Gonzales asserted that in the year 1543 Blasco de Garay successfully propelled a vessel by steam in the harbor of Barcelona. About 30 years later the papers in the case were examined by John McGregor, a Scottish lawyer and antiquary, who found that De Garay's apparatus consisted of paddle wheels turned by men. Sometime later M. Burgenroth made copies of all the documents concerning the experiments and claims, and they fully confirm Mr. McGregor's finding. In 1618 David Rumsey and Thomas Wildgoose patented an engine "To make boates for the carryage of burthens and passengers upon the water as swift in calms and more saft in storms than boats full sayled in greater wynes." In 1630 David Rumseye (presumably the same as the foregoing) took out another similar patent. Salomon de Caus, a native of Normandy, is said to have first thought of using steam for propelling boats in 1615. His ideas were ridiculed, and he was eventually imprisoned as a crazy man. In 1690 Prof. Denis Papin of Blois (France) described his invention of the steam cylinder in which the piston was driven by atmospheric pressure when the steam before it was condensed. In his remarks concerning its possible use he mentioned the propulsion of ships by *remi rotatiles* or paddle wheels. In 1707 he built a steamboat which he navigated on the river Fulda, but his success brought only ridicule and abuse; his boat was destroyed and he escaped to England, where he died three years later.



HULLS' BOAT.
From an old drawing.

In 1698 Thomas Savary of London suggested the use of steam-driven paddle wheels, but made no effort to carry out his ideas. In 1729 Dr. John Allen took out a patent in England for a method of propelling a boat by means of forcing water out through the stern with steam or other pressure. In 1736 Jonathan Hulls, a clockmaker of Campden, England, took out a patent for a stern-wheel boat driven by steam. His drawings and detailed descriptions of his inventions are extant, and he actually built a boat, though it failed to realize his expectations. In 1752 the French Academy of Sciences awarded a prize to the distinguished Swiss physicist Daniel Bernoulli for an essay upon propelling boats by steam, in which he recommended the use of a screw propeller. In 1775 the Marquis de Jouffroy began experiments with steam propulsion. Jouffroy's last steamboat was driven by paddle wheels and was so far successful that it continued to navigate the Saône for 16 months. From lack of means to develop his invention further he abandoned all work upon it.

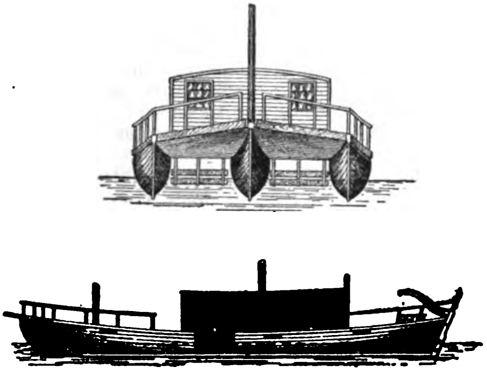
Up to this time practicable steam navigation was impossible because a suitable steam engine did not exist. This deficiency was supplied by Watt, who took out his first patent in 1769,



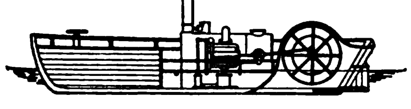
A FULL-RIGGED SHIP

but the engines contemplated were really single-acting pumps. Watt, however, had in mind their use for other purposes, for in 1770 he suggested driving vessels by means of his engines operating a screw propeller. In 1782 Watt brought out the double-acting engine and developed the principle of expansive working by cutting off the supply of steam at a suitable point instead of allowing it to follow full stroke. All the conditions necessary for the propulsion of vessels by steam were now in existence, and experimental boats rapidly appeared.

In 1784 James Rumsey exhibited a rude working model of a steamboat at Berkeley Springs, Va. It had a speed of about 3 miles an hour and was driven by the ejection of water through a tube at the stern. Later Rumsey built other models and boats, but none gave a speed of over 4 miles per hour. John Fitch's boats were fitted with various types of propelling devices. In 1785 he laid before the American Philosophical Society of Philadelphia the descriptions and drawings for a proposed steamboat. In 1786 this boat was built, and trials were made with a screw propeller, a "screw of paddles," an endless chain of paddles, and paddle wheels, but without much success. A new boat, built in 1788, had paddles at the stern pivoted to an overhead frame. This boat made the trip of 20 miles from Philadelphia to Burlington in three hours and ten minutes—an average speed of 6.3 miles per hour—and may therefore be considered the first successful steamboat. Fitch built a new and larger boat in 1789, which, with side paddles, attained a speed of 8 miles per hour and ran regularly as a passenger and freight boat on the Delaware River during the summer of 1790.



MILLER'S BOAT.



CHARLOTTE DUNDAS.

Patrick Miller, a retired banker of Edinburgh, for several years experimented with boat propulsion of different types in a lake on his estate of Dalswinton in Dumfriesshire. Paddle wheels turned by several men were tried in a race with a fast boat using oars, and the paddle boat won. Largely at the instance of James Taylor, a tutor in his family, Miller engaged William Symington, a Scottish engineer, to fit his boat with steam power. A small boat (see illustration) was tried and gave such success that a larger one was built in 1789. In October of that year this boat attained a speed of 7 miles per hour on the Forth and Clyde Canal. In 1801 Symington was commissioned by Lord Dundas of Kerse to build a steamer for towing barges on the Forth and Clyde Canal. This was the celebrated *Charlotte Dundas*. Her machinery was far in advance of her time, and she was a success in all essential respects, but the proprietors of the canal refused to allow her to be used because they feared the effects of the wash from her paddles on the banks of the canal.

Nathan Read of Salem, Mass., built a successful paddle-wheel steamboat in 1789 and in 1791 patented the multitubular boiler. Oliver Evans of Philadelphia, Samuel Morey, and Col. John Stevens produced successful boats about this time or a little later. Stevens boats were numerous, and many were successful; one, built in 1804, had twin screws. Stevens completed the steamboat *Phœnix* in 1807, a few days after the *Clermont* started on her maiden trip. Not being permitted to operate in New York waters, she was used for a time to carry passengers on the Raritan River between New Brunswick in New Jersey and the city of New York. In 1809 she was sent by sea to Philadelphia and plied regularly on the Delaware for six years. Her speed was about the same as that of the *Clermont*, but the engines embodied many superior features.

The advent of Robert Fulton's *Clermont* marks the beginning of steam navigation as a commercial success. In 1797 Fulton (q.v.) went from England to Paris and soon afterward began experiments with submarine torpedoes and torpedo boats. About 1801 he secured the assistance of Robert Livingston, then the United States Minister to France, and they built a small steamboat. In 1804, as the agent of Livingston, Fulton went to England, where he ordered of Boulton and Watt the machinery for a much larger vessel, which was to be built in the United States. A hull, built in New York, was launched early in 1807, the engines were placed on board, and on Aug. 7, 1807, the *Clermont* started on her trial trip. Without stopping she proceeded to Clermont, the home of Livingston, on the Hudson, 110 miles away, and 20 hours later went on to Albany. The next day she started for New York and made the trip in 30 hours at an average speed of 5 miles per hour. Within a month she began to run regularly between New York and Albany.

The success of steam navigation in sheltered waters was now assured, and steamboats multiplied rapidly, especially in the United States. The first commercial steamboat in Great Britain was the *Comet*, built for Henry Bell. She was only 40 feet long (less than one-third the length of the *Clermont*), her beam was 10½ feet, and she had engines of *three* horse power, which gave a speed of 5 miles per hour. The British steam coasting trade grew rapidly and soon extended to the Continent, the first Dover-Calais line being started in 1820. In the previous year the Dublin-Holyhead service was begun.

DEVELOPMENT OF THE STEAMSHIP

The first steamer to cross the Atlantic was the American-built *Savannah*, of 350 tons and a length of 100 feet, which crossed from Savannah to Liverpool in 25 days. In her, however, the engines were purely auxiliary; she was fitted with full sail power, and, when the wind was fair or the sea too rough for steaming, the paddle wheels were unrigged and taken in on deck. She was followed in 1828 by the Dutch steamer *Curaçao* and in 1832 by the Canadian-built *Royal William*. The beginning of real transatlantic voyages under steam was made by the *Sirius* and the *Great Western*. The *Sirius* started on April 4, 1838, and the *Great Western* four days later. They arrived in New York within 24 hours of each other, on April 22 and 23. The average speed of the *Sirius* was 161 miles per day—the highest 220 miles and the lowest 85 (half a day only); the amount of coal consumed was 450 tons. The *Great Western* averaged 208 miles per day, and her highest run was 247 miles. Neither vessel carried much sail.

For two or three years the transatlantic service was very irregular, chiefly because it was unprofitable. The *Sirius* was withdrawn after making a few trips, and, although the *Great Western* continued running, she lost money for the company that owned her. In 1839 Samuel Cunard of Halifax, Nova Scotia, founded the Cunard line. Assisted by a liberal government subsidy, it was commercially successful from the start. The Cunard Company enjoyed a practical monopoly of the transatlantic service until 1850, when the Collins (American) and Inman lines were started. The Collins lost two of its steamers, its subsidy was withdrawn, and it discontinued its service in 1858. Two other American lines were started in 1850, the New York and the Havre Steamship Company and the Vanderbilt line. Both ceased running at the beginning of the Civil War.

DETAILS OF SHIPS INCLUDED IN ACCOMPANYING DIAGRAMS

NAME OF SHIP	Date of completion	Length on deck feet	Beam feet	Gross tonnage	Displacement tonnage at full load	I. H. P. of machinery	Ocean speed in knots
Britannia	1840	215	34.33	1139	2,370	640	8.5
Asia	1850	285	40.70	2,402	4,650	3,000	12.3
Persia	1855	385	45.25	3,300	6,871	3,600	12.9
Great Eastern	1859	692	83.00	18,915	28,000	8,000	14.5
City of Paris	1866	398	41.00	3,081	6,500	......	13.5
City of Berlin	1875	489	45.00	5,491	9,500	5,200	15.7
Teutonic	1890	585	57.80	9,984	14,000	16,000	20.6
Oceanic	1899	704	68.00	17,274	29,000	27,000	20.7
Lusitania	1906	790	88.00	32,000	44,500	70,000	26.0
Olympic	1911	883	92.50	46,359	52,000	50,000	22.5
Imperator	1913	909	98.00	51,000	57,000	62,000	23.0
Vaterland	1914	950	100.00	54,300	61,000	80,000	24.0

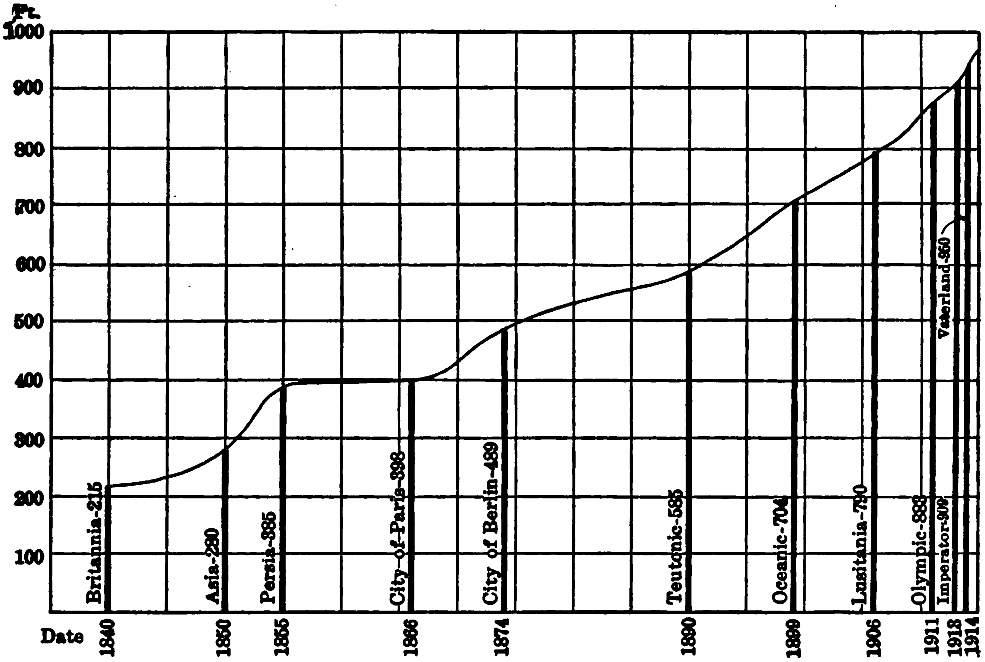
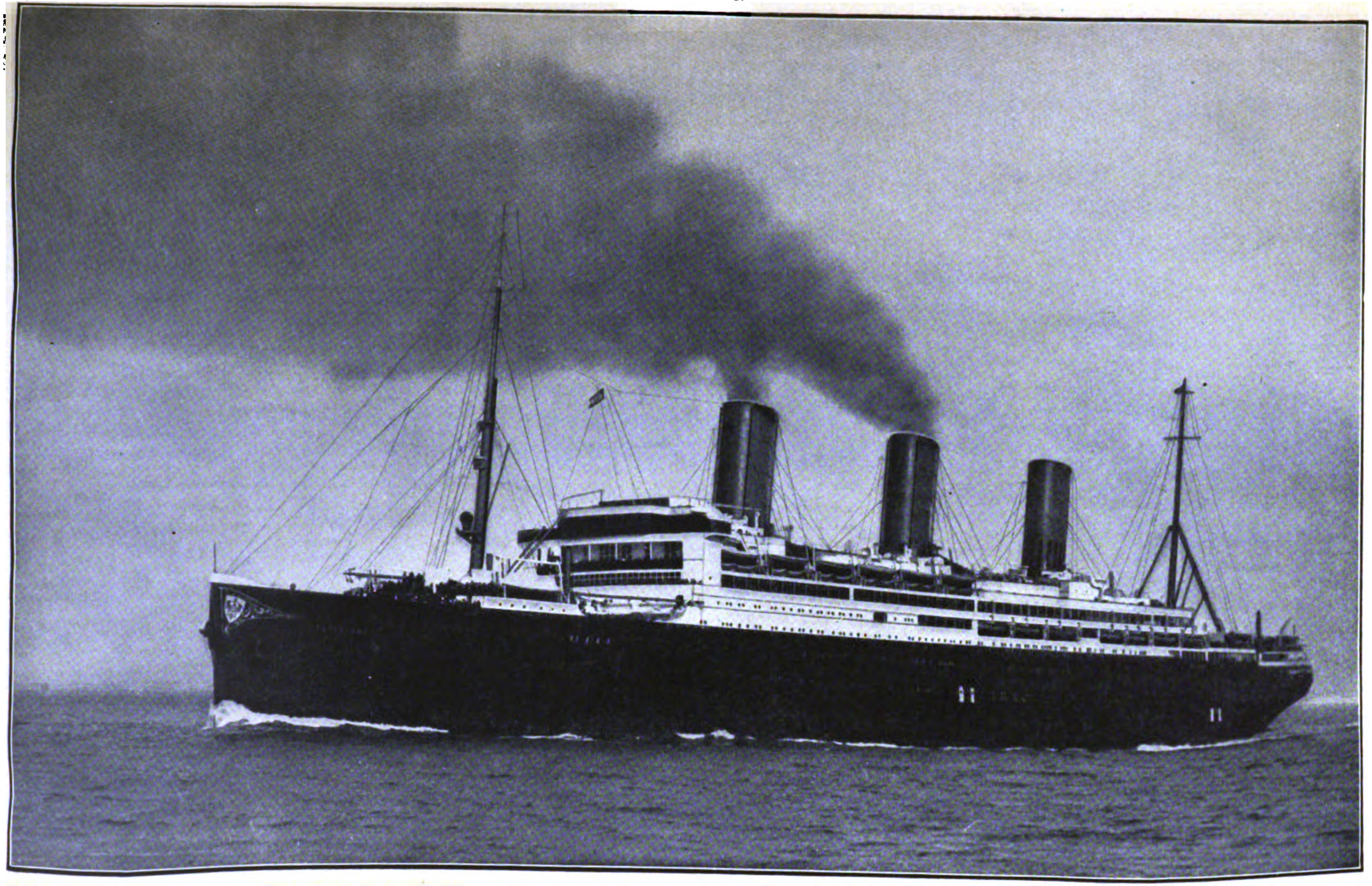


DIAGRAM GIVING CURVE WHICH SHOWS THE INCREASE IN LENGTH OF TRANSATLANTIC STEAMERS, 1840–1916, BASED ON THE LONGEST STEAMER IN SERVICE AT THE END OF EACH DECADE, OMITTING THE GREAT EASTERN.

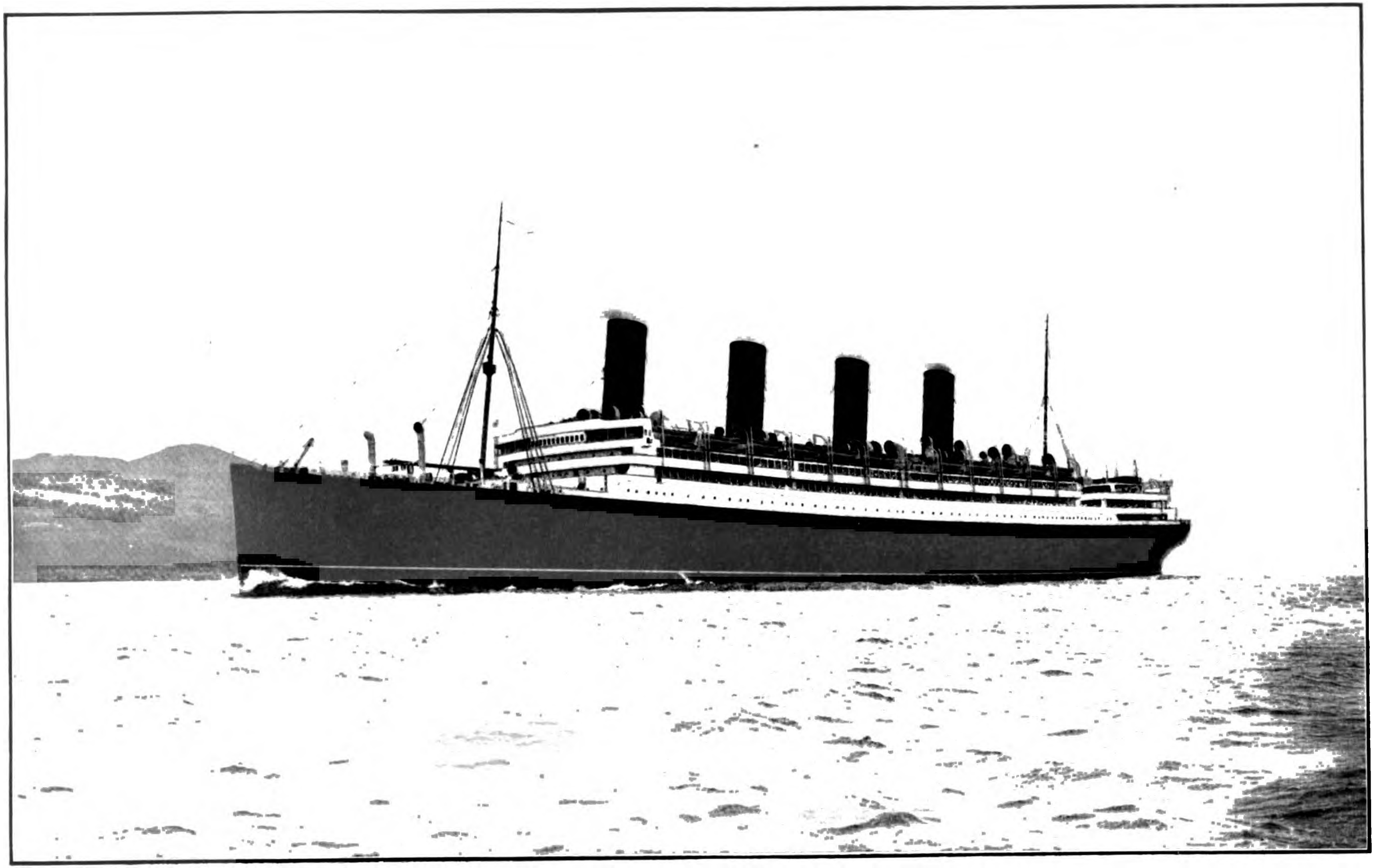
The Inman line was more successful. Though without a government subsidy at first, it had excellent mail contracts. It began its career with steamers built of iron and propelled by screws. Though no faster than the wooden paddle-wheel Cunarders, they were cheaper to operate. The screw propeller (q.v.) now began rapidly to re-

SHIPPING



HAMBURG-AMERICAN LINE STEAMSHIP "VATERLAND"
THE WORLD'S LARGEST STEAMSHIP 1914

SHIPPING



CUNARD LINE ROYAL MAIL STEAMSHIP "AQUITANIA" place the paddle wheel, though the Cunard Company launched the *Scotia*, their last and finest paddle steamer, in 1861. The rapid increase in the size of ocean steamships between 1840 and 1855 led to the production of the *Great Eastern* (q.v.), but she was half a century ahead of the demands of ocean traffic and the adequate development of marine engineering. She was fitted with both screw and paddle engines, as it was thought impossible for either separately to deliver sufficient propulsive effect. The combination was not an economical one and was a leading cause of her failure as a commercial venture.

In the fight for supremacy the screw had, by 1860, become the unquestioned victor over the paddle wheel so far as ocean navigation was concerned, both in the merchant marine and in naval construction. Its advantages for war vessels are numerous, but the greatest of these is the possibility of placing all the propelling machinery below the water line; and this of itself was decisive. In merchant steamers the advantages of the screw are of a different kind. The draft and depth of lading of screw steamers are of less importance and can be varied within much wider limits without perceptible loss of efficiency; rolling produces little effect; and though pitching may be serious in short vessels in which the screw is not deeply immersed, yet, owing to the small ordinary angle of pitch, the screw rarely rises high enough above the surface to give trouble. The possible wide limits within which the size, pitch, and blade area of screws may be varied adapt them to the various types of modern engines, and the possibility of using several screws enables the power on a single shaft to be kept within practicable limits.

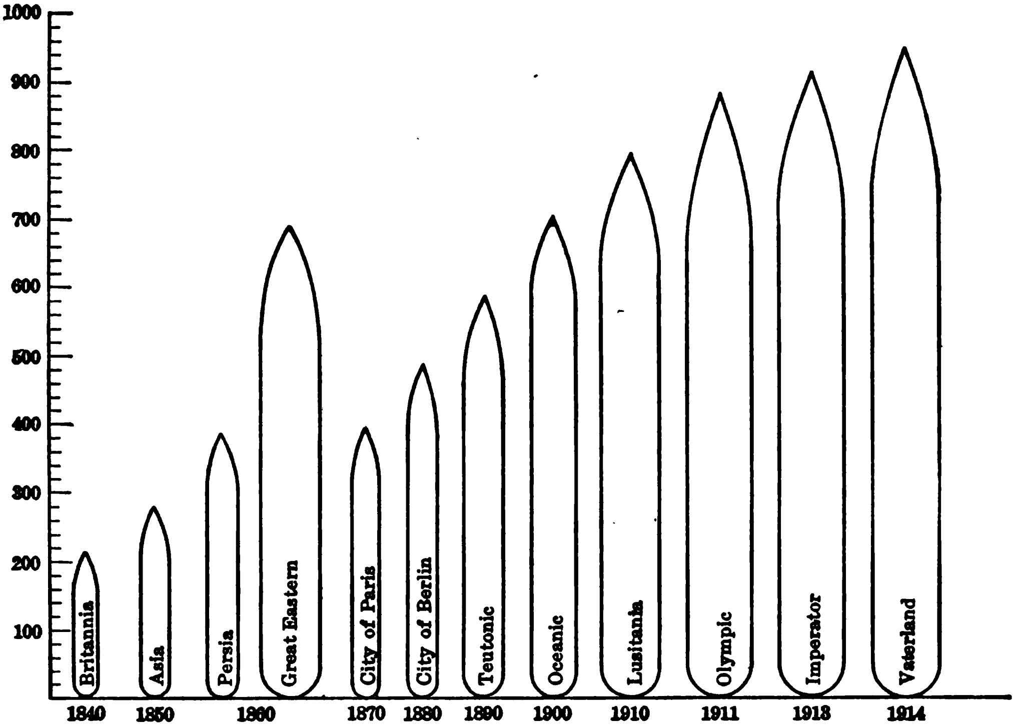


DIAGRAM SHOWING RELATIVE DIMENSIONS OF THE LARGEST TRANSATLANTIC STEAMERS IN SERVICE AT THE END OF EACH DECADE FROM 1840 TO 1916 (GREAT EASTERN INSERTED FOR COMPARISON BUT NOT OTHERWISE CONSIDERED; ALSO OLYMPIC, IMPERATOR, AND VATERLAND).

The demand for increased speed and reduction in weight of machinery for a given horse power led to still higher steam pressures and greater engine speed. The range of economical expansion in two cylinders being limited, the tricompound or triple-expansion engine was designed. The gain was twofold. The new engines were lighter than their predecessors of equal power, and they were also more economical. The first large vessel to be fitted with them was probably the *Propontis*, which in 1874 was supplied with machinery designed by A. C. Kirk. By 1880 the use of triple-expansion engines became common, though compound engines were largely used for another decade, and they are still fitted in certain steamers where the conditions favor their economical working.

The capability of the water-tube type of boiler to furnish very high-pressure steam with ease and safety reacted upon engine design and produced the quadruple-expansion engine. This held its own for a time, but it is now very largely replaced by the turbine and other forms of steam and internal-combustion engines for reasons that are explained fully under SHIPBUILDING, *Machinery*.

The length of the voyage and the vast amount of traffic have caused the transatlantic trade to be the principal field of steamship development. While the gain in size and speed of vessels in this trade has been continuous from the start, a great impulse was given by the building of the *Britannic* and *Germanic* for the White Star line in 1874. They at once reduced to about eight days the average length of passage from Queenstown to New York. They were followed in 1879 by the *Arizona* of the Guion line, confessedly built to outstrip all competitors, and her success was the beginning of a race for speed supremacy that culminated in the *Mauretania* and the *Lusitania*, by which the average passage was reduced to less than five days.

MERCHANT MARINE

TRANSATLANTIC STEAMERS, 1916

Table giving the principal details of the most important vessels, Jan. 1, 1916

NAME OF VESSEL AND OWNERS	When completed	Gross tonnage	Displacement tonnage at full load	Length over all feet	Beam feet	Depth of hold feet	Indicated horse-power of machinery	Mean ocean speed knots
American Line:								
St. Paul	1895	11,629	16,600	554.2	63.0	42.0	20,000	21.0
St. Louis	1895	11,629	16,600	554.2	63.0	42.0	20,000	21.0
New York	1888	10,675	15,800	560.0	63.3	42.0	20,000	21.0
Philadelphia	1901	10,787	15,900	560.0	63.3	42.0	20,000	21.0
Built, 1888; rebuilt, 1901								
Cunard Line:								
Aquitania	1914	47,000	53,000	901.0	97.0	72.6	60,000	23.5
Mauretania	1907	32,000	42,000	790.0	88.0	60.6	70,000	26.0
Carmania b	1905	19,524	31,000	a 650.4	72.6	63.9	21,000	21.0
Caronia	1905	19,687	31,000	a 650.0	72.6	63.9	21,000	21.0
Transylvania c	1915	.....	19,400	a 548.0	66.3	45.0	11,000	16.0
Compagnie Générale Transatlantique:								
France	1910	29,000	......	720.0	75.0	75.0	45,000	23.0
Provence	1906	19,200	19,160	624.0	66.0	42.0	30,000	23.0
Hamburg-American Line: *								
Bismarck	1915	60,000	65,000	955.0	100.0	65.0	70,000	22.5
Vaterland	1914	54,300	61,000	950.0	100.0	65.0	80,000	24.0
Imperator	1913	51,000	57,000	909.0	98.0	63.0	62,000	23.0
Kaiserin Augusta Victoria	1906	24,581	43,000	700.0	77.0	54.0	73,500	18.0
Amerika	1905	22,225	42,000	a 668.0	74.0	52.0	15,500	17.5
Victoria Luise	1900	16,502	....	663.0	67.0	44.0	37,800	23.0
Netherlands-American Line:								
Rotterdam	1908	24,170	37,200	668.0	77.0	57.0	15,000	17.0
Nieuw Amsterdam	1906	16,967	31,000	616.0	68.9	35.6	10,000	16.0
North German Lloyd Line: *								
Columbus	1914	35,000	......	775.0	85.0	60.0	25,000	20.0
George Washington	1909	27,000	37,000	723.0	78.2	54.0	20,000	19.0
Kronprinzessin Cecilie	1907	19,503	27,000	707.0	72.2	52.6	45,000	23.6
Kaiser Wilhelm II	1903	19,500	26,000	707.0	72.3	52.6	42,000	23.7
Kronprins Wilhelm	1901	14,908	22,300	663.0	66.3	43.0	35,000	23.5
Red Star Line: *								
Finland	1902	12,185	19,000	577.0	60.2	42.0	9,300	16.0
Kroonland	1902	12,185	19,000	577.0	60.2	42.0	9,200	16.0
Lapland	1909	18,694	30,500	620.0	70.4	40.0	14,500	18.0
Belgenland	1914	25,000	......	697.0	78.0	50.0	......	...
(New ship)	Bldg.							
White Star Line:								
Britannic	1914	50,000	53,500	900.0	94.6	64.3	54,500	22.0
Olympic	1911	46,359	52,300	882.6	92.0	64.0	50.000	21.5
Adriatic	1907	24,541	40,800	726.0	75.6	57.0	17,000	18.0
Baltic	1904	23,876	40,700	726.0	76.0	49.0	15,000	17.0
Cedric	1902	21,035	38,000	697.0	75.3	48.0	14,000	16.5
Celtic	1901	20,904	37,900	697.0	75.0	48.0	14,000	16.5

* Ships of these lines were not running (1916) because of the war. Some of the German ships were laid up in home ports and some were interned in the United States. The Belgian ships were engaged in other service or laid up.

a. Length between perpendiculars.

b. First transatlantic liner to have turbine engines.

c. First transatlantic liner to have geared turbine engines.

Many of the larger British steamers were engaged in service of the navy or army as hospital ships, transports, etc., in 1916.

The very fast express vessels of the Atlantic fleets added greatly to the prestige of the companies building them, but they were not always profitable, and the rates for passengers and freight were high. Large vessels of less speed and much greater cargo capacity therefore began to be added to the great lines. The first of these were the steamers of the *Pennsylvania* class (13,000 gross tons) for the Hamburg-American Company, built in 1897, but the idea was more fully developed in the White Star *Celtic* (21,000 tons) in 1901. Other lines followed suit. The next step was the great jump in dimensions made by the White Star Company in the *Olympic* (46,000 tons) in 1910, soon followed by the Hamburg-American *Imperator* (52,000 tons) in 1913. In these vessels the speed was again increased, but not at the expense of carrying capacity, a feat rendered possible by increased dimensions and improved engine design. No attempt had yet been made up to 1916 to rival the *Mauretania's* speed, but geared turbines and steam-electric propulsion (see SHIPBUILDING, *Machinery*) have both proved successful and highly efficient, and, were it not for the Great War, new record-breaking express steamers would probably have been under construction. The largest vessel fitted with geared turbines is the Cunard liner *Transylvania*, of 19,000 tons' displacement and 10,000 horse power; and the largest one fitted for electric drive is the

UNITED STATES MERCHANT MARINE, JUNE 30, 1915: GENERAL

Tonnage in foreign trade	1,871,543
Foreign seaborne, commerce, exports and imports	3,957,098,176
Per cent carried in American ships	14.3
Tonnage in coasting trade, including Great Lakes and inshore fisheries	6,486,384
Tonnage in whale fishery	8,829
Tonnage in deep-sea fishery	31,502
Tonnage on Great Lakes	2,818,009
Total tonnage (foreign, coasting, deep-sea)	8,389,429

United States battleship *California*, of 32,000 tons and 35,000 horse power.

The steady increase in the size of transatlantic steamers is shown in the table and diagram, pages 12 and 13. In considering the regularity of the development the *Great Eastern* should be omitted, as she was not built for this trade and was, as regards size, 40 years ahead of her time. She is included for purposes of comparison.

UNITED STATES MERCHANT MARINE, JUNE 30, 1915

AS REGARDS CHARACTER OF VESSELS AND TRADE

CHARACTER OF VESSELS	CHARACTER OF TRADE						Totals	
	Foreign		Domestic		Fisheries			
	No.	Gross tons	No.	Gross tons	No.	Gross tons	No.	Gross tons
Steam	554	1,329,790	6,357	4,444,587	41	7,039	6,952	5,781,416
Sail	555	384,416	5,048	978,806	263	21,252	5,866	1,384,474
Gas	540	16,374	7,886	133,980	570	12,040	8,996	162,394
Canal	......	....	560	61,979	.....	....	560	61,979
Barge	1,106	132,134	3,221	867,032	.....	....	4,327	999,186
Total	2,755	1,862,714	23,072	6,486,384	1,874	40,331	26,701	8,389,449

The introduction of internal-combustion engines for marine propulsion is a comparatively recent achievement. For years only gasoline engines were used to any extent for this purpose, and they were employed almost exclusively in small craft. About 1910 Diesel heavy-oil engines began to be fitted in larger vessels. They have given fair satisfaction for horse powers up to 2000 in single engines, and larger engines are projected. One of their latest applications is to submarines for surface running, and in this field of usefulness they are displacing gasoline machinery. See Torpedo Boat Submarine. See also Commerce; Great Eastern; Measurement; Merchant Marine; Safety at Sea; Shipbuilding; and tables giving statistics of merchant shipping on pages following and preceding.

SHIPBUILDING IN THE UNITED STATES

SHOWING THE NUMBER OF DOCUMENTED VESSELS BUILT DURING THE FISCAL YEARS ENDING JUNE 30 FROM 1911 TO 1915

CLASS	1911		1912		1913		1914		1915	
	No.	Gross tons	No.	Gross tons	No.	Gross tons	No.	Gross tons	No.	Gross tons
Sailing vessels	82	10,092	95	21,221	72	28,610	51	13,749	51	8,021
Steam vessels	969	227,231	1,051	153,493	1,004	243,408	778	224,225	751	154,990
Canal boats	51	5,862	27	2,978	39	4,641	25	2,558	40	4,457
Barges	320	47,977	332	54,977	360	69,496	297	75,718	315	57,654
Total	1,422	291,162	1,505	232,669	1,475	346,155	1,151	316,250	1,157	225,122

MERCHANT VESSELS (OVER 100 TONS) LAUNCHED IN EUROPEAN COUNTRIES IN 1913

COUNTRIES	Number	Tonnage
United Kingdom	688	1,932,153
British Colonies	91	48,339
Austria-Hungary	17	61,757
Denmark	31	40,932
France	89	176,095
Germany	162	465,226
Holland	95	104,293
Total	1,173	2,828,795

Bibliography. Preble, *History of Steam Navigation, 1543–1882* (Philadelphia, 1883); Meeker, *History of Shipping Subsidies* (New York, 1905); Fletcher, *Steamships and the Story of their Development* (Philadelphia, 1910); Fry, *History of North Atlantic Steam Navigation* (London, 1896); Blackmore, *The British Mercantile Marine* (ib., 1897); Marvin, *The American Merchant Marine* (New York, 1910).

CLASSIFICATION OF SHIPS FOR MARINE INSURANCE

This is a work performed by private registration societies. These were first formed by the underwriters for their own protection to secure a registry of all ships applying for insurance in which would be recorded such information as might be necessary to guide them in granting insurance. The character of the information gradually broadened until the data recorded include full particulars in regard to the vessel's hull, machinery, and equipment, ownership, master, builders of hull and machinery, etc.

From the information so obtained, from experience gathered through inspection and survey of vessels in all stages of construction and operation, and from other sources the societies have been able to formulate rules for construction, equipment, and operation. The rules for construction give the necessary features of design to secure the highest classification and the minimum rates of insurance. They also give in great detail the character, quality, and strength of materials; the scantling of parts of the ship's structure; the methods of lapping, butting, and calking; size, spacing, and character of rivets; the fitting of bulkheads, bulkhead doors, bottom and double-bottom plating; spacing of frames, beams, etc.; character and number of pumps, anchors, chains, etc.; character of rudder and steering gear; details of the machinery and boilers for different powers and steam pressures; and a schedule of necessary auxiliaries and their capacities. Plans of new vessels are submitted to the society. After approval the local surveyor oversees the work. The classification of the vessel upon her completion is based on the surveyor's report, occasionally supplemented by a special survey. Nearly all recent editions of the books of rules and tables of the various societies provide for steel construction only, but the old rules are in force (with some modifications) for iron, wood, and composite vessels, and they are still classed. See article on A1.

MERCHANT SHIPPING OF THE WORLD, JULY 1, 1915

(From *Lloyd's Register*, 1915–16)

NATION	STEAM AND OTHER POWER			SAIL		TOTAL	
	No.	Tonnage Net	Tonnage Gross	No.	Net tonnage	No.	Tonnage
Great Britain:							
United Kingdom....	8,675	11,760,277	19,235,705	610	305,663	9,285	19,541,368
Colonies..........	1,543	930,764	1,595,213	525	137,487	2,068	1,732,700
Total.........	......	....	....	......	....	11,353	21,274,068
United States *.......	1,863	3,364,055	4,854,748	1,386	1,037,891	3,249	5,892,639
Germany...........	1,897	2,661,945	4,419,167	269	286,860	2,166	4,706,027
Norway.............	1,658	1,179,568	1,977,809	516	551,379	2,174	2,529,188
France..............	1,016	1,190,809	1,909,609	523	376,119	1,539	2,285,728
Japan **............	1,155	1,162,331	1,826,068	....	....	1,155	1,826,068
Italy...............	655	925,464	1,513,631	522	222,914	1,177	1,736,545
Netherlands.........	710	922,860	1,498,519	99	24,028	809	1,522,547
Sweden..............	1,090	574,808	1,021,796	372	101,887	1,462	1,122,883
Russia †............	744	498,155	851,951	512	252,811	1,256	1,054,762
Austria-Hungary......	422	630,840	1,106,695	11	1,515	433	1,018,210
Greece...............	433	561,330	892,991	77	15,734	510	908,725
Spain................	588	539,134	885,755	54	13,449	642	899,204
Denmark.............	586	474,278	803,701	249	51,295	835	854,996
Brazil...............	391	182,223	302,513	52	14,901	443	317,414
Belgium..............	159	170,961	269,252	5	7,175	164	276,427
Argentina............	245	110,199	188,771	72	33,762	317	222,533
Turkey...............	145	67,163	115,342	67	17,820	212	133,162
Chile................	93	63,749	100,320	30	28,272	123	128,592
Portugal.............	104	55,610	92,425	102	30,301	206	122,726
China................	79	61,839	97,536	2	543	81	98,079
Rumania..............	33	30,560	54,210	1	393	34	54,603

NOTE.—Only vessels of 100 tons or more are included.
* Includes vessels on the Great Lakes, in Hawaii, Porto Rico, and the Philippines.
** Japanese sailing vessels not included.
† Does not include vessels on the Caspian Sea.

The oldest registration society is the Bureau Veritas, founded in 1828. Its headquarters are in Paris. The number of existing vessels which have received their classification from the society is about 4800. The highest classification assigned is designated by the following symbols, ✠ I 3/3L I.I., in which ✠ indicates special survey; I that the vessel is in all respects of the I (i.e., first) class, and a circle shows that the number of water-tight compartments is sufficient to insure flotation in still water with one compartment open to the sea—two rings would indicate that two compartments could be flooded without causing disaster; 3/3 that the hull and machinery are excellent—a letter following this symbol denotes the navigation for which the vessel is intended; the first I of the last group signifies that the wooden parts of the ship are satisfactory and the second I that the equipment is equally so.

Lloyd's Register succeeded two older societies in 1834, and others have since been merged into it. It is by far the largest of all the registry societies in scope and number of vessels classed, which on June 30, 1915, was 10,542 of 24,174,877 tons. Its headquarters are in London. The symbols designating the highest classification are ✠ **100A 1** ✠ **L.M.C.** The Maltese cross indicates special survey; **100A** indicates conformity with rules as regards the hull; 1 shows efficiency of equipment; **L.M.C.** that Lloyd's machinery certificate has been issued.

The British Corporation dates from 1890. Its headquarters are in Glasgow. The number of vessels classed is about 750. The symbols for highest classification are **B.S.** ✱ **M.B.S.** ✱,

MERCHANT SHIPPING OF THE WORLD

ON JULY 1, 1914, AND JULY 1, 1915

(From *Lloyd's Register*)

NATION	Tonnage July 1, 1914	Tonnage July 1, 1915	Increase + Decrease −
British Empire.....	21,045,049	21,274,068	+229,019
Germany...........	5,459,296	4,706,027	−753,269
United States *.....	5,368,194	5,892,639	+524,445
Norway...........	2,504,722	2,529,188	+ 24,466
France...........	2,319,438	2,285,728	− 33,710
Japan**...........	1,708,386	1,826,068	+117,682
Italy.............	1,668,296	1,736,545	+ 68,249
Netherlands........	1,496,455	1,522,547	+ 26,092
Sweden...........	1,118,086	1,122,883	+ 4,797
Austria-Hungary....	1,055,719	1,018,210	− 37,509
Russia†...........	1,053,818	1,054,762	+ 944
Spain.............	898,823	899,204	+ 381
Greece............	836,868	908,725	+ 71,857
Denmark..........	820,181	854,996	+ 34,815
Belgium...........	352,124	276,427	− 75,697

Note.—Only vessels of 100 tons or more are included.'
* Includes vessels on the Great Lakes, in Hawaii, Porto Rico, Alaska, and the Philippines.
** Japanese sailing vessels not included.
† Does not include vessels on the Caspian Sea.

in which **B.S.** indicates that the hull and equipment conform to the British standard and **M.B.S.** that the machinery also conforms to it. The star ✱ indicates special survey.

The Record of American and Foreign Shipping was established in 1867 by the American Bureau of Shipping (then called the American Shipmasters Association). Its rules have received the approval of the United States government and of different boards of underwriters and constitute the standard American authority. The headquarters are in New York, and the number of vessels classified is about 1500. The classification symbols are ✠ **A1 M.C.**, in which the Maltese cross indicates special survey; **A1** indicates conformity of the hull and equipment with its rules, and **M.C.** that a machinery certificate has been issued.

The Registro Nazionale Italiano has its headquarters in Genoa. In 1910 it succeeded the Registro Italiano. Its rules are the same as those of the British Corporation.

The Germanischer Lloyd was established in 1867. Its headquarters are in Berlin, and the number of ships classed is about 3000. The symbols for highest classification are ✠ **100A4** ✠ **M.C.** The Maltese cross has the usual signification of special survey; a rectangle about it shows that the water-tight-compartment system ought to insure flotation with one or two compartments flooded; the signification of the group **100A4** is that the hull and equipment conform to the highest requirements; the figure **4** signifies that the vessel is to be resurveyed at the end of four years, when, if satisfactory, the classification will be renewed; **M.C.** denotes that a machinery certificate has been issued.

The Norske Veritas was organized in 1864, and its headquarters are in Christiania. The number of ships classed is about 1600, and the symbols of highest classification are ✠ **1A1 1** ✠ **M. & K.V.** The first group, **1A1**, indicates excellence of hull; the next figure, 1, that the equipment is equally satisfactory; and the last group, **M. & K.V.**, that an engine and boiler certificate has been issued.

SHIPBUILDING. History. The simplest form of floating craft designed to support and transport men or objects is the log; the next step is the raft; then the dugout, or log hollowed out; the hollowed-out principle being established, the canoe of bark or skins stretched upon light frames naturally followed when lightness was a matter of importance. To secure increased size the dugouts were split and additional planks inserted between the sides to form a broader bottom, the next step naturally being the construction of a vessel of planks sewed together with ropes or held together with wooden pins and braced by light interior frames. The next form was that of a vessel in which the planking was attached to strong frames by wooden pins or metal fastenings; when this point was reached the larger craft had whole or partial decks. Lastly we have the iron or steel ship of the present day.

The earliest Egyptian drawings show boats constructed of sawn planks and having sails as well as oars. Though these are the most ancient large boats of which we have positive knowledge, and although they were large enough to carry a great many men, they were designed for use on the Nile and not for traversing the open sea, for the Egyptians were not a seafaring race. The Chaldæans seem to have been navigators and shipbuilders, but it is certain that to the Phœnicians belongs the principal credit for the development of the ship. As early as 900 B.C. the Phœnician war galley had reached the trireme stage and had decks, masts, yards, stays, sails, a ram, etc. The war galleys differed from those used for carrying merchandise in being longer, faster under oars, generally larger, and probably less seaworthy.

Among the ships of the ancients there were many of great size, but it is doubtful if they were strong enough to have gone to sea in the modern sense of the expression. They were chiefly used for harbor service or as house boats, and, though some were fitted as men-of-war, it does not appear that they were ever in action. One great ship, of which the dimensions are not precisely known, was built for Hiero II, King of Syracuse, under the direction of Archimedes. Though the descriptions are not very clear, she seems to have been copper-fastened and sheathed with lead laid over cloths soaked in pitch. She was presented by Hiero to Ptolemy Philopater soon after completion; her further history is unknown. The ordinary trireme galley was probably 110 to 140 feet in length (including the beak) and had a breadth of 14 to 18 feet. This size seems to have been the general favorite throughout the galley period. As ramming was one of the principal methods of attack, speed, weight, and handiness were of prime importance, and these were better combined in the trireme than in vessels of greater or less size. With merchant vessels the conditions were somewhat different. Merchant galleys used their sails much more and had less imperative need of speed. They were therefore broader in proportion to the length.

As the use of sails became more common and they were better fitted, ships began to increase in average size, the advantage of speed and power being with the larger ones. As soon as the sea power of Venice began to wane the great centres of shipbuilding changed from the Mediterranean to the Atlantic, the North Sea, and the Baltic. William the Conqueror invaded England in very small vessels, but 100 years later English ships of considerable size were in use. King John established a royal dockyard at Portsmouth. Early in the fourteenth century the use of large sailing ships and of the mariner's compass had become general. In the reign of Henry VIII ship construction was much improved, and ships began to take on much of the form which they have preserved to the present day. During the next four centuries improvements of design and construction were continuously made until the wooden sailing ship reached its culminating point in the clipper ship of the nineteenth century. See Navies; Ship and Shipping.

THEORY AND DESIGN

So long as ships depended upon sails for propulsion, shipbuilding remained a mechanical art bound by rules, traditions, and dogmas which were the result of centuries of experience. But with the advent of steam came the general scientific awakening, and shipbuilding received its due share of attention. Its theoretical side has been given the name of naval architecture.

For convenience we may divide the subject into three principal parts, viz. (1) design as it affects the buoyancy, stability, steadiness, seaworthiness, etc.; (2) design as it affects the efficient propulsion and manœuvring powers; (3) design as regards the strength, habitability, and general structural arrangement.

A vessel floating freely in still water displaces a volume of water equal in weight to its own, and the weight is called the vessel's displacement. This weight is supported by the pressure of water, which acts at all points perpendicular to the surface of the ship's bottom; but the sum of the vertical components of the water pressure at all points must balance the weight of the ship, and this sum is termed the buoyancy. The total weight of a fully loaded ship may be divided into the weight of hull and the weight of lading. The latter represents her carrying power or useful displacement, and it is of course desirable to make this as large as possible (compared to the weight of the hull), consistent with other necessary requirements. The reduction in hull weight is the principal cause of the substitution of iron for wood in shipbuilding and, in turn, the displacing of iron by steel.

In considering ships of different forms it is useful to know something definite concerning their shapes without exhaustive examination, and this is obtained by comparing them with the parallelepipedon, which has dimensions equal to the length (L), breadth (B), and mean draft (M) of the ship. If $v =$ the volume of the ship and V the volume of the parallelepipedon, we have $\frac{v}{V} = C =$ coefficient of fineness of the ship. If d and D are the corresponding displacements (i.e., weights) in tons, since 35 cubic feet of sea water weigh a ton,

$$C = \frac{d}{D} = \frac{d \times 35}{L \times B \times M}.$$

This formula takes no account of the shape of the midship section of the ship, in which there is considerable difference in vessels of the various types. A bluff vessel might have a high rise of floor, and a fine-ended ship a nearly rectangular midship section, and yet the coefficient of fineness be the same. To obviate this uncertainty the prismatic coefficient is used. In this case the volume of the ship is compared to the volume of a prism, whose length is the length of the ship, but whose base is the midship section of the ship. If the area of the midship section is A, we have prismatic coefficient, or coefficient of water lines as it is commonly called $= C' = \frac{d \times 35}{A \times L}$.

In modern steamships the midship section closely approaches a rectangle, and the ordinary coefficient of fineness suffices. For steamers of exceptionally fine form (particularly those with no parallel midship body) the coefficient is from 40 to 50 per cent; in large fast steamers, 45 to 55 per cent; in recent battleships, 55 to 65 per cent; in low-speed cargo steamers, 65 to 78 per cent. The coefficient of water lines is greater and varies from about 55 to 83 per cent in value.

In referring to the displacement of a ship it is necessary to specify some particular condition, as of course the displacement varies with the loading. With men-of-war the condition commonly used is that of normal or mean-load draft. That is supposed to be the average cruising condition, but is usually somewhat less. The deep-load condition for a man-of-war is when her full supply of stores are on board and her coal bunkers are full. For merchant ships, displacement is only beginning to be used, and it is generally given for a light-load condition—when the ship is practically empty—or when she is immersed to her Plimsoll mark (see LOAD-LINE MARKS OF VESSELS); it may also be given for a specific mean draft of water. The tonnage of ships is a measure of capacity for cargo and is fully treated under MEASUREMENT OF SHIPS FOR TONNAGE.

After considering the volume of displacement of ships, the next point to be examined is the shape of the volume as regards stability and steadiness. These two expressions are linked together in the minds of many people as if they were convertible terms. Instead of being so they are in a measure antithetical, as we shall presently see. When a vessel is at rest in still water it is evident that her centre of gravity and the centre of gravity of the volume of water she displaces (which is called the centre of buoyancy) must lie in the same vertical line, for only in that condition will the forces of weight and buoyancy act in exactly opposite directions and produce equilibrium. The relative positions of these points are shown in the accompanying diagrams, in each of which G is the centre of gravity of the ship and B the centre of buoyancy.

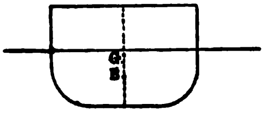


FIG. 1.

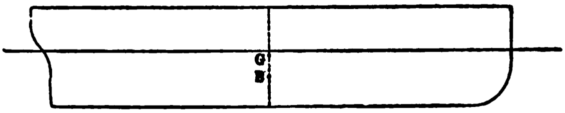


FIG. 2.

If the ship is made to roll, the position of the centre of buoyancy will be displaced, as shown in Fig. 3. We have then a force acting vertically upward at B' and a force working vertically downward at G', producing a couple tending to turn the ship back to her upright position. Similarly, if the ship pitches, the centre of buoyancy is displaced longitudinally, and the couple acts as before. In either case, if W is the weight of the ship in tons, the moment of this couple is equal to $W \times G'H$, or $W \times G''H'$. If a vessel rolls and pitches at the same time, the centre of buoyancy will be displaced both laterally and longitudinally, and the couple will then tend to act in a plane, making an angle with the keel which is greater than 0 and less than 90 degrees. If a ship is pressed over by a constant force, such as the wind or the action of the rudder, and the surface of the water is smooth, the righting moment is simply that of the couple. But if the surface of the water is broken by waves, the shape of the submerged body is constantly changing, thereby moving the centre of buoyancy and adding to or subtracting from the righting force due to the couple.

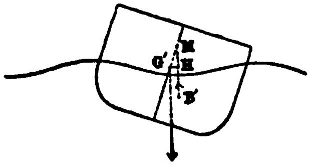


FIG. 3.

When a ship is forcibly inclined in still water the point M (Fig. 3), called the transverse metacentre, is the point in which the vertical line through *B'* cuts the line *G'M*, which is vertical when the ship is upright; and the distance *G'M* is called the transverse metacentric height. Similarly in Fig. 4, *M'* is the longitudinal metacentre, and *G"M'* is the longitudinal metacentric height. In vessels of ordinary type *G"M'* is so large that there is practically no danger of their turning end over end unless they are very small. *G'M*, however, is often very small, and its value must be very carefully considered. Being so much used, it is commonly referred to as the metacentric height. The determination of it is effected by inclining the ship in still water. It changes for every change in the position of the centre of buoyancy, but for angles not exceeding 15 degrees the change is slight. The value of the metacentric height usually given in tables is, therefore, that obtained by inclining the ship through a very small angle.

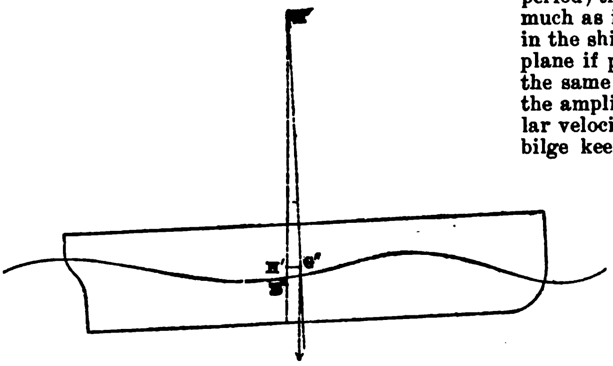


FIG. 4.

The rolling of a ship, when forcibly inclined in still water and then allowed to right herself, is like that of a pendulum which has been drawn to one side and then permitted to vibrate until it comes to rest. Acted upon by the couple (the moment of which in this case is called the moment of statical stability), she rapidly reaches the upright position at a constantly varying angular velocity. As soon as this position is reached the couple ceases to act, while her momentum causes the roll to continue; but beyond the upright position a couple in the opposite direction is formed, and this (together with friction and wave making) gradually checks her roll until it ends, whereupon the new couple sets up a roll in the opposite direction just as a pendulum returns in its vibration. The rolling continues, though the arcs are smaller and smaller each time, until the vessel comes to rest in stable equilibrium in the upright position. The oscillations of a pendulum in vibrating are performed in equal periods of time, irrespective of their amplitude; and this is practically true of the ship, though the wave making due to the high angular velocity of deep rolls and the increased friction due to greater area of immersed surface cause some variation. The mean length of time required for a ship to make a complete double roll through a moderate angle in smooth water is called the still-water period. In rough water this period is modified by the action of the waves, which gives a constantly varying value to the total righting moment. If the waves pass under a ship in such a way as to add to this moment when the ship is rolling towards the vertical and reduce it when she is rolling away from the vertical, a dangerous condition of affairs is produced which may result in her capsizing. This condition can exist only when the wave period (time between waves) is practically the same as the ship's still-water period; when it does exist the course of the ship with reference to the waves should be materially changed.

Since the righting moment is the force which makes a ship roll, it is evident that if this force is powerful the ship will roll quickly and perhaps deeply, neither of which is desirable. To reduce the time of rolling (i.e., the still-water period) the metacentric height may be reduced as much as is consistent with safety, or the weights in the ship may be moved away from the midship plane if practicable, at the same time preserving the same height of centre of gravity. To reduce the amplitude of the roll, and therefore its angular velocity, the best means so far devised is the bilge keel (q.v.) or rolling chock. Horizontal, thwartship water chambers with a central dam or several dams, and partly filled with water, are useful to reduce small angles of roll, but the noise and shock of the moving water is so objectionable that they have not been adopted. The latest device for the reduction of rolling is the gyroscope, which has been fitted in a number of small vessels and has given good results. Its availability for use in large ships is yet to be determined. Vessels are designed to have a certain metacentric height under various conditions of loading, and the stowage of cargo should, as far as possible, be so arranged as to give proper value to the righting moment. Vessels with double bottoms may, within small limits, vary their righting moments by filling or emptying double-bottom compartments.

To secure seaworthiness, vessels must not only be sufficiently stable at all moderate angles of roll, but they must be stable at all possible angles. The range of stability is independent of the force of the righting moment and varies in different classes of ships. In battleships and large vessels it usually reaches 70 degrees of inclination on each side of the vertical; for small vessels, such as torpedo boats, the range is usually greater. Seaworthiness further requires a reserve of buoyancy, i.e., only part of the hull below the upper deck must be submerged, and the openings in the hull must be capable of being closed in rough seas. (See SAFETY AT SEA.) Comfort and health require that the sides of the ship, and particularly the bow, should be high above the water; without high sides a vessel can be kept at sea for a short period only.

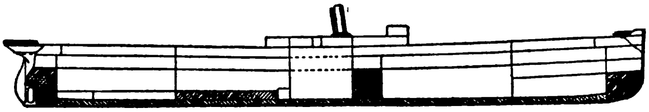


FIG. 5. DIAGRAM SHOWING USE OF WATER-BALLAST TANKS IN A MERCHANT STEAMER.

The shaded portion indicates ballast tanks.

The second part of the subject relates to efficient propulsion and manœuvring power. In this we must consider the shape and smoothness of the hull as regards resistance to its movement through the water. The total resistance is made up of three parts: (*a*) frictional resistance; (*b*) eddy-making resistance; (*c*) wave-making resistance.

Frictional resistance is due to friction between the water and the hull of the ship. It does not depend upon the shape of the hull to any appreciable extent, but upon its smoothness, the area of the wetted surface, the length of the ship, and the speed. It forms the greater part of the total resistance of a ship moving at low speeds and an important part of it at all speeds, particularly if the bottom is rough or foul. For any given ship it varies about as the square of the speed. The difference in resistance between a smooth and a rough bottom is very great. A smoothly painted bottom has only half that of one of the roughness of fine sandpaper and only about a third of that of coarse sandpaper. The difference in the power required to drive a ship when her bottom is foul and when her bottom is clean is then very easily appreciated.

Eddy-making resistance is not usually important in well-designed ships and ought not to exceed about 8 per cent of the frictional resistance. Eddies are chiefly to be found at the stern, where the water rushes in behind the ship. If the run is long and fine, the speed moderate, and the propeller struts, rudder, etc., well designed, they are scarcely noticeable; but a ship with too short a run, badly designed rudder, propeller struts, etc., leaves at full speed a boiling, troubled, eddying wake behind her.

Wave making is in many respects the most important part of the resistance of ships, for it is the one over which we have the most control and which is the greatest impediment to high speed. The laws which govern it are not yet fully understood, but the character of the waves and the losses entailed by them have been very carefully examined. A ship moving through undisturbed water puts certain particles of it in motion, carrying some along with her by friction and giving motion to others in such a way as to cause them to rise in waves. All the energy taken up by the water must come from the propelling machinery, and if it is not returned to the ship in pushing her ahead, it is wasted.

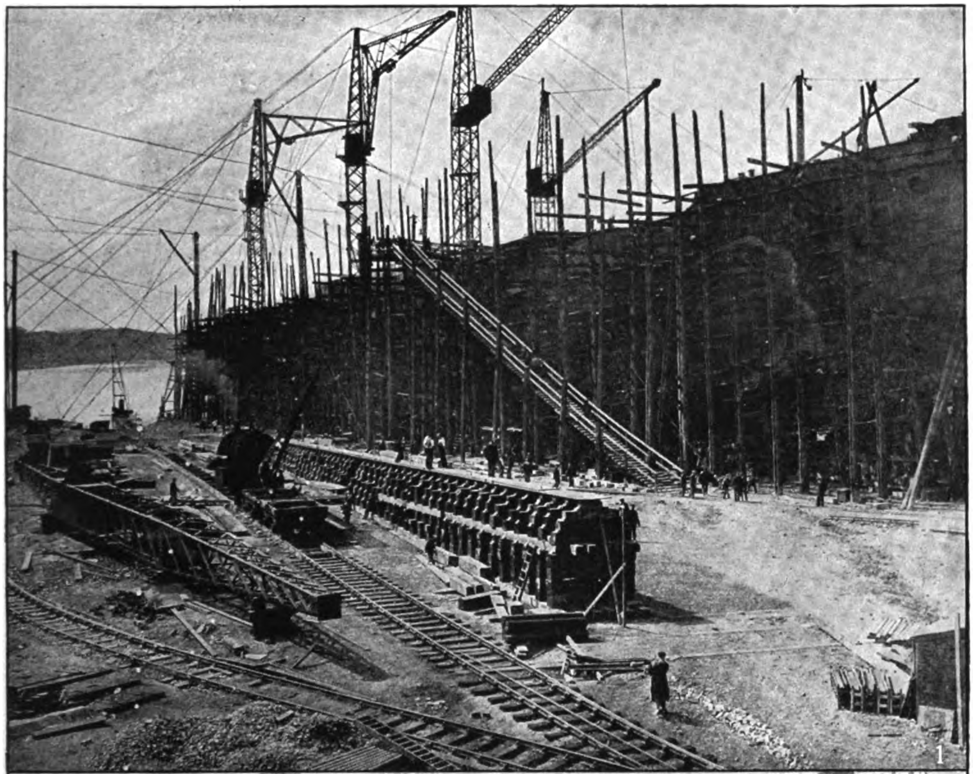
The entrance of a ship is the tapered forebody which extends from the stem to the point where her hull has obtained the full dimensions of the midship (or maximum) section, and the run is the corresponding tapered portion of the afterbody. These two parts of a vessel are termed the wave-making features because the movements of the particles of water forming waves depend upon their lengths and shapes. A vessel passing through undisturbed water forms a double series of waves at the bow and at the stern. The former are most readily seen, largely because the action of the screw tends to degrade and confuse those at the stern. One set of waves are called divergent because their crests make an angle of 40 to 50 degrees with the keel; the other waves are called transverse because their crests are perpendicular to the keel line of the ship. Both sets increase in height with the speed, and this height is a measure of the energy absorbed by them and indicates the speed with which they are traveling. The divergent waves are thrown off and, leaving the ship, no longer influence it, but the transverse waves move at the same speed as the ship and keep their crests and hollows at about the same points on her sides so long as the speed is constant. Furthermore the length between crests is the same as between the crests of ocean waves moving at the same rate of speed. It is found that if a wave crest is maintained at about the middle of the run the wave making is decreased, but if a wave hollow exists there the wave-making resistance is increased. Some of the variations in power required to drive vessels at different speeds may be due to this cause.

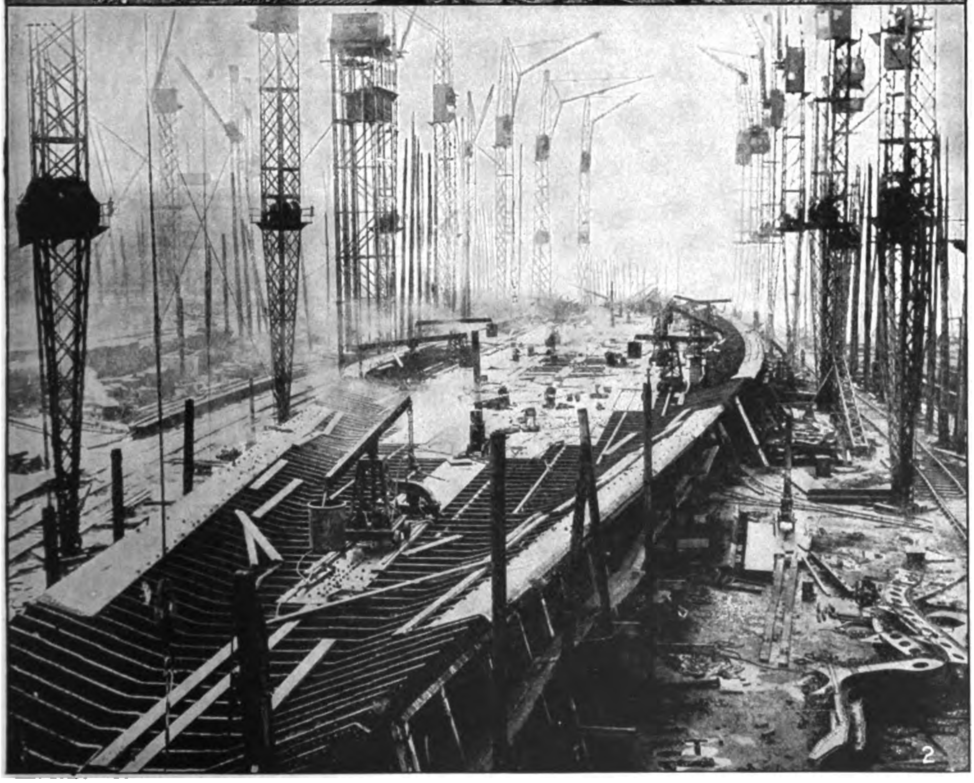
A study of the behavior of models and of full-sized ships of different designs and under different conditions has shown that for every design there is a certain critical speed below which wave-making resistance increases quite regularly and moderately, but beyond which it increases with great rapidity. It is further shown that the greater the length of the entrance and the run the higher is this critical limiting speed. It was at one time supposed that of two designs of equal length and displacement that with the least midship section would give the least resistance, but experiment has shown that this is not necessarily the case. If two designs of equal length and displacement are tested, one having fair lengths of entrance and run and considerable length of parallel middle body, and the other having no parallel middle body and a much greater beam, but tapering from the midship section to the bow and stern, the latter will have the higher limiting speed. Ships, however, are built to carry cargo. The depth is kept as moderate as possible on account of the shallowness of many harbors, and with a given depth only a certain breadth is practicable or the righting moment will be unduly great. Therefore it is desirable to increase the displacement only by increasing the length; this means that, after allowing a suitable entrance and run, the remainder of the length is applied to extending the parallel middle body.

HULL CONSTRUCTION

The plans of the naval architect are prepared on paper and are occasionally supplemented by a wooden model. The three principal ones are the sheer plan (showing sections of the ship made by vertical longitudinal planes), the half-breadth plan (showing sections made by horizontal longitudinal planes), and the body plan (showing sections made by vertical transverse planes). In the figures the dotted lines, 1, 2, 3, are water lines and are the intersections of horizontal longitudinal planes and the inner surface of the planking or plating of the hull; lines *I*, *II*, and *III* are bow (forward) and buttock (aft) lines, made by vertical longitudinal planes; the full lines in the body plan are sections *A*, *B*, *C*, etc., and *A'*, *B'*, *C'*, etc., made by vertical transverse planes, which are passed at equal distances from each other, *X* being at the point of greatest breadth and called the midship section. In the body plan the right half shows half sections forward of the midship section and the left half the half sections abaft it.

The drawings being completed, the work is taken up by the constructive force. The plans are laid off on the mold-loft floor in full size. Wooden molds are then prepared for the frames or else the shapes of the frames are cut (or scrived) into a great piece of flooring called the scrive board. The frames are heated and bent on the bending slab. This is a large floor of thick metal with a great number of holes in which pins

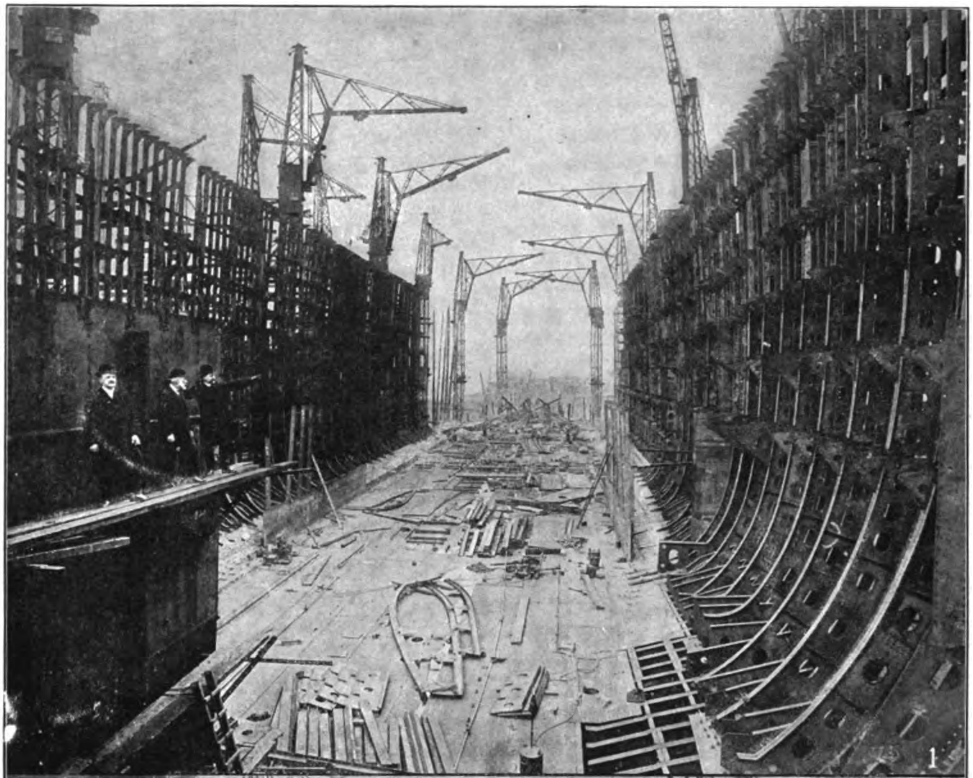




1 PART OF KEEL PLATES LOOKING AFT 2. INNER BOTTOM

THE CONSTRUCTION OF AN OCEAN LINER—THE "AQUITANIA"

SHIPBUILDING



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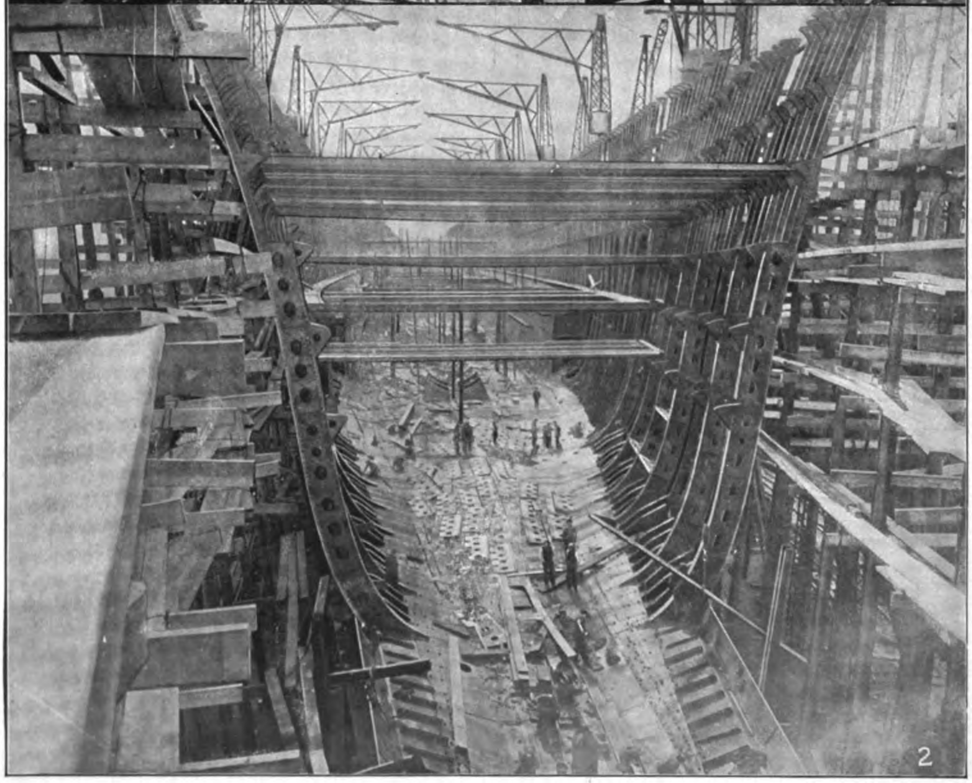

2

1. FRAMES AND CENTRE LINE BULKHEAD AT ENGINE SPACE
2. VIEW LOOKING AFT SHOWING THE VARIOUS DECKS

THE CONSTRUCTION OF AN OCEAN LINER—THE "AQUITANIA" may be placed. The mold of the frame is laid on the bending slab and pins inserted along its edge. The hot-iron angle bar (or channel or Z bar), which is to form the frame (or the outer part of the frame, if it is built up of plates and angles), is then pressed up against these pins and so given its proper curvature. A sufficient number of frames having been prepared, the work of erection begins.

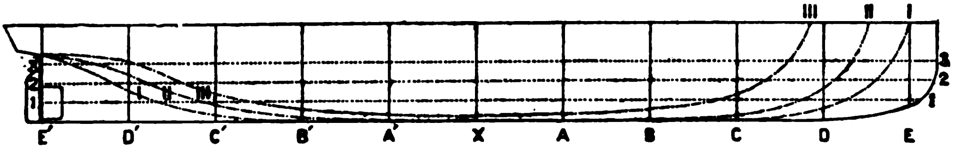

FIG. 6. SHEER PLAN.

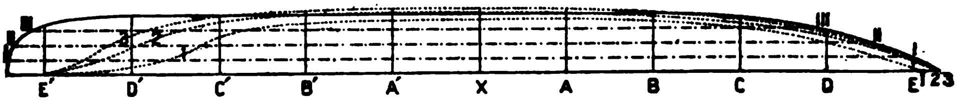

FIG. 7. HALF-BREADTH PLAN.

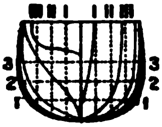

FIG. 8. BODY PLAN.

The building way is prepared by setting up the keel blocks. These are short heavy timbers 1 foot or more square built up in piles 2 or 3 feet apart and having the upper surface shaped to the keel line of the vessel. On these the keel is laid. In nearly all modern steamers the keel or keel plate is a broad flat plate of extra thickness. It is in sections, riveted together, and joined to the stem and stern posts. After the keel is laid the midship frames are erected and held in place by shores and ribbands until secured by the internal vertical keel, the longitudinals, stringers, side and bottom plating, etc. The large castings or forgings forming the stem and stern posts are then erected, the remainder of the plating put on, and the interior of the ship partly completed.

The next step is the launching, and this may take place at any time after the outside plating is on, and the interior completed so far as necessary to assure sufficient strength and stiffness. The weight of the vessel has so far been supported on the keel blocks and bilge shores. It must now be transferred to the launching ways. These consist of heavy timber ways inclined at about the same angle as the keel blocks (about five-eighths of an inch to the foot) and are built up on each side of them. Resting on the launching ways are the sliding bilge ways, also of heavy timber, and on top of the bilge ways is built a framework that fits closely to the bottom of the ship. This is called the cradle. To remove the weight of the ship to the launching ways wedges are driven under the cradle, lifting the ship off the keel blocks; or the weight during building is taken on sand boxes, from which the sand is allowed to run when ready for launching. The hull is thus lowered instead of being raised. The under surface of the bilge ways and the upper surface of the launching ways having been well lubricated, the ship is ready to slide into the water as soon as released by sawing the tie piece, or knocking out the dogshore, which holds her. In the case of large modern ships, instead of tie pieces or dogshores, hydraulic jacks hold the cradle. When these are released, other jacks at the upper end of the cradle exert a heavy pressure against it to insure starting promptly. The ship starts down the ways slowly, but her velocity on reaching the water is frequently considerable and must be checked by hawsers if there is not much room for her to range astern. As soon as she is water-borne she floats clear of the cradle. Small vessels are usually nearly completed before launching, but large ones are commonly launched when not much over half their weights are on board. As soon as the ship is in the water the boilers and engines are installed and the interior and upper works finished. In England many armored vessels are built in dry-docks. This saves the labor of lifting heavy weights, it being only necessary to lower them; and the cost of the launching and building ways

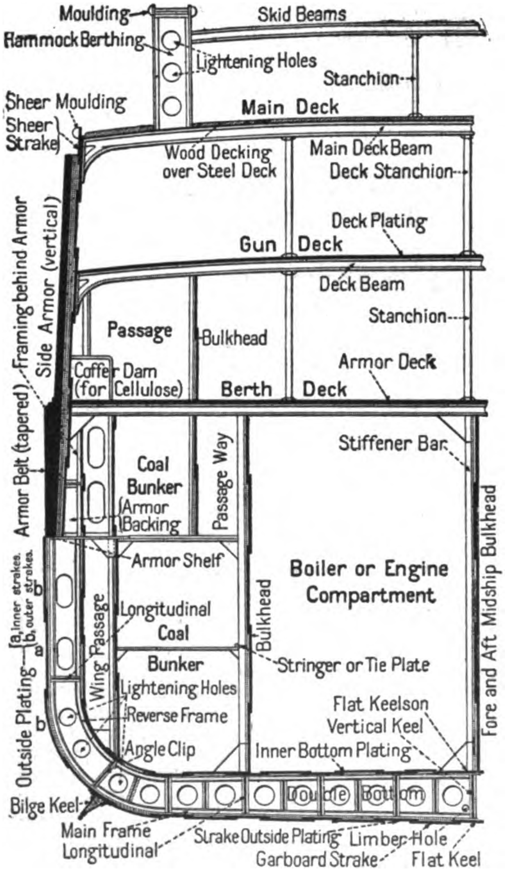

FIG. 9. MIDSHIP SECTION OF BATTLESHIP.

is avoided. As an offset to these advantages the use of a drydock is lost for a year or two.

Comparatively few wooden steamers are now built, but wooden sailing vessels are still produced in considerable numbers. The general features of wooden shipbuilding resemble those of shipbuilding in iron and steel, but there are of course differences. The keel blocks are laid in the same way. On them are laid the heavy timbers forming the keel, which are sometimes nearly 2 feet square. The different lengths of timbers are scarfed and bolted together; over and across the keel are laid the floor timbers of the ribs or frames, and the frames are thence built up, being held in place by shores, braces, cross-spalls, beams, and ribbands. Between the floor timbers and extending up usually to the principal deck (sometimes to the rail) the space is closely packed with filling timbers forming a structure which is nearly tight without planking. The beams in wooden ships are of wood, and they may be attached to the frames by wooden or iron knees. The former are considered to give the best fastening, but the iron knees save much room.

The advantage of having a copper bottom has caused a few composite vessels to be built. These are mostly yachts, gunboats, and small sailing vessels. Composite vessels are framed much like those of iron or steel. Over the frames wood planking is used instead of metal plating, though a good many plates of metal are placed under the wood to give the proper strength to the structure in different parts. The wood planking is attached to the frames with bolts setting up with nuts on the inside and is covered with copper to a short distance above water. The topsides of many composite vessels are plated with steel or iron above the level where coppering is necessary, as the metal is stronger and more durable than the wood.

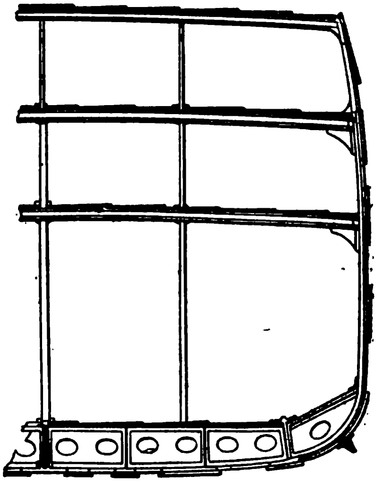

FIG. 10. CELLULAR DOUBLE BOTTOM OF A MERCHANT STEAMER.

The safety of a ship depends upon its stability, strength, water-tightness, and reserve stability and floatability, if injured. The stability of ships has already been considered. The strength is due to the framing and plating or planking. Water-tightness is effected by calking the seams between plates or planks. The seams of iron plates are calked by forcing the edge of the uppermost plate against the plate underneath it by means of a calking tool. The seams between planks are partly filled with oakum, which is forced in, and the remainder of the seam filled with pitch, marine glue, or putty. The reserve stability and floatability when injured depend upon the position and volume of the interior space which is flooded. To reduce this volume to a safe point, vessels are divided into compartments by water-tight bulkheads which extend across the ship at intervals. In merchant vessels, except in the engine and boiler spaces, the bulkheads usually have no passages through them, but in men-of-war many of the bulkheads have openings closed by water-tight doors. In addition to transverse water-tight bulkheads many ships have longitudinal ones, such, e.g., as the one separating the engine rooms in a twin-screw vessel. As a further protection against flooding due to striking ground, large vessels usually have a double bottom extending the whole or part of the length and rising at the sides to about the turn of the bilge or higher. The inner bottom thus fitted is laid over the inside of the frames and secured in the same manner as the outside plating. The frames in the double bottoms are deep enough to give considerable space between the inner and outer plating, which is necessary to give access for cleaning and painting. Most frames are lightened by holes cut through them, but about every fourth or fifth frame is water-tight and has no holes. The space between the imperforate frames forms a double-bottom compartment, access to which is had by a manhole closed by a removable water-tight cover. Most ships are fitted with a water-tight bulkhead close to the bow, called the collision bulkhead; many have a similar one aft. The spaces beyond these bulkheads are commonly used as trimming tanks.

For vessels building in the United States and elsewhere, see tables near the end of the article on SHIP AND SHIPPING. See BILGE; BULKHEAD; DECK; LAUNCH; LOAD-LINE MARKS OF VESSELS; MEASUREMENT OF SHIPS FOR TONNAGE; MERCHANT MARINE NAVIGATION; NAVIES; SHIP AND SHIPPING; ETC.

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MARINE MACHINERY

General Considerations. The efficiency of marine machinery, like that of other types, is represented by the equation

$$\text{Efficiency} = \frac{\text{Useful work performed}}{\text{Total energy received}}, \text{ or } E = \frac{W}{e}.$$

The heating value of good semibituminous coal is from 15,000 to 16,000 B. T. U. per pound; fuel oils range between 18,000 and 21,000 units. Of the total heat units in any fuel, only a small portion is turned into useful work. The boiler losses are 30 to 40 per cent, due to incomplete combustion, radiation, condensation, and waste heat in the smoke-pipe gases. The engine wastes are due to condensation and radiation in the steam pipes, cylinders, or steam spaces, incomplete expansion, friction, and the heat carried into the condenser. These losses exceed 70 per cent. There is a further loss in transmission of the power to the propeller, and in the propeller itself, amounting to 50 or 60 per cent. The total maximum efficiency of the combination, therefore, is about

$$E = \frac{70 \times 30 \times 50}{100 \times 100 \times 100} = 10.5 \text{ per cent,}$$

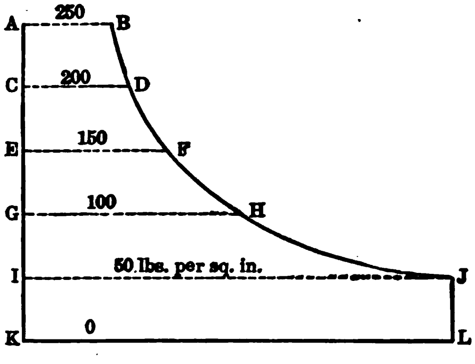
and the ordinary average efficiency is 5 to 6 per cent. Since this is only about half the maximum, every effort is made to increase it.

The efficiency of steam is represented by

$$E = \frac{T_1 - T_2}{T} = \frac{t_1 - t_2}{t_1 + 461},$$

where T_1 = initial absolute temperature, t_1 = initial temperature F., T_2 = final absolute temperature, and t_2 = final temperature F. It is evident that the greater the value of t_1 and the smaller the value of t_2, the higher will be the efficiency of the steam. The amount of heat required to convert one pound of water from a temperature of 100° into steam at 60 pounds' pressure is about 1115 thermal units, and to convert the same water into steam at 200 pounds' pressure is 1140 units, i.e., only 2.5 per cent greater heat is required for three times the pressure. From the foregoing it is evident why high-working steam pressures and a good condenser conduce to engine economy.

A further gain is obtained by expansion. If steam at 50 pounds' pressure be admitted to an engine during the entire stroke of the piston, the work performed by it would be represented by the rectangle *IJLK* in the accompanying diagram. If the same weight of steam be raised to 100 pounds' pressure, cut off at half stroke, and allowed to expand, it would, if it were a perfect gas, have a pressure of 50 pounds at the end of the stroke, and the work performed would be equal to the area *GHJLK;* similarly, for 250 pounds, the area would be *ABJLK.* There are practicable limits to the point of cut-off and degree of expansion due chiefly to liquefaction because steam is not a perfect gas. The loss from liquefaction can be reduced by (*a*) using several cylinders in which to effect the total expansion; (*b*) supplying heat by means of a steam jacket about the cylinder; (*c*) superheating the steam after generation in the boiler and before admitting it to the engine; (*d*) reheating the steam in the receivers between the cylinders; (*e*) compression; (*f*) increasing the speed of rotation of the shaft.



The gains and losses in a reciprocating engine have alone been considered, for these will be used as a standard for referring the efficiency of other forms of propelling machinery.

PROPELLING ENGINES

After a century of steady improvement the reciprocating engine is giving away to other forms for many classes of vessels. These other forms are direct-connected turbines, geared turbines, turboelectric engines, and reduction gear of the Föttinger and other types.

Reciprocating Engines of recent design are mostly triple expansion. The gain in economy by the compound over the simple is about 50 per cent, of the triple expansion over the compound about 25 per cent, and of the quadruple expansion over the triple about 10 per cent; but the gain is attained at the expense of considerable increase in weight, so that for most conditions the gain in using the quadruple is questionable. A great advantage of the multiple-expansion engine, and one cause for its adoption, is the more even turning effect and the better balancing obtained. The strains upon the machinery, bedplate, and vessel are thereby reduced, as well as the vibration of machinery and hull. Triple-expansion engines are usually built with cylinders of such size that the crank effort is equalized as far as practicable, and the cranks are set at 120°. When the low-pressure cylinder would be too large to be conveniently installed, or if a better balancing effect is desired, two low-pressure cylinders are used. In the Yarrow-Schlick-Tweedy system of balancing reciprocating engines the arrangement of cylinders along the shaft is: first low pressure, high pressure, intermediate pressure, second low pressure.

The course of the steam is as follows: leaves main steam pipe, passes through separator, then throttle, and into high-pressure valve chest. The movement of the valve opens the steam ports of the cylinder during a part of the stroke and then cuts off; the steam in the cylinder then expands, moving the piston. Just before the end of the stroke the valve opens to the exhaust and at about the same time begins to allow steam to enter on the other side of the piston; this results in cushioning at the end of the stroke. The steam from the exhaust port, reduced in temperature and in pressure, then passes to the intermediate-pressure receiver, which is really the intermediate-pressure valve chest. Thence via the intermediate-pressure valve it enters the cylinders, performs its work, and is again thereby reduced in temperature and pressure (usually at this stage about that of the atmosphere). It then passes through the low-pressure receiver and cylinder or cylinders. On leaving the low-pressure cylinder it goes to the condenser, where it is condensed, and then as water and vapor it is pumped by the air pump to the hot well or feed tank. From there the feed pumps deliver it to the boiler, where it is reëvaporated.

Steam is expanded in triple-expansion engines from six to nine times. The ratio of expansion in each cylinder is such that the volume of steam from the high pressure will just fill the intermediate pressure up to the point of cut-off, and similarly for the intermediate pressure. Piston speed varies from 80 to 100 feet per minute in long-stroke engines to 500 or 600 in torpedo boats and fast yachts.

Turbines. As all mechanical power is delivered through shafting which is caused to revolve by the engine, James Watt and innumerable inventors since his day have endeavored to produce a practicable rotary engine. So far as ship propulsion is concerned, the first successful attempt was that made by the English engineer, the Hon. C. A. Parsons, who about 1896 built the *Turbinia*, a small, high-speed, turbine-propelled boat. Since that date steam turbines (q.v.) have developed rapidly. In 1903 the Cunard line fitted turbine engines of 21,000 horse power in one of their large steamers, and in 1906 the *Lusitania*, with turbine engines of 70,000 horse power, was completed. Many torpedo boats were fitted with them, but the first battleship to have turbine machinery was the *Dreadnought*, launched in 1906. Practically all naval vessels are now driven by turbines or by a combination of turbines and other machinery.

Marine turbines are of two types, impulse and reaction, the former represented by the Curtis and the latter by the Parsons. Both have developed and improved until they are at least as efficient as reciprocating engines, if arranged and operated in a manner to secure the greatest economy, and under certain conditions they are much more so.

In a multiple-impulse turbine in which there are a number of moving rings, as in the Curtis, the velocity of the steam acquired in the nozzles is reduced as the steam passes through the three moving and two fixed blades of each stage. After passing the third moving ring of any stage except the last the steam enters another set of nozzles, in which it loses pressure and gains velocity, and then enters the first ring of another stage, composed of three moving and two fixed rings, and it repeats the cycle. In a four-stage Curtis turbine the peripheral speed of the moving blades is about 400 feet per second. The steam leaves each set of expansion nozzles with a velocity of about 2000 foot seconds, and each moving ring reduces this about 400 feet. After the pressure is reduced to the proper point the steam passes from the final stage to the condenser.

In the impulse turbine the steam loses velocity, but not pressure, while acting on the moving blades. In the reaction turbine the steam loses pressure and acquires relative velocity as it passes each ring of moving blades and of fixed blades. A pair of blades, one moving, one fixed, constitutes a stage. In a low-speed turbine there may be 200 or 300 of such stages, the number depending upon the circumferential speed. In high-speed engines the number of stages may be as low as 45. Owing to the comparatively low velocity of the steam in a reaction turbine, there is practically no wear of the blades from this cause. They are therefore made very thin, while the erosive action of the steam in an impulse turbine is considerable.

As turbines cannot be made to reverse, in applying them to marine propulsion special backing turbines have to be fitted; this adds materially to the weight of the machinery and to the floor space occupied. Furthermore, in order to insure operating economy, the peripheral speed of the turbine must be high or else the propeller will be driven too fast to secure propeller efficiency. To keep the propeller speed within bounds the turbines are made of large diameter when directly connected to the propeller shaft, and this adds much to the weight. Moreover, the turbine has but one economical speed, and that is high. To secure the requisite reduction in power necessary to give moderate and low speeds, cruising turbines are fitted on war vessels and others in which a moderate speed is necessary during long periods. Further variations in speed are effected by varying the course of the steam through the different turbines of the installation, which, when the turbines are directly connected, consists usually of two to four shafts with one or more turbines on each.

The defects of directly connected turbines have caused numerous efforts to be made to utilize their manifest advantages by indirect connection. The systems in use or proposed are:

(*a*) Geared turbines in which the rotor is allowed to turn at its economical speed and is connected to the propeller shaft by reduction gearing.

(*b*) Hydraulic transformer gearing in which the rotor also turns at its economical speed. Centrifugal pump wheels are keyed to the rotor shaft, and impulse-reaction water-turbine wheels are similarly secured on the propeller shaft. The water flows from the pump through the water turbines and so drives the shaft ahead if sent through one set and astern if sent through the other.

(*c*) Electric transmission in which the turbines, operating at economic speed, drive dynamos which furnish current to motors on the propeller shaft.

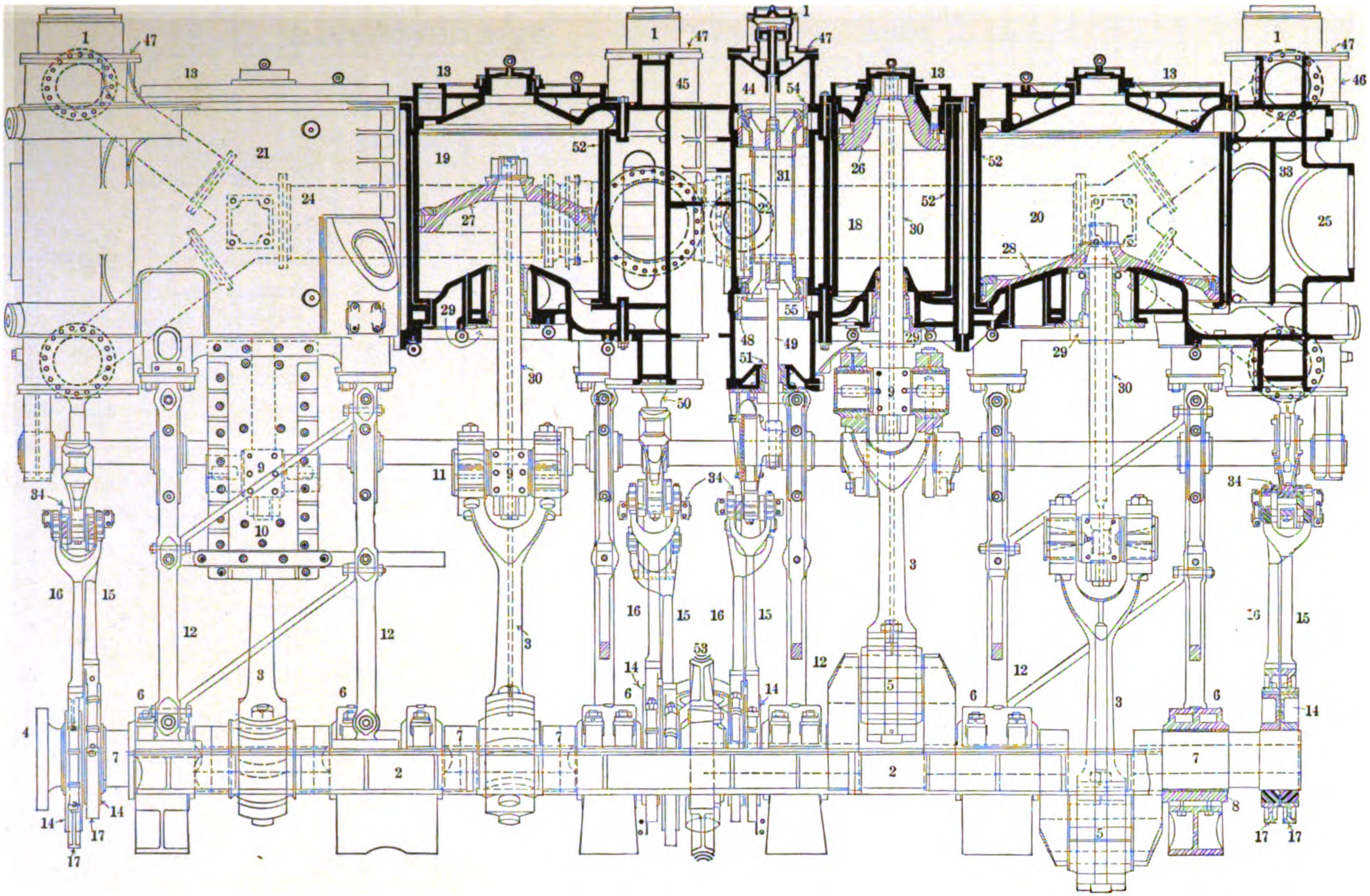
Another form of partial indirect connection which is advocated, but up to 1916 had not been applied, consists in the combination of a high-pressure reciprocating engine discharging into a low-pressure turbine, the rotor of which is geared to the shaft it drives.

Each of these methods of indirect connection has its advantages and disadvantages.

The principal advantages of the geared turbine are: reduction in weight (15 per cent) over a directly connected turbine; saving in coal (15 per cent); simplicity of mechanism; reduction in size of turbine casings and easier repair; possible speed-reduction ratio about 30 to 1. Its disadvantages are: some noise, though slight; wear, slight; possible limitation of power (this is disputed); nonreversibility—requires special backing turbine, usually of not more than 50 per cent of ahead power.

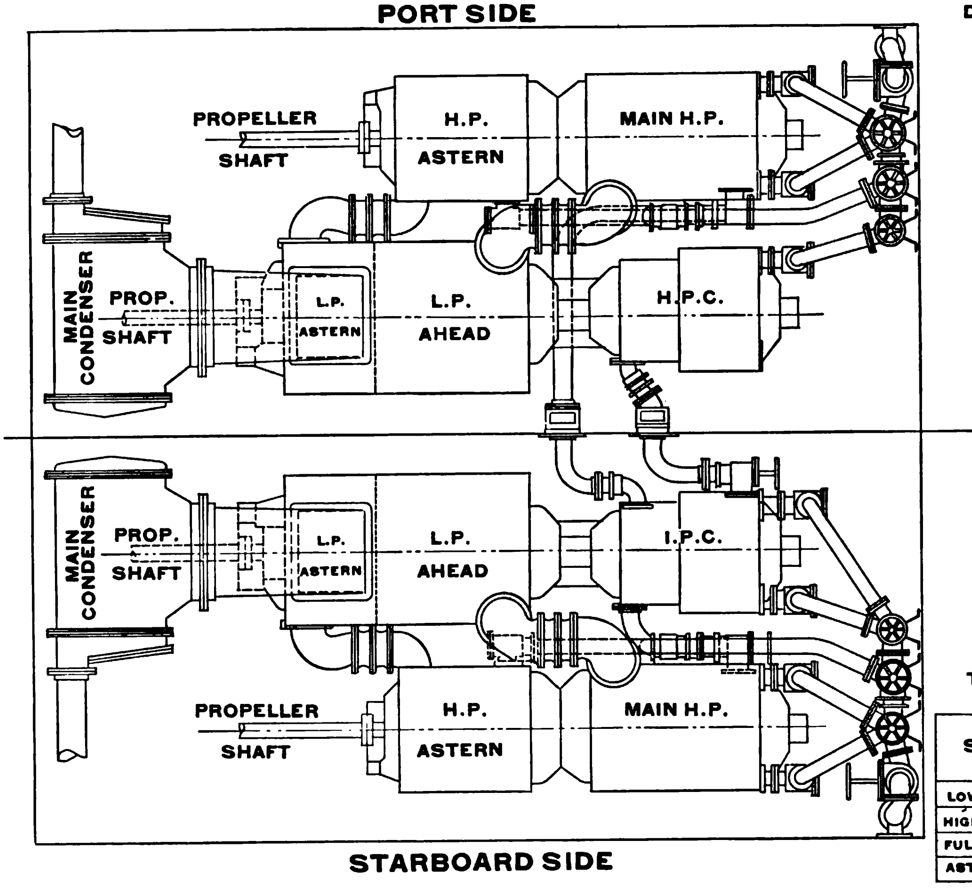
The advantages of the hydraulic transformer mechanism are: reversibility without backing turbines and 85 per cent backing power; practically no limitation as to power; no additional noise; no appreciable wear; increased economy and saving of weight as compared with direct turbine drive. The disadvantages are lower efficiency (about 89 per cent) compared with gearing; limitation in speed-reduction ratio, the maximum being about 6 to 1; complication in mechanism.

The advantages of the electric transmission system, in which large high-speed turbines drive the generators, are: saving of weight and space and great steam economy; speed-reduction ratios may be varied at will by changing the motor winding; efficiency at low powers; reversibility without backing turbines and nearly full backing power; transmission adapted to any power; steady running, turbine being uninfluenced by racing of the screws. The principal objections are: difficulty of ventilating generators (this is denied); difficulty of cooling of resistances (not



FOUR-CYLINDER INVERTED, DIRECT-ACTING TRIPLE-EXPANSION ENGINE. U. S. BATTLESHIP "OKLAHOMA." IN COMMISSION 1916. DESIGNED 1911

1. Lovekin improved assistant cylinders. 2. Bed-plate. 3. Connecting-rods. 4. Shaft coupling flanges. 5. Crank-pins. 6. Crank-shaft bearings. 7. Crank-shaft. 8. Crank-shaft brasses. 9. Cross-heads. 10. Cross-head guides. 11. Cross-head pins. 12. Engine columns. 13. Cylinder covers. 14. Eccentrics. 15 and 16. Eccentric rods. 17. Eccentric straps. 18. High-pressure cylinder. 19. Intermediate-pressure cylinder. 20. Forward low-pressure cylinder. 21. After low-pressure cylinder. 22. Main steam pipe. 25. Low-pressure exhaust. 26. Piston, high-pressure. 27. Piston, intermediate-pressure. 28. Piston, low-pressure. 29. Piston-rod stuffing boxes. 30. Piston rods. 31. Piston valve, high-pressure. 32. Piston valve, intermediate pressure. 33. Piston valve, low pressure. 34 Link blocks. 44. Valve chest, high-pressure cylinder. 45. Valve chest, intermediate-pressure cylinder. 46. Valve chest, forward low-pressure cylinder. 47. Valve chest, covers. 48. Valve chest, liners. 49. Valve stems. 50. Valve stem guides. 51. Valve stem stuffing boxes. 52. Cylinder liners. 53. Turning engine. 54. High-pressure steam port, top. 55. High-pressure, steam port, bottom.



FLOW OF STEAM

DIAGRAMATIC SKETCH FOR DIFFERENT SPEEDS

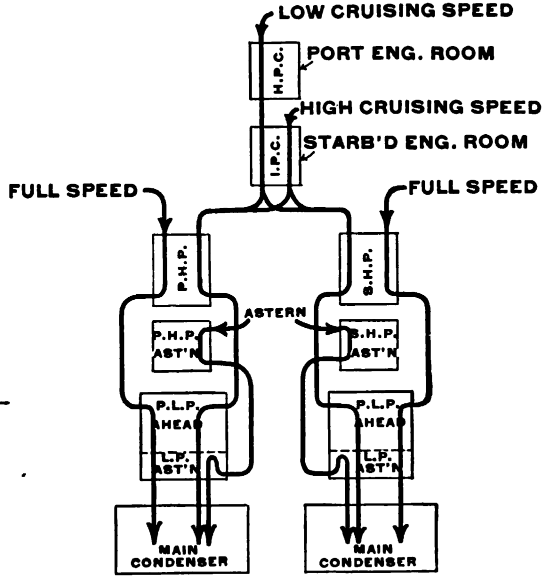


TABLE SHOWING TURBINES THROUGH WHICH STEAM FLOWS FOR DIFFERENT SPEEDS

SPEED	TURBINES									
	H.P.C.	I.P.C.	P.H.P.	S.H.P.	P.H.P. AST'N	S.H.P. AST'N	P.L.P.	S.L.P.	P.L.P. AST'N	S.L.P. AST'N
LOW CRUISING	X	X	X	X			X	X		
HIGH CRUISING		X	X	X			X	X		
FULL			X	X			X	X		
ASTERN					X	X			X	X

PLAN OF TURBINE ENGINES OF THE U. S. BATTLESHIP "UTAH"

SHOWING LOCATION OF TURBINES AND PIPING. ALSO A DIAGRAM AND TABLE SHOWING THE COURSE OF THE STEAM AT DIFFERENT SPEEDS OF THE SHIP admitted by advocates of system); complexity of accessories; possible effect of high-tension voltage in steel ships on the ship's instruments and personnel (in the existing installations no trouble on this head has been experienced). One type of electric transmission machinery has Diesel engines for driving the electric generators.

The combination of the geared turbine and the reciprocating engine is designed to utilize the advantages of both and eliminate some of the disadvantages of each. The reciprocating engine is wasteful at the lower end of its cycle of expansion because the energy remaining in the steam at the end of the stroke of the low-pressure piston is not only lost, but it has to be overcome in the air pump and condenser. A low-pressure turbine replaces the low-pressure cylinder and utilizes nearly all the remaining energy of the steam. Such a combination is probably very economical, but its exact efficiency has not been practically determined.

Internal-Combustion Engines. Three types of internal-combustion engines (q.v.) are used in the propulsion of vessels, viz., heavy-oil engines of the Diesel type, gasoline, and producer gas engines. The last named has been fitted in experimental installations only; gasoline is too expensive except for small boats, submarines, and yachts; but heavy-oil engines are used in increasing numbers.

Engines of the Diesel type have been built for service on shore that develop over 6000 brake horse power, but the largest installed on board ship up to 1916 were of about 2000 B. H. P. Such engines are usually fitted for twin-screw propulsion, so that one or two ships have machinery of about 4000 B. H. P. (or 5000 I. H. P.). Engines of this power have eight cylinders, as 300 B. H. P. is about the maximum for a single cylinder, and few develop over 200 B. H. P. Diesel engines cost more than steam machinery (including boilers) of the same power, but they weigh considerably less, take up less space, require no boiler personnel, and develop their power at a less cost when the oil does not cost more than three or four times as much (by weight) as coal. There are many advantages connected with the use of oil as fuel. It is easily taken aboard, and the cost of doing so is small. It can be stowed in places unsuitable for coal or cargo, the distance from the engine room, hatches, or deck being comparatively unimportant. This enables the vessel to utilize spaces otherwise wasted and to carry a much larger supply of fuel than a steamer, so that she needs to stop for fuel much less frequently and can make her purchases where oil is cheapest. The saving of space and weight and the decreased personnel add to the cargo capacity, while the remaining advantages reduce the costs in other directions. The total effect of the economies obtained enables these engines to operate at a less expense than a steamer, unless the oil costs five or six times as much as coal—which shows that engine efficiency is not the only point to be considered.

By far the greater number of Diesel engine ships have machinery of the four-stroke cycle type, though two-stroke cycle are used, and the use is apparently increasing. So far the four-stroke engines have proved to be so much more economical in fuel consumption than the two-stroke that the difficulties connected with reversing, the additional complexity of the machinery, the greater weight, and increased cost have not sufficed to displace them. In recent designs the fuel consumption on long voyages has averaged less than 0.4 pound per B. H. P., including auxiliaries. The maximum shaft speed has been brought down to about 100 r. p. m., so that the propeller efficiency is about as high as that with any form of propulsion machinery.

The difficulty in building marine Diesel engines of great power has so far prevented their use in large high-speed vessels, but for cargo ships, in certain trades, they are said to be very satisfactory, and they are also displacing gasoline engines in submarine boats. Another use, which bids fair to be extended, is for auxiliary propulsion in sailing ships. In some of these it is hard to say whether sails or the engines are auxiliary, as the vessels are full-rigged sailing ships, and the engines are capable of giving a speed of 10 knots, while the fuel supply is sufficient for a power mileage equal to that of the ordinary freight steamer. See INTERNAL-COMBUSTION ENGINE.

AUXILIARY MACHINERY

The auxiliary machinery of power-propelled vessels consumes much power and adds considerably to the costs of operation and to the permanent weights carried. The most important auxiliaries of the engine room are the condenser, circulating pump, and air pump. The condenser consists of a cylindrical shell in which there is a transverse diaphragm near each end. Between these diaphragms run the small condenser tubes of copper alloy coated with tin. The steam enters the side of the condenser, circulates about the tubes, is cooled, and goes to the air pump chiefly as water. The air pump assists to lower the vacuum in the condenser as well as to remove the water and vapor, and it discharges into the hot well or feed tank. The circulating water is forced through the tubes by the circulating pump, which takes its cooling water from the sea through the main injection valve and discharges the warm water through the outboard delivery. The action of the condenser and air pump reduces the pressure on the exhaust side of the engine very nearly to a perfect vacuum, 13 pounds below the atmospheric line being common, and under favorable conditions slightly better results are obtained. It is evident that much rests upon an ample supply of the circulating water and upon its temperature.

The principal boiler auxiliaries are feed pumps, hydrokineters, feed-water heaters, superheaters, evaporators, distillers, and ash ejectors or ash hoists. There are usually two or more feed pumps to each group of boilers. They take the water from the feed tank and force it into the boiler. Hydrokineters are used to insure circulation in the boilers. Feed-water heaters are of various types. Most of them use waste steam from auxiliaries to heat the cold feed water before it is supplied to the boiler. There is always a certain loss of water in operating machinery, and this entails an addition of cold water from the ship's fresh-water tanks which makes good the deficiency and is called make-up feed.

The superheater is a tubular addition to the boiler which contains no water, but through which the steam passes on its way from the boiler to the engine. It is heated by the furnace gases after they have passed through the boiler proper, and they raise the temperature of the steam which passes through it 25° F. to 100° F.

This dries the steam and reduces condensation in the engine. Superheaters were not regularly used with reciprocating engines because the dry steam made internal oil lubrication of cylinders necessary, and the oil caused troubles in the boiler. In turbine engines the oil difficulty is not present, and dry steam is much more necessary, so that superheaters are now generally fitted.

The evaporator is similar to a condenser in design, but the tubes are much larger and fewer, and its purpose is quite the reverse. Steam instead of water passes through the tubes; sea water passes around them and is evaporated, leaving its salts behind as an incrustation on the tubes. The steam so formed is then condensed in the distiller and pumped into the ship's fresh-water tanks to cool. The evaporator is a necessary adjunct of the ship's boilers to supply make-up feed, but it also furnishes fresh water for drinking, cooking, washing, etc. The ashes from the boiler are either hoisted to the deck and discharged by hand or gravity or are ejected through a tube discharging above water by means of a steam jet. The apparatus for the latter method of handling ashes is called an ash ejector. Types of ejectors for discharging below water have been used, but are not regarded with great favor.

The electric generating plants of warships and passenger vessels is a very important part of the auxiliary machinery. In turboelectric drive the propelling part of the electric installation forms part of the main engines. In vessels having other types of propulsion electric power is used only for lighting, operating small machinery, handling water-tight doors, operating deck hoists for cargo, turning turrets, handling guns, driving steering and anchor gear, etc. In such ships the generators are of the continuous current type. See DYNAMO-ELECTRIC MACHINERY.

The anchor engine of most vessels is operated by steam or hydraulic power, but in a few ships electric motors are geared to the shafts which drive the cable winches. As the anchor is no longer handled, but simply pulled up into a large hawse pipe and held there, a powerful winch of some sort is all that is needed. The character of the power is immaterial. See ANCHOR; CAPSTAN; CHAIN.

Steering engines are usually steam driven, but many hydraulic and a few electric engines have been installed. The control of hydraulic and steam-steering engines is effected by means of a wheel and small wire ropes, by a telemotor, or by electric gear. Small and medium-size ships have the rudder turned by chains or gears leading from the engine to an arc on the rudder head. In very large ships the rudder is operated by heavy levers driven by hydraulic pressure or a worm wheel.

One of the few machines on all large vessels still operated by steam is the ice machine. In merchant ships it is usually of the ammonia type, but in men-of-war it uses compressed air for refrigerating and ice making. Turret machinery, ammunition hoists, and other ordnance fittings are electrically operated in nearly all modern ships, though hydraulic power is much used in the British navy.

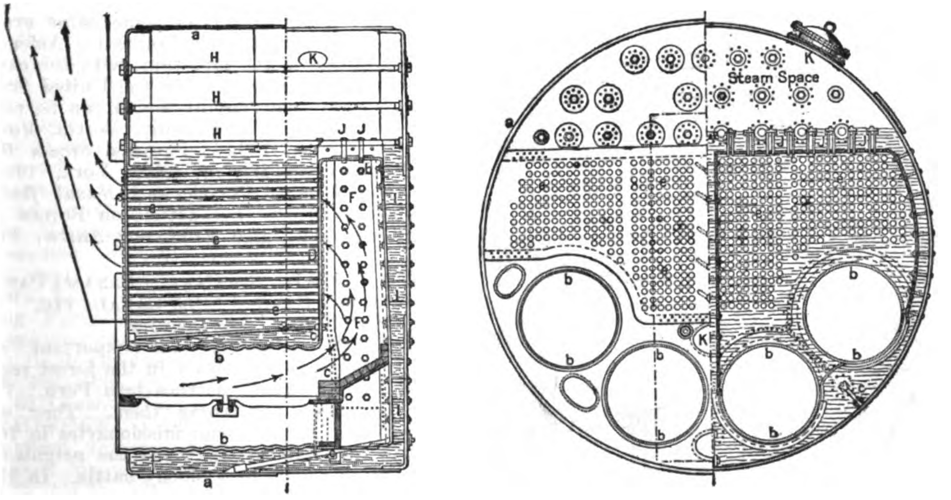
Bibliography. J. K. Barton, *Internal Combustion Engines* (Annapolis, 1907); id., *Naval Reciprocating Engines and Auxiliary Machinery* (rev. ed. by H. O. Stickney, ib., 1914); Bauer and Lasche, *Marine Steam Turbines* (New York, 1911); Bauer-Robertson-Donkin, *Marine Engines and Boilers* (ib., 1905); Biles, *The Steam Turbine as Applied to Marine Purposes* (Philadelphia, 1907).

BOILERS

Modern marine boilers are of two general types, Scotch and water tube. The Scotch boiler is horizontal, cylindrical, fire tubular; it is used very generally in the merchant service and, until quite recently, in naval vessels. It consists of a cylindrical shell in the lower half of which are placed one or more cylindrical, corrugated furnaces (large boilers have three or four), extending from the front for about three-fourths the length and there opening into the combustion chamber or back connection, a space for furnace gases which rises slightly above the furnace crowns. From the back connection return tubes, extending to the front connection, are placed between and above the furnaces. The furnace gases escape thence to the smoke pipe. Double-ended boilers are occasionally built; they consist of two single-ended boilers, back to back, in a single shell. Scotch boilers are built in all sizes up to 20 feet in diameter and 18 feet in length for single-ended and 24 feet in length for double-ended. They carry steam pressures of 150 to 200 pounds per square inch. Their principal advantages are: reliability; simplicity; they will stand hard usage; they have been in use so long that their peculiarities are very thoroughly understood and generally known. Their disadvantages are: great weight; steam cannot be raised or reduced quickly; heavy forced draft cannot be used; very high pressure cannot be used in boilers of large capacity owing to the thickness of shell which makes the weight excessive; they are difficult to repair; when they begin to deteriorate the working pressure must be lowered, and this reduces the power; owing to the large amount of water contained, accidents are usually serious—often disastrous—to life and property.

The advantages of the water-tube boiler are: lightness; adaptability to high pressure; it is readily adjusted to change of output; forced draft can be used (in nearly all types); it is relatively safe, and accidents are less serious; repairs and renewals are so easily made that all parts are kept up to strength, and reduction of pressure and power are unnecessary. The disadvantages are: increased complication; it needs more care and attention than the cylindrical; it cannot use salty or dirty water; the different types are not so well understood by the average fireman, so that the best results are not always obtained. Of the many kinds in use the Babcock and Wilcox, Yarrow, Niclausse, Schultze, Durr, Belleville, Normand-Sigaudy, Thorneycroft, White, Reid, Seabury, and Almy are most common. The economy of fuel is probably about the same in water-tube and cylindrical boilers when each is efficiently operated. For average running, especially in cargo carriers of moderate speed, the cylindrical boiler is considered to be more economical than the water tube; in large high-speed vessels, naval and mercantile, the reverse is the case.

An illustration of a large single-ended cylindrical boiler is shown; *aa* is the shell plating; *bb*, corrugated furnace; *cc*, stays supporting combustion chamber; *DD*, tube sheets with tubes extending between them; some of these are stay tubes and are screwed into the tube sheets, which they help to support; the other tubes have their ends expanded into the tube sheets; *F*, combustion chamber (back connection), where the gases of combustion are finally mixed and burned; *H, H, H*, steam space stays supporting the boiler ends; *II*, short stay bolts supporting back and sides of combustion chamber; *JJ*, girder stays supporting top of combustion chamber; *KK*, manholes for cleaning. The heating surface is composed of the furnaces, combustion chamber, and tubes, the tube surface being the principal part. The water surface is kept a short distance above the tops of the return tubes *ee;* above this is the steam space, which is fitted with a dry pipe that collects the steam, assists to prevent water from being carried over to the engines, and discharges through the boiler stop valve to the main steam pipe. The furnaces are divided by the grates into very nearly equal parts, the lower being called the ash pit. The fire-box part (commonly referred to as the furnace) and the ash pit have separate doors. All parts of the boiler (except doors, grates, bridge wall, etc.) are usually built of mild carbon steel; in some cases nickel or special steel is used. The grate surface of such a boiler, with ordinary draft apparatus, develops 13 to 16 horse power per square foot; ratio of heating to grate surface, 30–35 to 1. The weight per I. H. P., including water, is 90 to 120 pounds. The amount of coal burned per square foot of grate is 15 to 20 pounds with ordinary draft arrangements. The efficiency of the boiler is 70 to 75 per cent when in best condition. The attachments of such a boiler are: main and auxiliary stop valves in the steam pipe; check valves, through which the feed water enters; surface and bottom blow valves, through which the water is blown down or pumped out; two water columns (glass tubes) to show the height of the water; pressure gauge; safety valve; circulating apparatus (generally a hydrokineter); superheater.

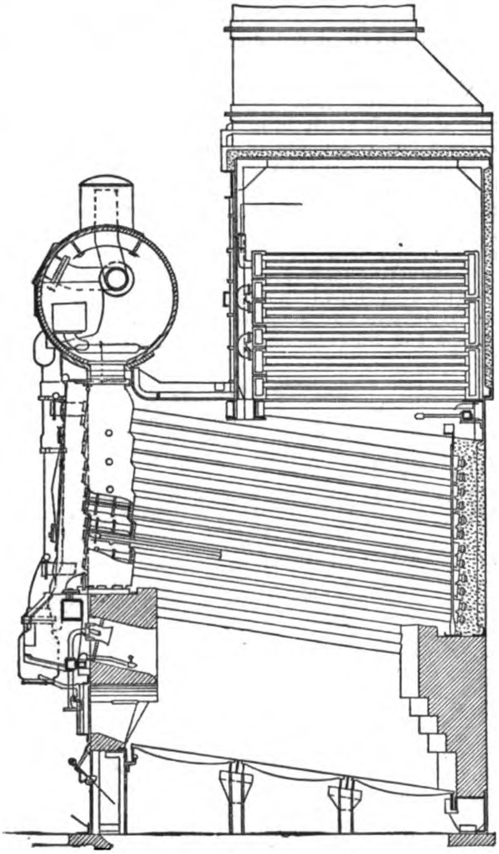


SINGLE-ENDED CYLINDRICAL BOILER.

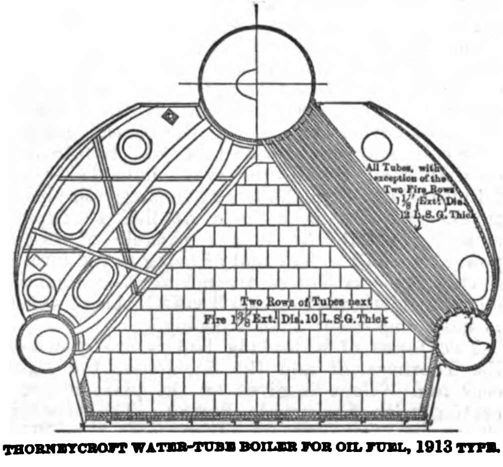
In water-tube boilers the water is contained chiefly within the tubes, and the furnace gases pass around them, the exact reverse of fire-tube boilers. As the amount of water carried is relatively small, they are usually much lighter than the cylindrical. Most types have a number of steam and water chambers connected by a system of tubes either straight or bent. The feed water usually enters the upper or steam drum and is conducted by down tubes to a lower or water drum; from this the water, becoming heated, rises and passes up through steam-forming tubes to the drum again. Thus a circulation is set up, and the efficiency of the boiler largely depends upon the adequacy of this circulation. As the distance from grate to smoke pipe is usually quite short, it is necessary, in order to extract a proper amount of heat from the gases, to introduce baffle plates for holding the gases in contact with the tubes for a sufficient length of time. Since the gases are external to the water and steam containers, a casing is fitted of sheet metal lined with fire brick, asbestos, or other nonconducting material. Water-tube boilers have all the attachments noted as belonging to cylindrical boilers and some in addition. Nearly all except the Babcock and Wilcox have automatic feed. Practically all have feed-water heaters. The fitting of superheaters is becoming general. Most types have an arrangement of steam or air for the removal of soot from the tubes.

Drowned-tube boilers are those in which the steam-generating tubes discharge into a steam drum below the level of the water; in priming boilers the discharge takes place at or above the water surface. Such a boiler as the Schultz seems to be neither one nor the other. Large-tube boilers are fitted with tubes of 3 to 5 inches in diameter. Small-tube types have tubes of 1 to 2 inches. Some boilers have large and small tubes. Express is a term applied to rapid-steaming small-tube boilers capable of large power on small weight and of using heavy forced draft. Express boilers are not very economical and are chiefly used on small vessels where speed is more important than economy.

Two forms of water-tube boilers are shown—the Thorneycroft and the Niclausse; the Babcock and Wilcox is given on the plate in connection with the article **Boiler**. The type of Thorneycroft boiler as constructed in 1916 closely resembled the Yarrow. The Niclausse boiler shown is of the same design as the ones installed on the French battleship *Bearne*. One tube is in partial section, and a portion of the header casing is removed to show the exterior of the header end of the next tube above. Where the outer tube is partly cut away, the upper end of the inner one, which is somewhat shorter, is visible. The cooler water descends from the steam drum, enters the inner tube, escapes to the outer one, is heated, and reascends to the drum.



CROSS-SECTIONAL ELEVATION OF NICLAUSSE HIGH-DUTY BOILER, 1914 TYPE.


All Tubes, with exception of the Two Fire Rows 1⅛" Ext. Dia. 12 L.S.G. Thick
Two Rows of Tubes next Fire 1⅜ Ext. Dia. 10 L.S.G. Thick

THORNEYCROFT WATER-TUBE BOILER FOR OIL FUEL, 1913 TYPE.

There are no double tubes in the other boilers which are illustrated.

Oil Fuel. The extended use of oil fuel has had an important effect on the design of boilers and of vessels. While oil costs two to five times as much as coal and is less than 50 per cent more efficient, the gain in other directions offsets the extra fuel expense. There is considerable reduction in fireroom space, because less room is needed for stoking oil-fed boilers. Nearly the whole volume of the bunkers is saved, for oil can be stowed where cargo or other stores cannot be conveniently placed, such as double-bottom tanks and small out-of-the-way and irregularly shaped spaces. Distance from the boilers is of no particular importance. The number of firemen is greatly reduced, and coal passers are eliminated, as there is neither coal nor ashes to handle. The cost, delay, and waste of starting and hauling fires are largely obviated. Merchant vessels plying on routes where oil may be obtained cheaply and coal is high find economy in oil fuel. Where the reverse is the case, coal burning is much less expensive. In the United States navy all new vessels are fitted for burning oil alone. In other navies some ships are so fitted. The hesitation in following American practice is due to the fact that, with the exception of Russia, no nation but the United States has an ample home supply which can be relied upon in time of war. Consult: Bertin, *Marine Boilers* (London, 1898); Parsons, *Steam Boilers—Theory and Design* (New York, 1904); Lyon and Hinds, *Marine and Naval Boilers* (Annapolis, 1915). See article on Boiler and its bibliography; also Fuel for Ships; Fuel Ship.

SHIP CANAL. See Canal; Panama Canal; Saint Marys Canal; Suez Canal; etc.

SHIP FEVER. See Typhus.

SHIPIBO, shē-pē'bō. An important wild tribe of Panoan stock (q.v.) in the forest region of the upper Ucayali, northeastern Peru. Very little is known concerning them. They were first visited by Franciscan missionaries in 1651. In 1736 they almost destroyed the neighboring and cognate Setebo in a bloody battle. In 1764, by the efforts of the missionaries, a reconciliation was effected between the two tribes, and the Shipibo were collected into a mission settlement, but three years later they massacred all the missionaries and reverted to their former wild life. Consult G. E. Church, *Aborigines of South America* (London, 1912).

SHIP'KA PASS. A pass in the Balkan Mountains between Philippopolis and Plevna (Map: Balkan Peninsula, E 3). Elevation, 4370 feet. Opened during the Russo-Turkish War of 1877–78 (q.v.).

SHIP'LEY. A market town in the West Riding of Yorkshire, England, on the Aire, 3 miles northwest of Bradford (Map: England, E 3). There are important manufactures of worsted and woolens and a large quarrying industry. Pop., 1901, 25,570; 1911, 27,706.

SHIPLEY, Arthur Everett (1861–). An English zoölogist and educator, born at Datchet, Buckinghamshire, and educated at Christ's College, Cambridge. He was demonstrator of comparative anatomy at Cambridge from 1885 to 1894, lecturer on zoölogy from 1894 to 1908, and from 1910 master of Christ's. He received the honorary degree of Sc.D. from Princeton University and became fellow of the Royal, the Linnean, and the Zoölogical societies. Besides articles, he wrote *Zoölogy of the Invertebrata* (1893). He was translator in part of Weismann's *Essays on Heredity* (2 vols., 1889–92), joint editor and part author of the *Cam-*

bridge Natural History (1905–09), and coeditor of *Parasitology* and of the *Journal of Economic Biology*. In 1915 he published *The Minor Horrors of War*.

SHIPMASTER. The commander of a merchant vessel, in most countries licensed if master of a steam vessel. He has complete control of navigation and over all on board, whether passengers or crew. He may use strong measures in case of mutiny, even kill a seaman to enforce order, and may compel passengers to obey within reason. He is the representative of the owners on a voyage and in foreign ports and may bind the ship by contracts for necessary supplies, repairs, etc. He may even pledge the cargo in extreme cases. Consult Kay, *Shipmasters and Seamen* (2d ed., London, 1895).

SHIP MONEY. A tax levied in England at various times. In 1008, when the country was threatened by the Danes, a law was made obliging all proprietors of 300 hides of land to equip a vessel for coast protection. Elizabeth, on the threatened Spanish invasion, required various ports to fit out ships. In 1626 Charles I levied such an impost in time of actual war. The first levy of ship money in time of peace was issued in 1634, a contribution being demanded from the coast shires. The next year a second writ taxed the entire Kingdom. Resistance was aroused, chiefly because it came by arbitrary authority of the King. In 1637 John Hampden refused its payment. He was prosecuted before the 12 judges of the Exchequer and seven of them pronounced in favor of the crown; but the trial aroused the public, and the Long Parliament in 1640 voted ship money illegal and canceled Hampden's sentence. Consult S. R. Gardiner, *History of England* (London, 1893–95), and *Old South Leaflets*, vol. iii, no. 60 (Boston, 1895).

SHIPPEN, William, Jr. (1736–1808). An American surgeon, born in Philadelphia. He received his education at Princeton and Edinburgh (M.D., 1761), was one of the founders of the medical department of the College of Philadelphia, and became its first professor of anatomy and surgery in 1765. From its formation in 1791 till his retirement in 1806 he was professor in the medical school of the University of Pennsylvania. In 1777 he succeeded his friend John Morgan (q.v.) as surgeon-general of the American army. He showed himself capable and more practical than Morgan, but did not escape jealousy and the consequent accusation of improper administration of office. He resigned in 1781, although the military court did not sustain the charges against him.

SHIPPENSBURG, ship′enz-bērg. A borough in Cumberland Co., Pa., 41 miles southwest of Harrisburg, on the Cumberland Valley, the Western Maryland, and the Philadelphia and Reading railroads (Map: Pennsylvania, F 7). It is the seat of the Cumberland Valley State Normal School. There are furniture factories, engine and pump works, etc. It was settled in 1749. Pop., 1900, 3228; 1910, 3457.

SHIPPING. See Ship and Shipping.

SHIPPING, Law of. See Admiralty Law; Maritime Law; Road, Rules of the.

SHIPPING ARTICLES. Articles of agreement between the master of a ship and a seaman serving on board her in regard to wages, length of service, character of service, etc. See Seamen, Laws Relating to.

SHIPPING SUBSIDIES. Pecuniary aid to shipping by public grant. The terms "bounty" and "subvention" may be employed in the same sense. The first direct bounty in aid of shipping of any kind was granted in 1730 by the 3 Geo. II, c. 20, § 9, which provided for a bounty of 20 shillings per ton on all vessels of 20 tons or over engaging in the white-herring fisheries. The object of these fishing bounties was to encourage the fisheries, which served as a training school for mariners for the British war fleet. The bounty laws were modified from time to time until they were finally repealed in 1867. It was not, however, until 1839 that the English government began the policy of paying subsidies for mail service. In that year Samuel Cunard made a contract with the British Board of Admiralty, by which he agreed to establish a fortnightly mail service between Liverpool and Halifax for a yearly payment of £60,000. The New World terminal was afterward changed to Boston and then to New York. In 1841 the amount of the subsidy was increased to £80,000, and the number of vessels increased from three to seven. The subsidy was again increased in 1848 to £145,000, but was reduced to £80,000 in 1868, after the failure of its chief competitor, the Collins line. Since that time the amount of the annual subsidy has varied greatly in different years. In 1870 the amount of the subsidy for the transatlantic ocean mail service was made to depend upon the weight of the mail matter transported, the contracts being given to the Cunard and the White Star lines.

The subsidies were given with the twofold purpose of establishing quicker and better mail communications with America and of encouraging a rival to the American clipper lines, which were rapidly driving the British ships out of business. When the United States Congress passed the bill giving a subsidy to the Collins line in 1848, the British government raised the subsidy to the Cunard Company by £65,000, without requiring any additional services, showing that the British government was not solely bent on obtaining a quicker mail service. The subsidy undoubtedly gave the Cunard Company a great advantage over its competitors. Whether, as is often alleged, the subsidy really helped to establish steam navigation is more than doubtful. The Great Western Company was in the field before the subsidized Cunard line.

In 1868 the Cunard line received £80,000 as a fixed subsidy, while the Inman line received £22,161, the North German Lloyd £9504, and the Hamburg-American £3343, paid according to the weight of mail carried. The next year the Cunard received £80,000 for its service twice a week and the Inman £35,000 for a weekly service. The contracts were drawn for seven years. In 1870 the Postmaster-General introduced the system of payment by weight throughout, by which the English lines were paid 4s. per pound for letters and 4d. for papers and the North German Lloyd 2s. 4d. for letters and 2d. for papers. In 1887 the rates were reduced to 3s. for letters and 3d. for other mail, the Cunard and White Star lines to carry all mail except specially directed letters. These rates are about one and a half times the international postal rates, so there is still a subsidy of about £75,000 to the Cunard and White Star lines, not counting the admiralty subventions, amounting to £42,000, which are paid for the privilege of hiring or buying certain of the faster steamers in case of war.

The Peninsular Company in 1837 began the carriage of mails to and from Spain and Portugal for an annual payment of £29,600, which was soon after reduced to £20,500. The next year the company took the contract of carrying the mails between England and Alexandria for £34,200 per annum. In 1842 it became the Peninsular and Oriental Company and took over the service from Suez to Calcutta with a yearly subsidy of £115,000, or about 20s. per mile. The service was soon after extended to China, with an addition of £45,000 to the yearly subsidy at the rate of about 12s. per mile. The East India Company continued to carry the mails between Bombay and Suez for a yearly subsidy of £105,-200, or 30s. per mile. In 1858 the Peninsular and Oriental took over the service for £24,700 and rendered a much quicker and more regular service. In 1852 the government advertised for bids for a mail service to Australia. The Peninsular and Oriental offered to perform the Australian service, together with all other contracts, for £199,600 per annum, to be reduced by £20,000 on the completion of the railroad across the Isthmus of Suez.

During the Crimean War the British government chartered 11 of the Peninsular and Oriental vessels for transport service. This so crippled the company's fleet that they were compelled to give up the service between Australia and Singapore. After the war the contract for a monthly service between Australia and Suez was let (1857) to the European and Australian Steam Navigation Company for £185,000 per year, but the severity of the terms and the inefficiency of the management made the enterprise an utter failure, involving the loss in one year of the entire capital of £400,000 and a further debt of £270,000. The Peninsular and Oriental, for a yearly compensation of £180,000, then took the service, including a service to Mauritius and Aden. The latter line was soon given up, and the subsidy was reduced to £134,672. In 1866 the service was made semimonthly and the subsidy increased to £170,000, and four years later a new contract on all the Peninsular and Oriental lines was made, with an annual subsidy of £450,000. Since that time the amount has been steadily decreased until in 1898 it was £330,000.

The Royal West India Mail Steam Packet Company is another line which has drawn heavy subsidies from the British government. It was founded in 1841 and was granted a subsidy of £240,000 for traversing a distance of 684,816 miles every year. There was no advertisement for bids and no revision of the extravagant terms of the contract until 1874. There was little freight and less mail to be carried, and in spite of the large subsidy the company lost about £80,000 the first year through inefficient or dishonest management. The second year the government reduced the mileage to 392,973 miles, leaving the subsidy as before and granting new favors. The service was slow, irregular, and unsatisfactory, and in some years the amount paid in subsidies exceeded the postal receipts of the line by £183,938. The most palpable case of the use of mail subsidy to aid in the extension of British commerce was the Pacific Steam Navigation Company, which was given a subsidy in 1840 for carrying the mails between the ports of Central and South America. No British ports were touched by the service, and the amount of British mail carried was almost nothing. The bounty kept the company solvent for some years, but the trade was insufficient to justify such a service and eventually the company failed. The Galway line presents another case of the tendency of subsidies to carry the creation of facilities for trade further than circumstances really warrant. This company contracted in 1860 to carry English mails from Galway to Portland, Boston, or New York via Newfoundland, agreeing to deliver dispatches in six days. They built four new vessels, but none of them came up to the requirements of strength and speed. One was lost and two others disabled. The company failed and involved all the investors in ruin.

In 1914 the British government paid in postal and admiralty subventions about $10,000,000; Canada in 1912 paid subventions amounting to about $2,000,000. A subsidy of $194,400 per annum is paid by the British government for the service to Jamaica, as the outcome of the recommendations of the West India Royal Commission of 1896–97, to encourage the fruit trade of the West Indies. This is the only example of a subsidy granted by Great Britain expressly to encourage trade.

Opinions differ as to whether the British postal and admiralty subsidies have resulted in direct advantages which justify the outlay made by the government. Mr. Buxton Forman of the British Post Office gave it as his opinion that this is not always the case; Sir Spencer Walpole, former Secretary of the Post Office, thought full value is received. No careful statistical inquiry with regard to this question has ever been made, nor is it possible to make one. The open bidding on mail contracts does not at all secure service at cost, because there is nothing like free competition among steamship companies. Careful observers, however, agree that the British postal and admiralty subsidies do contain an element of genuine subsidy for the encouragement of British shipping. This belief is strengthened by the refusal of the British government to let the mail contract to the White Star line after its purchase by the Mercantile Marine Company in 1902 until full assurance was given that the White Star Company would remain a thoroughly English concern.

The policy of other European countries is quite different from that of Great Britain. Germany paid (1914) an annual subsidy of 13,000,-000 marks for its East Asian service. Other services undertaken by the North German Lloyd were given subsidies amounting to 4,790,000 marks. The German East Africa Company receives 1,350,000 marks for its services to Africa. The total mail subsidies to all lines amount to about 8,000,000 marks. In addition the government gives indirect bounties in the shape of exemption from import duties on materials of construction and preferential railway rates on iron, steel, and fuel used in shipbuilding and on many articles exported in German ships. These reductions in railway tariffs amount to from 36 to 66 per cent of the ordinary rates. The Germans generally feel that these direct and indirect bounties have been a good investment and point to the fact that German shipping has developed very rapidly since the beginning of this policy of protection in 1886. The development of shipping is not, however, conclusive proof of the advantages of the subsidies, since numerous other factors have contributed to the growth of the German mercantile marine.

The annual postal subsidies voted by France amounted in 1914 to 31,500,000 francs ($6,030,000). In addition the government paid 10,400,000 francs in construction premiums and 26,000,000 in postal subventions. Navigation subsidies were fixed by the Austrian Law of 1907 at a maximum of $1,136,800 for the five-year period ending in 1916. Construction bounties varying from $2.84 per ton for sailing vessels to $8.12 for steam vessels are paid. A subsidy of $200,000 annually was voted in 1909 for the service between Triest and Brazil and Argentina.

Italy began a policy of bounties on construction and navigation in 1885. In 1912 the total bounties in aid of shipbuilding and navigation were $2,000,000. In 1897 Japan adopted the subsidy policy. In 1912 the shipping subsidies of Japan amounted to $6,845,995, of which $551,975 was for construction and the remainder for navigation. Holland, Sweden, Denmark, and Norway pay mail subsidies which are no more than fair compensation for services. In addition Norway and Sweden grant loans to steamship lines, thus subsidizing indirectly through assumption of risks.

Except for the bounties granted in 1792 to certain fishing vessels, the history of government encouragement to shipping in the United States begins with the Act of March 3, 1845, which provided for the transmission of the mails in American ships. An Act of March 3, 1847, authorized the Secretary of the Navy to accept the offers made by E. K. Collins & Co. to carry the mails from New York to Liverpool and by Mr. Sloo for a mail service between New York and Chagres. In 1848 two lines were started under subsidies—one from New York to Bremen, the other from New York to Havre. The most important subsidized line was the Collins line, which began operations June 1, 1850. The original subsidy was $385,000 per annum for 20 voyages, or at the rate of $19,250 per voyage. At this time the Cunard line was receiving about $30,000 per voyage. In 1852 the subsidy to the Collins line was increased to $33,000 per voyage for 26 trips, or $858,000 per annum. The competition between the Collins line and the Cunard line was severe from the first. Previous to 1850 the Cunard had a virtual monopoly of the fast-freight business. In a few months after the Collins line started freights fell from £7 10s. a ton to £4 a ton. For a time the Collins line had the advantage in the fight. But the loss of the *Arctic* in 1854 and the *Pacific* a little more than a year later seriously crippled the Collins line. The *Pacific* was succeeded by the *Adriatic*, the finest and fastest steamship of that day, but it was impossible to retrieve such disastrous losses. In 1856 Congress reduced the subsidy to $385,000 per annum for 20 trips. Two years later all contracts for carrying the mails were abrogated, and the Collins line failed. The cost of this experiment was about $4,500,000. From 1848 to 1858 the United States government expended a total of about $15,000,000 in subsidies without any manifest benefit to the American merchant marine. The United States government gave no further mail subsidies until 1866, when a line from New York to Rio de Janeiro was subsidized to the amount of $250,000 per annum. One year later the Pacific Mail Steamship Company was granted a subsidy of $500,000 a year for a monthly service to Japan and China via Hawaii. In 1872 the company offered to double the service for an additional $500,000 a year. With some difficulty a bill authorizing such a contract was passed by Congress in 1873. It was afterward discovered that the company had spent more than $1,000,000 to influence Congressmen to vote the subsidy. As a result of this disclosure and of the subsequent failure of the company to comply with the conditions imposed a new contract was abrogated by the government. The Pacific Mail Company, during its 10 years of contract service, received $4,583,000 in subsidies. In that period there was no increase in the trade of the United States with the Orient that could not be traced to other causes than subsidized mail service, and the general merchant marine declined steadily.

Under the Act of 1891 the United States pays for carrying the mails on a mileage basis as follows: for first-class steamers, $4 per mile; second-class steamers, $2 per mile; third-class steamers, $1 per mile; fourth-class steamers, 66⅔ cents per mile. Besides these contract prices the Post Office Department pays American vessels carrying mail $1.60 a pound for first-class matter and 8 cents a pound for other matter. Foreign vessels carrying United States mails are paid the international postal rates (44 cents and 4½ cents per pound respectively). It will be seen that these payments constitute a very liberal subsidy to the mail steamers. In 1898 Senator Hanna introduced the first general subsidy measure designed to introduce a system of direct navigation bounties, but after passing the Senate it failed in the House. Similar measures were before Congress in the sessions of 1904–05, 1905–06, and 1906–07. In 1904–05 a committee of the Senate made an exhaustive investigation of the subject and published a report in 1905, recommending a subsidy policy. Consult: Meeker, *History of Shipping Subsidies* (New York, 1905); United States Merchant Marine Commission, *Development of the American Merchant Marine* (Washington, 1906); Dunmore, *Ship Subsidies* (Boston, 1907); Bacon, *A Manual of Ship Subsidies* (Chicago, 1911). See MERCHANT MARINE.

SHIP RAILWAY. A railway on which ships are transported either in a cradle running on wheels or in the water in a tank carried on a wheeled truck or car. Such railways are designed to connect two navigable bodies of water separated by an isthmus, and thus save a long détour around the intervening land. They are of very ancient origin. A railway capable of transporting vessels 149 feet long, 16 feet wide, and drawing 8½ feet of water is said to have been in operation across the Isthmus of Corinth as early as 427 B.C. The Greeks in 831 A.D., the Venetians in 1483 at Lake Garda, and the Turks at Constantinople used tramways for the conveyance of vessels across intervening land. Coming nearer to modern times, there are various canal inclines and portage railways built in England and in the United States in the early part of the last century. The railway for large vessels was an extension of the canal inclines, and several very ambitious attempts have been made to construct such thoroughfares at various times. None, however, has ever been carried to completion. One of the earliest propositions for a ship railway to carry ocean vessels was the plan submitted to De Lesseps in 1860 for crossing the Isthmus of Suez. In 1872 a similar railway across Honduras was proposed to connect the Atlantic and Pacific oceans, but the project failed for lack of money. In 1879 Capt. James B. Eads proposed a ship railway across the Isthmus of Tehuantepec. Various plans were proposed by Captain Eads for this structure, the earliest being for ships 350 feet long, of 6000 tons, carried in cradles running on 1380 wheels. The length of the road across the isthmus was about 150 miles, and it was planned to run it at a speed of from 6 to 10 miles an hour. The most important project ever developed for a ship railway was that known as the Chignecto Ship Railway in Nova Scotia. A neck of land only 15 miles wide separates Chignecto Bay, an inlet from the Bay of Fundy, from Baie Verte, leading through Northumberland Strait into the Gulf of St. Lawrence. It was proposed to construct a ship railway across this neck to enable coasting vessels of 1000 tons' register and 2000 tons' displacement to avoid a stormy détour of 500 miles around the coast of Nova Scotia. The line proposed was 17 miles long and nearly straight throughout. The construction of this road was begun in 1888 and was about three-quarters completed in 1891 when work was abandoned for lack of funds. Since the Chignecto railway no ship railway has been seriously considered, though many individual plans for such roads have been proposed.

A marine railway is a device frequently employed at shipyards to haul out small vessels and especially yachts for repairs to the hull or clearing. A cradle is carried on wheels running on rails extending into deep water, and on to this the vessel is floated and supported so that it can be drawn out.

SHIPS. See Ship, Armored; Ship and Shipping; Shipbuilding.

SHIPS, Classification of, for Marine Insurance. The process of correlating all information obtainable about a vessel, in order that the underwriters may be guided in granting insurance. This work is done by registration societies such as the Bureau Veritas, Lloyd's Register, etc. For a description of these societies and their work, see Ship and Shipping.

SHIPS, Fuel for. See Fuel for Ships.

SHIPS, Measurement of. See Measurement of Ships.

SHIPS' BOYS. See Boys, Ships'.

SHIP'S COMPANY. The ship's company is the crew of the ship. It is organized in accordance with the requirements of the rig. In large, full-rigged ships the crew was divided into forecastlemen, foretopmen, maintopmen, mizzentopmen, and afterguard. Owing to the increase in mechanical means of handling sails these divisions are now almost obsolete—entirely so in the navy and in merchant steamers, and the number of square-rigged merchant ships is very small. In modern men-of-war the organization of the ship's company is based on the battery and engines. The men are stationed at the guns, ammunition rooms, boilers, and engines, according to the various needs. See Complement.

SHIP'S LIGHTS. See Lights, Ship's.

SHIP'S MAGNETISM. See Compass.

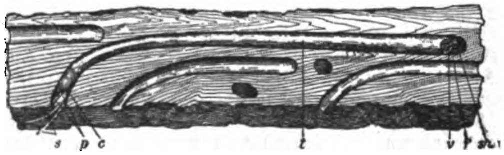
SHIPS OF WAR. See Frigate; Ram, Marine; Ship and Shipping; Navies; Shipbuilding; Ship, Armored.

SHIP'S PAPERS. A merchant vessel is required to carry certain documents which are termed the "ship's papers." These consist of: (1) register, sometimes replaced or accompanied by (*a*) certificate of enrollment (if employed in United States coasting trade), (*b*) passport issued by the sovereign authority, (*c*) sea letter issued by the local authorities of the port of departure; (2) charter party (q.v.) if chartered; (3) log book (q.v.); (4) bills of lading (q.v.), or duplicate receipts of cargo from the master to shippers; (5) invoices, or detailed statements of separate lots of goods; (6) manifest (q.v.), or general statement of cargo; (7) clearance (q.v.), or permission from the authorities to sail; (8) muster roll, or list of crew; (9) shipping articles (q.v.); (10) bill of health (q.v.); (11) bill of sale (if ship has been sold by citizens of one country to citizens of another) together with consular certificate; (12) certificate of inspection; (13) officers' licenses; (14) passenger list (if passengers are carried); (15) license to carry on a particular trade (fishing, carrying oil, explosives, etc.). The evidence of nationality of United States vessels is contained in: (*a*) register for foreign trade; (*b*) certificate of enrollment for coasting vessels; (*c*) license for enrolled vessels; (*d*) license for vessels under 20 tons; (*e*) license for fishing vessels; (*f*) sea letter or passport issued by a collector of a port to certify to national character and ownership of vessel; (*g*) consul's certificate for foreign vessel purchased abroad by American citizens. In foreign countries the evidence is found as follows: Austria, in royal license and certificate of registry; Great Britain, certificate of registry; Brazil, Portugal, and Sweden, passport; Denmark, certificate of nationality and registry; Germany and Norway, certificate of nationality; Russia and Spain, patent authorizing the use of flag. The register or certificate of registry should contain the following information: name and character of vessel, name of country to which it belongs, dimensions of vessel, rig, date of building, name of master, name of owner or owners, date of registry, number (international signal code), and signatures and seals of the officials issuing the document.

SHIP'S POSITION. See Navigation.

SHIPTON, Mother. A reputed English prophetess, probably fictitious, of the time of Henry VIII. She is first heard of in 1641, when *The Prophecie of Mother Shipton*, an anonymous tract, was published in London. Chapbooks and pamphlets purporting to be collections of her prophecies appeared frequently. In 1862 one Charles Hindley reprinted what purported to be a life of Mother Shipton, originally published by Richard Heady (London, 1684). He inserted some doggerel verses of his own and wound up with the declaration that the world would come to an end in 1881. Hindley in 1873 acknowledged that the verses were a hoax. Consult W. H. Harrison, *Mother Shipton Investigated* (London, 1881).

SHIPWORM, or Teredo. An aberrant or much modified lamellibranch mollusk of the family Teredinidæ, so called from being wormlike in general shape and from boring into hulls below their waterline. The animal is several



A SHIPWORM (*Teredo navalis*).

Timber bored by the mollusk; *t*, tube; *sh*, shell; *v*, valves of shell; *f*, foot; *c*, collar; *p*, pallets; *s*, siphons.

inches to 3 feet in length. The shell itself is much reduced, equivalve, widely gaping, and covers only a part of the animal. The mantle of the animal secretes a calcareous lining to the burrow. *Teredo navalis* is said to be cosmopolitan and is the most abundant species on the United States coast. The shipworm, besides honeycombing the logs of wharves and piles and injuring fish pounds and traps as well as lobster pots, has been a serious pest of wooden ships; for this reason ships have copper sheathing. Its mode of boring has not been satisfactorily explained—it is usually with the grain of the wood.

Shipworms are found in a fossil state first in Jurassic rocks, where their shells are found in burrows made by the animals in wood that is now petrified. They are found in similar situations in the Cretaceous and Tertiary of North America, Europe, and Asia, but show little difference from modern forms. Consult A. A. Gould, *Invertebrates of Massachusetts* (Boston, 1870), and A. E. Verrill, *Invertebrate Animals of Vineyard Sound* (Washington, 1874).

SHIPWRECK. The accompanying table shows the more important disasters since the introduction of steam and more general transatlantic travel. Like other tables of this character the statistics in many cases can be considered but approximate. The list is useful in placing the dates of the more serious marine catastrophes outside of purely naval operations, for it must be borne in mind that the table does not give ships destroyed in actual warfare, though it shows certain disasters to warships in times of peace. See SAFETY AT SEA; WRECK.

CHIEF DISASTERS AT SEA, 1841–1915

YEAR	Month and day	Name of ship	Nationality	Voyage or place	Nature of disaster	Loss of life
1841	March 11	*President*	U. S.	New York to Liverpool	Never heard from	136
1841	August 9	Steamer *Erie*	U. S.	Lake Erie	Burned	175
1847	April 28	*Exmouth*	American	Londonderry to Quebec	Foundered	200
1847	November 19	Strs. *Talisman* and *Tempest*	American	On Ohio River	Collision	100
1847	November 21	Steamer *Phœnix*	U. S.	Lake Michigan	Burned	about 240
1847	December 20	Steam frigate *Avenger*	British	Coast of Africa	Wrecked	264
1848	August 24	Emigrant ship *Ocean Monarch*	U. S.	North Wales	Burned	396
1850	March 30	Steamer *Royal Adelaide*	British	Off Margate	Wrecked	200
1850	June 17	Steamer *Griffith*	U. S.	Lake Erie	Burned	300
1850	November 19	Emigrant ship *Edmond*	British	Coast of Ireland	Wrecked	96
1852	January 4	Steamer *Amazon*	British	Bay of Biscay	Burned	140
1852	February 26	Troopship *Birkenhead*	British	Queenstown to Cape of Good Hope	Wrecked	463
1852	August 20	Steamer *Atlantic*	U. S.	Lake Erie	Sunk in collision	250
1853	February 16	Steamer *Independence*	U. S.	Coast of Lower California	Burned	140
1853	September 28	Emigrant ship *Annie Jane*	British	Coast of Scotland	Wrecked	348
1853	Dec. 23–31	Troopship *San Francisco*	U. S.	New York to California	Foundered	240
1854	January 2	Emigrant ship *Tayleur*	British	Off Lanbay, Ireland	Wrecked	290
1854	March	Steamer *City of Glasgow*	British	Liverpool to Philadelphia	Never heard from	480
1854	April 16	Steamer *Powhatan*	U. S.	Off Barnegat	Wrecked	250
1854	May 10	Troopship *Lady Nugent*	British	Bay of Bengal	Foundered	400
1854	September 27	Steamer *Arctic*	U. S.	Liverpool to New York	Sunk in collision	350
1854	Nov. 13–16	Eleven transports	British	Bound for Crimea	Wrecked in storm	500
1855	May 1	Emigrant ship *John*	British	Off Falmouth	Wrecked	191
1856	January 28	Steamer *Pacific*	U. S.	Liverpool to New York	Never heard from	186
1856	January 30	Chilean warship *Cazador*	Chilean	Off Talcahuano	Wrecked	314
1856	November 2	Iron steamer *Le Lyonnais*	French	New York to Havre	Sunk in collision	160
1857	February 26	Steamer *Tempest*	....	....	Never heard from	150
1857	June 26	Steamer *Montreal*	Canadian	Quebec to Montreal	Burned	250
1857	August 20	Ship *Dunbar*	English	Off Sydney, Australia	Wrecked	121
1857	September 12	Steamer *Central America*	U. S.	Havana to New York	Foundered	400
1858	September 13	Steamer *Austria*	German	Hamburg to New York	Burned	471
1859	April 28	Ship *Pomona*	U. S.	Off Ireland	Wrecked	386
1859	October 25	Steamer *Royal Charter*	British	Anglesea coast	Wrecked	459
1860	February 17	Ship *Lima*	U. S.	Off Barfleur	Wrecked	100
1860	February 19	Steamer *Hungarian*	British	Cape Sable, N. S.	Wrecked	205
1860	September 8	Steamer *Lady Elgin*	U. S.	Lake Michigan	Sunk by collision	287
1863	February 7	H. M. S. *Orpheus*	British	New Zealand	Wrecked	190
1863	April 27	Steamer *Anglo-Saxon*	British	Cape Race, N. F.	Wrecked	300
1865	August 24	Emigrant ship *Eagle Speed*	British	Indian Ocean	Foundered	265
1866	January 11	Steamer *London*	British	Bay of Biscay	Foundered	220
1866	January 30	Steamer *Missouri*	U. S.	Ohio River	Exploded	100
1866	January 30	Steamer *Miami*	U. S.	Mississippi River	Exploded	150
1866	October 3	Steamer *Evening Star*	U. S.	New York to New Orleans	Foundered	250
1867	October 29	Royal Mail steamers *Rhone*, *Wye*, and other ships	British	St. Thomas, West Indies	Wrecked by hurricane	1000
1868	April 9	Steamer *Sea Bird*	U. S.	Lake Michigan	Burned	100
1869	October 27	Steamer *Stonewall*	U. S.	Cairo, Ill.	Burned	200
1870	January 24	U. S. S. *Oneida*	U. S.	Yokohama	Sunk by collision	120
1870	January 28	Steamer *City of Boston*	British	New York to Liverpool	Never heard from	141
1870	September 7	H. M. S. *Captain*	British	Off Finisterre	Foundered	472
1870	October 19	Steamer *Cambria*	British	Inishtrahul, Ireland	Wrecked	173
1871	July 30	Staten Island ferryboat, Westfield's boilers	U. S.	New York harbor	Explosion of boilers	100
1873	January 22	Emigrant ship *Northfleet*	British	Dungeness	Sunk in collision	300
1873	April 1	Steamer *Atlantic*	British	Nova Scotia	Wrecked	547
1873	November 22	Steamer *Ville du Havre*	French	New York to Havre	Sunk in collision	226
1874	November 17	Emigrant ship *Cospatrick*	British	37° 15′ S. lat., 12° 25′ E. long.	Burned at sea	470
1875	May 7	Steamer *Schiller*	German	Scilly Islands	Wrecked in fog	300
1875	November 4	Steamer *Pacific*	U. S.	Cape Flattery	Sunk by collision	236
1877	July 15	Steamer *Eten*	British	North of Valparaiso	Wrecked	100
1877	November 24	U. S. S. *Huron*	U. S.	Coast of North Carolina	Wrecked	100
1878	January 31	Steamer *Metropolis*	U. S.	North Carolina	Wrecked	100
1878	March 24	H. M. training ship *Eurydice*	British	Isle of Wight	Foundered	300
1878	September 3	Steamer *Princess Alice*	British	Thames River	Sunk in collision	600
1878	December 18	Steamer *Byzantin*	French	Dardanelles	Sunk in collision	210
1880	January 31	H. M. training ship *Atlanta*	British	Bermuda	Never heard from	290
1880	November 24	Steamer *Oncle Joseph*	French	Spezzia	Sunk by collision	250
1881	May 24	Steamer *Victoria*	Canadian	Thames River, Canada	Capsized	200
1881	August 30	Steamer *Teuton*	British	Cape of Good Hope	Wrecked	331
1883	July 3	Steamer *Daphne*	British	Clyde	Capsized in launching	546
1884	January 18	Steamer *City of Columbus*	U. S.	Gay Head Light, Mass.	Wrecked	99
1884	April 3	Steamer *Daniel Steinman*	Belgian	Sambro Head, N. S.	Wrecked	131
1884	April 18	Bark *Pomena* and steamer *State of Florida*		Coast of Ireland	Both sunk in collision	150
1884	July 22	Steamers *Gijón* and *Laxham*	Spanish and British	Finisterre	Both sunk in collision	150
1887	January 20	Steamer *Kapunda*	British	Coast of Brazil	Sunk in collision	300
1887	November 15	*Wah Yeung*	British	Canton to Hongkong	Burned	400

CHIEF DISASTERS AT SEA, 1841-1915—*Continued*

YEAR	Month and day	Name of ship	Nationality	Voyage or place	Nature of disaster	Loss of life
1887	November 19	Steamer *W. A. Sholten*	Dutch	English Channel	Sunk in collision	134
1888	August 14	Steamer *Geiser*	Danish	Off Sable Island	Sunk in collision	105
1889	March 16	U. S. warships *Trenton*, *Vandalia*, *Nipsic* and German ships *Adler* and *Eber*	....	Samoan Islands	Wrecked	200
1890	January 2	Steamer *Persia*	....	Island of Corsica	Wrecked	130
1890	February 17	Steamer *Duburg*	British	China Sea	Wrecked	400
1890	March 1	Steamer *Quetta*	British	Cape York, Torres Straits	Wrecked	124
1890	September 19	Frigate *Ertogrul*	Turkish	Coast of Japan	Foundered	540
1890	November 10	H. M. S. *Serpent*	British	Coast of Spain	Wrecked	167
1891	March 17	Steamer *Utopia*	British	Gibraltar	Sunk in collision	574
1891	April 22	Chilean warship *Blanco Encalada*	Chilean	Caldera Bay	Torpedoed	200
1892	January 13	Steamer *Namchow*	....	China Sea	Wrecked in China Sea	414
1892	October 28	Steamer *Roumania*	British	Portuguese coast	Wrecked	113
1893	February 11	Steamer *Naronic*	British	Liverpool to New York	Never heard from	
1893	June 22	H. M. S. *Victoria*	British	Off Tripoli	Sunk by collision	350
1894	November 1	Steamer *Wairarapa*	British	Coast of New Zealand	Wrecked	103
1895	January 30	Steamer *Elbe*	German	North Sea	Sunk in collision	380
1895	March 13	Cruiser *Reina Regenia*	Spanish	Mediterranean	Foundered	400
1895	May 27	Steamer *Don Pedro*	French	Coast of Spain	Wrecked	100
1895	May 28	Steamer *Colima*	U. S.	Coast of Mexico	Wrecked	180
1896	June 16	Steamer *Drummond Castle*	British	Off Ushant, France	Wrecked	244
1898	February 15	U. S. S. *Maine*	U. S.	Havana harbor	Blown up	262
1898	July 4	Steamer *La Bourgogne*	French	Off Sable Island, N. S.	Collision	560
1898	October 14	Steamer *Mohegan*	British	Off Lizard	Wrecked	106
1898	November 27	Steamer *Portland*	U. S.	Cape Cod, Mass.	Sunk in storm	157
1901	February 22	Steamer *Rio de Janeiro*	U. S.	San Francisco harbor	Wrecked	128
1901	April 1	Transport *Aslam*	British	Red Sea	Wrecked	180
1902	July 21	Steamer *Primus*	....	Elbe	Sunk in collision	112
1903	June 7	Steamer *Libau*	French	Marseilles	Sunk in collision	150
1904	June 15	Steamer *General Slocum*	U. S.	East River, N. Y.	Burned	over 1000
1904	June 28	Steamer *Norge*	....	Scottish coast	Wrecked	646
1905	September 13	Warship *Mikasa*	Japanese	....	Sunk by explosion	599
1906	January 21	Battleship *Aquidaban*	Brazilian	Rio Janeiro	Sunk by explosion	212
1906	January 22	Steamer *Valencia*	U. S.	Vancouver Island	Lost	129
1906	August 4	Emigrant S. S. *Sirio*	Italian	Cape Palos	Wrecked	350
1906	October 21	Steamer *Variag*	Russian	Vladivostok	Struck by torpedo, accidentally sunk	140
1907	February 12	Steamer *Larchmont*	U. S.	Long Island Sound	Sunk in collision	131
1907	February 22	Steamer *Berlin*	British	Hook of Holland	Stranded	128
1907	March 12	Battleship *Jena*	French	Toulon	Explosion	117
1907	July 20	Strs. *Columbia* and *San Pedro*	U. S.	California coast	Collision	100
1907	November 26	Steamer *Kaptan*	Turkish	North Sea	Foundered	110
1908	March 23	Steamer *Mutsu Maru*	Japanese	Hakodate	Sunk by collision	300
1908	April 30	Training cruiser *Matsu Shima*	Japanese	Pescadores Islands	Sunk by explosion	200
1908	July 28	Steamer *Ying King*	....	Hongkong	Foundered	300
1908	November 6	Steamer *Taish*	....	....	Sunk in storm	150
1908	November 25	Steamer *Sardinico*	British	Off Malta	Burnt	150
1908	November 27	Steamer *San Pablo*	....	Philippines	Sunk	100
1909	July 28	Steamer *Waratah*	British	Port Natal to Cape Town	Never heard from	300
1909	November 14	Steamer *La Seyne*	French	Riou Straits	Sunk in collision	101
1910	February 10	Steamer *Gen. Chanzy*	French	Off Minorca	Wrecked	154
1911	September 25	Battleship *Liberté*	French	Toulon	Sunk by explosion	285
1912	March 21	Steamer *Koombana*	British	Off Western Australia	Wrecked	130
1912	April 14	Steamer *Titanic*	White Star	41° 46′ N. lat., 50° 14′ W. long.	Collision with iceberg	1503
1913	October 10	Steamer *Volturno*	British	Mid-Atlantic	Burned	136
1914	May 29	Steamer *Empress of Ireland*	British	Quebec to Liverpool	Collision with Norwegian collier *Storstad*	1023
1915	May 7	Steamer *Lusitania*	British	Off Ireland	Sunk by German submarine	1150
1915	July 24	Steamboat *Eastland*	U. S.	Chicago River	Capsized at wharf	852
1915	November 9	Steamer *Ancona*	Italian	Mediterranean	Sunk by Austrian submarine	272

SHI′RAS, GEORGE, JR. (1832-). An American jurist. He was born in Pittsburgh, graduated at Yale in 1853, and was admitted to the Pennsylvania bar in 1856. In 1892 he was appointed associate justice of the United States Supreme Court by President Harrison and confirmed, though his nomination was opposed by the Pennsylvania Senators. He retired in 1903. In 1894 he gave his opinion against the constitutionality of the income tax. See INCOME TAX.

SHIRAZ, shē′räz. The capital of the Province of Farsistan, Persia, 112 miles from the Persian Gulf and 35 miles southwest of ancient Persepolis (q.v.) (Map: Persia, E 8). It is built on a limestone ridge of the West Persian mountain system, 4750 feet above the sea, and inclosed by walls nearly 4 miles in circumference. There are fine mosques, a citadel, bazars, colleges, caravanserais, etc. The houses, chiefly of stone, are of better appearance than most other Persian towns. The adjoining plain is well watered and has vineyards and rose gardens. The principal manufactures are silk, cotton, and woolen goods, rose water, glass, and inlaid goods. The wine of Shiraz, very strong and resembling Tokay, is famous throughout the East. Shiraz carries on trade with Yezd, Ispahan, and Bushire, receiving from the last Indian and European goods. The city was founded in 697 A.D., and from its beautiful situation and fine climate became a favorite resort of the Persian princes and under Kerim Khan in 1760 the capital of Persia. Earthquakes accompanied by great loss of life in 1812, in 1824, and in 1853 laid almost the whole town in ruins. The city has been partially rebuilt in a somewhat inferior style, and its population is now estimated at 55,000. Shiraz has been sung by scholars and poets, including S'adi and Hafiz.

SHIRE (AS. *scire*, *scyre*, district, county, jurisdiction, business, from *scirian*, *scerian*, secondary form of *sciran*, *sceran*, *sceoran*, to cut off, shear, OHG. *sceran*, Ger. *scheren*, to cut, shear; connected with Gk. *κείρειν*, *keirein*, Lith. *skìrti*, to cut). A term which seems to have originated before the time of King Alfred and is usually applied to the districts, often called counties, into which Great Britain is divided; but the word is also used for districts smaller than counties, e.g., Hallowshire in Yorkshire. Some of the counties of England, as Kent, Essex, Surrey, Norfolk, and Suffolk, were formed out of the petty Anglo-Saxon kingdoms, which gradually became consolidated into one. The substitution of ealdormen (or earls) for kings marks the gradual organization of the shires. It was usually convenient to split up a large kingdom into several shires. The national and military head of the shire was the ealdorman, an office not necessarily hereditary, though it had a tendency to become so. Shire is applied to all the Welsh counties except Anglesea. In Scotland, English tendencies of the sovereigns from Malcolm Canmore and the tide of immigration from the south brought in, among other innovations, the division into shires—probably early in the twelfth century. Twenty-five shires or counties are enumerated in a public ordinance of the date 1305.

In England, south of the Tees, there was a subdivision of shires into hundreds (q.v.), in some localities called wapentakes; these hundreds, or wapentakes, were further subdivided into tithings, and it became incumbent on every one to be enrolled in a tithing and hundred for the purposes of government. In some of the larger counties there was an intermediate division between the shire and the hundred. Yorkshire had and still has its ridings (q.v.), Kent had its lathes, and Sussex its rapes. The division into hundreds and tithings never penetrated into the four northern counties of England or into Scotland, where ward and quarter were the immediate subdivisions of the county. Consult Sir William Stubbs, *Constitutional History of England*, vol. i (6th ed., Oxford, 1897). See Anglo-Saxons; County.

SHIRE, shĕ′râ. A river of southeast Africa (Map: Congo, Belgian, F 6). It is the outlet of Lake Nyassa, from which it issues in lat. 14° 28′ S. and after a southerly course of 250 miles joins the Zambezi 90 miles from its mouth. The navigation is interrupted by a cataract, in which in 35 miles the river falls 1200 feet, about midway between the lake and the Zambezi. Below the rapids it expands into a broad, navigable stream, though somewhat obstructed by the abundance of aquatic vegetation.

SHIRE, Knights of the. See Knights of the Shire.

SHIRE HORSE. An English draft horse. Its exact origin is obscure. Horses of a large draft type existed in England from early times and were improved in the latter part of the eighteenth century by Robert Bakewell, who crossed the type, then known as the Leicestershire cart horse, with imported Dutch mares. The modern shire horse has been still further improved, retaining the features of large size, hairy legs, and draft type, but having more action and life, better quality and finish, and greater uniformity of type. He is from 16 to 17 hands high, with broad chest, short neck, straight shoulders, and broad, short back. The predominant color is brown or bay, with white about the feet.

SHIRLAW, shẽr′lạ, Walter (1838–1909). An American decorative, landscape, and genre painter; also an illustrator. He was born at Paisley, Scotland, and was brought to America as an infant. After being employed for 10 years as bank-note engraver in New York and Chicago he took up painting. He was one of the prime movers in the organization of the Chicago Academy of Design. From 1870 to 1877 he studied at Munich under Wagner and Raab, and the influence of this training was always recognizable. While abroad he painted his "Tuning of the Bell" (1874); "Sheep Shearing," exhibited at the National Academy of Design in 1877, now in the St. Louis Museum; and "Good Morning," now in the Buffalo Academy of Fine Arts. Upon his return to the United States he became one of the first instructors in the Art Students' League, New York, and was elected National Academician in 1879. He was one of the founders of the Society of American Artists and its first president (1877). His easel paintings are usually genre subjects, showing fine decorative feeling for line and color and free-flowing brushwork, with a tendency towards rich and warm low tones. Among them are: "Kappelmeister"; "Old Fiddler"; "Marble Quarry" (1880); "Very Old." Others are: "Eager for the Fray"; "Goose Girl"; "Jealousy"; "Kiss"; "Barnyard"; "In Mischief." Notable examples in pastel are: "The Dance"; "The Butterfly"; the beautiful "Morning"; "Easter Greeting." His most important decorative works are the frieze "Peace and Plenty" for the dining room in the house of D. O. Mills, New York City, and eight panels for the Congressional Library, Washington. Shirlaw died in Madrid. In 1911 a memorial exhibition of nearly 200 paintings, drawings, and pastels was held in New York and other American cities.

SHIRLEY, shẽr′lĭ. A novel by Charlotte Brontĕ (1849), the scene of which is a Yorkshire mill town. The heroine, Shirley Keeldar, was drawn from Emily Brontĕ.

SHIRLEY (SHERLEY), Sir Anthony (1565–c.1635). An English navigator. He was educated at Hart Hall, Oxford. In 1591 he accompanied the Earl of Essex on his expedition to Normandy and was knighted by Henry IV. Queen Elizabeth, angered at his acceptance of this honor without her consent, had him imprisoned until he gave up the Order of St. Michael that had been conferred upon him. In 1596 he led a buccaneering expedition to the West Indies and South America. An account of this cruise was published by Hakluyt in *Voyages and Discoveries* (1598). In 1599 he sailed to Persia, where he was hospitably received by Shah Abbas the Great, who made him Ambassador to the Christian courts of Europe. He passed his last years in Madrid, a pensioner of the King of Spain. He died in poverty some time after 1635. In 1613 he published *Travels into Persia*, a dull book. Sir Anthony had two brothers, Sir Robert and Sir Thomas, who were also adventurers. The three brothers were made the subject of *Travailes of Three English Brothers* (1607), a play written by John Day in collaboration. Consult *The Sherley Brothers* (Roxburghe Club, 1848).

SHIRLEY, James (1596–1666). An English dramatist, born in London in September, 1596. He attended the Merchant Taylors' School, London (1608–12), whence he passed to St. John's College, Oxford. He afterward entered Catharine Hall, Cambridge, where he received the degree of B.A. (c.1618). Subsequently he took orders and became a minister at St. Albans. He gave up his living, owing to his conversion to the Church of Rome, and held the mastership of the grammar school from 1623 to 1625. At the end of this period he moved to London and began his career as playwright. Before the theatres were closed in 1642 he produced about 40 plays, most of which have survived. He was befriended by the court, for which he composed many masques. He shared in the misfortunes of the Royalists during the Civil War. Surviving until after the Restoration, he became an important literary figure. He died during the great fire of 1666 and was buried in St. Giles's churchyard. Shirley carried on the traditions of the Elizabethan drama and served as a link to the new drama after the Restoration. Dryden disparaged his work, but his reputation revived under the appreciation of Richard Farmer and the warm praise of Charles Lamb—appreciation and praise rightly due a dramatist whose plays are in such measure high poetry, stamped with rare imaginative power and beauty. Compared with contemporaries in the drama, it is to his credit that he had respect for himself and his audience and seemed, on the whole, averse to licentiousness for its own sake. He essayed both tragedy and comedy. Of his plays may be cited as representative of him at his best: *The Traitor* (1631), a powerful tragedy; *Hyde Park* (licensed 1632; printed 1637), a comedy; *The Gamester* (1633), a comedy revived by Garrick; *The Lady of Pleasure* (1635), perhaps his most brilliant comedy; *The Cardinal* (licensed 1641; printed 1653), a strong tragedy; *The Sisters* (licensed 1642; printed 1653), a comedy. Of his masques, *The Triumph of Peace*, performed before the King and Queen (1634), is regarded as the best. Consult: *Dramatic Works and Poems* (London, 1833), with notes by Gifford and Dyce; *Shirley*, selected plays, edited by Gosse, in "Mermaid Series" (ib., 1888); A. W. Ward, *History of English Dramatic Literature* (rev. ed., New York, 1899); R. S. Forsythe, *Relations of Shirley's Plays to the Elizabethan Drama* (ib., 1914); H. T. Parlin, *A Study in Shirley's Comedies of London Life* (University of Texas, 1914); A. H. Nason, *James Shirley, Dramatist: A Biographical and Critical Study* (New York, 1915).

SHIRLEY, Selina Hastings, Countess of Huntingdon. See Huntingdon.

SHIRLEY, William (1693–1771). An American Colonial Governor, born at Preston in Sussex, England. After being called to the bar he emigrated in 1734 to Massachusetts, where he was appointed a commissioner in the boundary dispute between Massachusetts and Rhode Island, and while acting as such in 1741 was appointed Governor of the Colony. On the outbreak of King George's War he organized the expedition which captured Louisburg in 1745. Soon afterward he persuaded the colonists to apply the money they had received from the British treasury in reimbursement of their expenses on this occasion to the redemption of their paper currency. In 1745 he went to London to urge the settlement of the boundary disputes between the New England and the Canadian colonists and in 1750 was appointed one of the British commissioners in the fruitless negotiations at Paris. In 1753 he was reinstalled as Governor of Massachusetts. On the death of Braddock in 1755 he was appointed commander in chief of the British forces in North America, but was soon called to England. Shirley was promoted to the rank of lieutenant general in 1759 and was for a time Governor of the Bahamas. In 1770 he returned to Massachusetts, where he died. He published a *Journal of the Siege of Louisburg* (1745) and *The Conduct of Gen. William Shirley Briefly Stated* (1758). Consult *Correspondence of William Shirley* (New York, 1912).

SHIRREFF, shĭr′ĕf, Emily Anne Eliza (1814–97). A pioneer in the movement for the higher education of women and in the development of Fröbelian principles in England. In 1841 Miss Shirreff, with her sister Maria (Mrs. William Grey), published a novel, *Passion and Principle*, dealing with deficiencies in the education of women, and in 1850 the two collaborated in another work, *Thoughts on Self-Culture Addressed to Women*. In 1858 Miss Shirreff published alone *Intellectual Education and its Influence on the Character and Happiness of Women*. She was closely identified with the foundation at Cambridge of Girton College (1869), where she was honorary mistress for a short time, and with the establishment in 1871 of the National Union for Improving the Education of Women of all Classes, which led to the development of the Girls' Public Day Schools Trust in 1872. She was also connected with the founding of the Maria Grey Training College. Her efforts to popularize Fröbel's (q.v.) ideas consisted in the establishment in 1875 of the Fröbel Society and the publication of several works on the subject, including: *Essays and Lectures on the Kindergarten, Principles of Fröbel's System, and their Bearing on the Higher Education of Women* (1883); *Home Education in Relation to the Kindergarten* (1884); *Short Sketch of the Life of Fröbel* (1887); *Kindergarten at Home* (1890).

SHIRWA, shẽr′wä (Chilwa). A lake in southeast Central Africa, on the boundary between Portuguese East Africa and the British Central African Protectorate, 60 miles southeast of Lake Nyassa (Map: Congo, Belgian, G 6). It is about 40 miles long and 18 miles wide and is surrounded by high mountains. Once a tributary of the Lujenda River, it has, by desiccation, retreated by that system and is to-day a brackish pool of no great depth.

SHIRWAN. See Diyala.

SHISHAK, shī′shăk (Heb. *Shishaq* or *Shushaq;* Egypt. *Shoshenk*). A king of Egypt, founder of the twenty-second or Bubastite dynasty and a contemporary of Solomon and Rehoboam (c.960–939 b.c.). His name is found in the portico built by this dynasty at the great temple of Karnak and on several statues of the goddess Pasht, which probably came from Luxor. Jeroboam fled to Shishak from Solomon (1 Kings xi. 26–40); when the latter died he left Egypt and headed the rebellion against Rehoboam which resulted in the division of the Kingdom of David into the two states of Israel and Judah. (1 Kings xii.) In the fifth year of Rehoboam (c.949 b.c.) Shishak, according to the biblical account, marched to Jerusalem with a large army. He took the city, the treasures of the temple, and all the gold bucklers which Solomon had made. (1 Kings xiv. 25–26.) The conquest of Palestine is recorded on the monuments of Karnak, where Shoshenk is represented dragging before the god Ammon three files of prisoners, and various names of places are mentioned. In all no less than 156 Palestinian cities are enumerated by Shoshenk. His expedition, however, is insignificant when compared with Asiatic campaigns of the eighteenth and nineteenth dynasties, and Wellhausen has recently expressed a suspicion that the inscription is only a copy of an earlier list. As no mention is made in it of Jerusalem, and 1 Kings xiv. 25 only speaks of Jerusalem, this is not impossible. Perhaps the most probable view is that Jerusalem occurred in one of the gaps of the list and that it was expanded freely from an earlier account of Syrian victories. Consult: K. A. Lepsius, *Denkmäler aus Aegypten und Aethiopien* (Berlin, 1850–59); W. Max Müller, *Asien und Europa* (Leipzig, 1893); id., *Egyptological Researches* (Washington, 1906); Rudolf Kittel, *Geschichte des Volkes Israel* (2d ed., Gotha, 1909); Julius Wellhausen, *Israelitische und jüdische Geschichte* (7th ed., Berlin, 1914).

SHISMAREF, shĭs-mä′rĕf. See Wales (Alaska).

SHITE′POKE′. See Fly-up-the-Creek; Heron.

SHITOMIR. See Zhitomir.

SHIT′TIM WOOD (Heb. *shiṭṭīm*, for *shinṭah*, Ar. *sanṭ*, Egypt. *shant*, acacia tree). The wood of which the Ark of the Covenant was made (Ex. xxv. 10; Deut. x. 3), generally identified with the wood of *Acacia nilotica*, the name (*shiṭṭāh*, for *shinṭah*, *sanṭ*) being identical with the old Egyptian word for acacia. This is the characteristic tree of the wilderness of Sinai and the Dead Sea; it grows to the height of 15 to 20 feet and has stiff thorny branches. The wood is hard and well suited for furniture.

SHIURI. See Shuri.

SHIVE′LY, Benjamin Franklin (1857–1916). An American lawyer and legislator, born in St. Joseph Co., Ind. He was educated at the Northern Indiana Normal School and at the University of Michigan, from which he graduated in law in 1886. He was early a farmer, teacher, and editor of a paper at South Bend. Through his editorial writing he became known as a leading member of the antimonopoly party, and, as such, he was elected to fill the unexpired term of Representative Calkins in 1884. Again in Congress, from 1886 until 1892, he was prominent as a radical Democrat. Although resuming law practice at South Bend, he continued active in politics, and in 1909 was elected United States Senator over J. W. Kern, being reëlected in 1914. He was chairman of the Committee on Pensions and as Senator Stone's chief aid on the Committee on Foreign Relations he was an important figure during the troubles with the Huerta government of Mexico (1914).

SHIVEREE, shĭv′ẽr-ē′. See Charivari.

SHLUHS. See Shulluhs.

SHOA, shō′ȧ. A division of Abyssinia, southeast of Amhara (Map: Egypt, D 5). Estimated area, 20,000 square miles. Pop. (est.), 1,000,000. It is an elevated country watered by the Hawash and the Blue Nile. It contains Addis Abeba, the capital of Abyssinia, and the town of Ankobar. Before the unification of Abyssinia under Menelek in 1889, Shoa was a separate kingdom. See Abyssinia.

SHOALS, shōlz, Isles of. See Isles of Shoals.

SHOCK (MDutch *schock*, Dutch, *schok*, OHG. *scoc*, shock, jolt; connected with AS. *scacan*, *sceacan*, Eng. *shake*). A sudden depression of vital power due to injury or profound mental emotions. Through this depression of the nerve centres a circulatory paresis is induced, resulting in the accumulation of the blood in the large abdominal vessels, with corresponding loss to the cerebral and peripheral circulation. This is shown by the lowering of the surface temperature and disturbance of voluntary cerebration. Shock may be slight and transient, or severe and prolonged, or almost instantly fatal. Surgical shock results from accidental injuries—extensive burns, gunshot wounds, crushing of the limbs, a blow or penetrating wound of the abdomen, injuries to the base of the skull, with concussion of the brain. It is apt to follow extensive operations, especially those upon the abdominal viscera. Sudden and profuse hemorrhage and occasionally anæsthetics cause shock. Crile has attempted to prove by extensive research that surgical shock is due to subconscious pain impressions upon the great nerve centres, inflicted while the individual is under general anæsthesia. His theories, while ingenious, have not found support among surgeons. Mental shock is induced by sudden grief, fright, or other powerful mental impressions. Its condition is denoted by subnormal temperature, rapid and feeble pulse, pinched features, skin cold, pallid, and clammy, or covered with profuse perspiration, shallow and irregular respiration, loss of sensibility to pain, and tendency to urinary suppression. The patient may be conscious, replying to questions, but with no volition either of movement or speech. Delirium is sometimes present and, in children, convulsions. Shock is increased by cold, loss of blood, and age. Recovery is followed by a period of reaction, which is indicated by returning color, increased temperature, and improvement in pulse, respiration, and inclination to voluntary movement. Deferred shock is a curious condition in which the symptoms do not develop until some time after the occurrence of a violent mental impression. This variety may be more severe than that produced by bodily injury.

The treatment of collapse is as follows: the patient is placed in a horizontal position with the head slightly lowered and the feet raised. Surface temperature is maintained by hot-water bottles and blankets. Hypodermic injections of brandy, ether, strychnine, atropine, or digitalis are given according to indications. Hot coffee or brandy may be given by the mouth, the stomach retaining these better than anything else. A useful and frequently employed measure in shock is the injection either into the veins, rectum, or connective tissues of warm, normal saline solution. Large quantities of fluid may thus be taken into the circulation, with generally quick and certain results. In severe cases bandaging the limbs in order to increase the blood supply of the brain and vital centres is helpful. Operation should never be done during shock except when imperatively necessary to save life. Consult G. W. Crile, *The Emotions* (Philadelphia, 1915).

SHODDY (probably a variant of dialectic *shode*, shedding, separation, from AS. *scēad*, separation, from *scēadan*, Goth. *skaidan*, OHG. *sceidan*, Ger. *scheiden*, to separate; connected with Lith. *skédžu*, I separate, Lat. *scindere*, Gk. *σχίζειν*, *schizein*, Skt. *chid*, to split). A generic term referring to reclaimed wool and cotton fibre of any sort. Such fibre may be obtained by passing rags of wool, worsted, or union fabrics, tailors' clippings, and various mill wastes through pickers, so that they are reduced to a fibrous form and can be mixed with new wool and spun into yarn. In England and America the term "shoddy" is applied to the fibre manufactured from yarn and soft products, "mungo" to that from hard-spun fabrics, and "wool extract" to that obtained from union or cotton-mixed fabrics, by carbonizing the cotton fibre with chemicals. The mills manufacturing shoddy also make a considerable quantity of flocks, which consists of short refuse wool, shearing of woolen goods, or wool dust, and is employed for weighting certain kinds of woolen cloth and coating of waterproof garments, in the surfacing of wall papers, and for other purposes. The shoddy industry in the United States, according to the Thirteenth United States Census, in 1909 involved 88 establishments, with a capital of $6,886,825, producing a product valued at $7,446,364, from raw material valued at $5,000,706. The shoddy industry is quite important, and the utilization of waste products has a legitimate use, not only in adulterating and cheapening woolen cloths, but in making certain light fabrics, which have their special purposes. Consult "Manufactures," in *Thirteenth Census of the United States*, vol. x (Washington, 1913).

SHOEBILL, or WHALEHEAD. A large remarkable, heron-like, grayish bird (*Balæniceps rex*) from the White Nile in eastern Africa. It is made the type of a special family, the Balænicepitidæ, but is closely allied to the umbrette (q.v.). The most peculiar external feature is the huge blotched yellow bill, longer than the head and shaped like a shoe. These birds feed on fish and snakes and also the viscera of dead mammals, ripping open the carcass with the hook tipping the upper mandible. Consult Alfred Newton, *Dictionary of Birds* (London, 1893–96), and authorities there cited.

SHOE BLACKING. See BLACKING.

SHOES (Ger. *Schuh*, Swed. and Dan. *sko*, AS. *sceo*, Fr. *soulier*, It. *scarpa*, Sp. *zapato*). A general word for foot coverings, especially those with stiff sole and soft upper. Boots have a closed or laced upper reaching to the calf or higher. The earliest and simplest shoe is the sandal, a sole without upper, fastened to the foot by straps and protecting only its bottom. A primitive shoe protecting the top of the foot also is the Indian moccasin, usually soft soled and often made of a single piece of leather. By European peasants and by workers in dyehouses and chemical factories wooden shoes (sabots) or shoes with wooden sole and leather upper (clogs or pattens) are much worn. Expensive clogs with fancy uppers are used by clog dancers on the modern vaudeville stage. The ancient Egyptians wore sandals of leather, papyrus, or plaited straw, sometimes turned up in front to protect the toes. But the Hittites wore shoes, often with gaiters above to protect ankle and calf. Boots as well as shoes were used by Assyrians and Egyptians in war, on journeys through rocky districts, or where special protection was desired. Slaves and the lower classes usually went barefoot.

Among the Greeks the poorer classes commonly wore cheap and simple shoes, the upper classes sandals; there were slippers for the ladies and high laced boots for hunting and traveling, as well as boots with high soles for actors in tragedy. While the Romans often wore sandals or soft shoes for dress, they had a special shoe (*calceus*) with slits at the sides and straps laced in front, of red leather for patricians and black for senators. The soldier's *caliga* was a heavy hobnailed sandal, with straps wound around the foot and ankle. During the Middle Ages most shoes had soft uppers, sometimes closed to the ankle or higher, but frequently open down the front, and laced over with decorative straps. Stocking boots, woolen gaiter shoes, and simple leather soles sewed to the feet of tights were also worn. Tops of high shoes and boots were often folded over or trimmed with fur. During the thirteenth century pointed toes of shoes increased constantly in length, reaching the extreme in the fourteenth century, when the points were sometimes turned up and back and tied to a garter just below the knee. Sometimes the pointed toes were made to curl out, giving a splay-footed effect. High wooden clogs were worn to exalt the stature. In the last quarter of the fifteenth century pointed toes began to be succeeded by round ones that in the first quarter of the sixteenth century became broad and almost square. Boots were worn soft and with roll top, some reaching high up on the thigh, the more fashionable ones only to the calf. Heels came definitely into vogue during the reign of Queen Elizabeth, some of these for ladies being very high, almost like the French heels of today; thick soles were much worn. The buskins of Elizabeth preserved at Oxford must have increased her apparent height at least 3 inches. Shoes also became narrow with oval toes almost pointed, and the fronts of the uppers were decorated with pricking and slashing, and often with jewels. Short leather boots with fur tops and long boots with serrated tops are noteworthy features of nobles' costumes.

In James I's time shoes became fuller and rounder at the toes, mostly with thick welted soles and short heels or none. They were fastened with a large rosette of gold lace or ribbon in front and the latchets set back to show an open side. Top-boots were close fitting with square toes. During the reign of Charles I the toes of shoes became squarer, even blocked, and the fronts were set with rosettes of silk, silver and gold lace, the heels varying in height, but often large and low. Boots coming well above the knee had tops turned down and sometimes trimmed with lace or gold braid. Late in the seventeenth century heels became high and toes pointed, and latchets were elaborately tied or buckled.

In the time of George III men wore boots with long brown tops and high boots with curved tops and a gold tassel in front. Heels of shoes were low, toes a pointed oval, and latchets and buckles low on the instep. Ladies' shoes about 1760 were on high spindle heels and had large buckles and round toes until 1780, when latchets went out, toes became pointed, and heels small. About 1800 the heels practically disappeared, the soles assumed quaint shapes, and shoes were attached sandal fashion by ribbons around the ankle. From 1840 on ladies' shoes began to have heels again and large rosettes. About 1870 came round toes with low, round front and bow, high heels, and high shoes either buttoned or laced. In comparing shoes of to-day with those made by hand before machines were introduced, the extent to which they are shaped is noticeable. The collection of historic shoes in the Cluny Museum at Paris is noteworthy.

Shoe Manufacture. The manufacture of shoes in the United States was established in 1629 by Thomas Beard, who came over with hides, both upper and bottom, in the *Mayflower*, on its third voyage, charged to the Governor of the Colony by the company in London at a salary of $50 a year and a grant of 50 acres of land. Seven years later Philip Kertland of Buckinghamshire began to make shoes in Lynn, and ever since Massachusetts has led in the boot and shoe industry. For two centuries the shoemaker was often an itinerant workman who journeyed from one farmer's family to another, tarrying long enough to convert the farmer's supply of home-tanned leather into foot coverings. When he settled down and had a shop of his own, he sat on a low bench, one end of which was divided up into compartments where his knives, awls, hammers, and rasps were kept, and there was also room for his pots of paste and of blacking, his shoulder sticks for setting the edges of heel and sole, and rub sticks for finishing the bottom; tacks, pegs, nails, thread, wax, buttons, and linings. Close by he kept a dish called a higgin in which was placed the water to wet the soles, a pair of clamps to hold the uppers supported between his knees, while he seamed or bound them, and also the strap which, passing under his foot, held the sole upon the last and both on his knee while he stitched on the welt and upper.

In making a sewed shoe by hand the leather is first solidified by hammering or rolling; it must be skived, i.e., trimmed down to a uniform thickness, and all imperfections cut away; the parts must be cut out and the different portions composing the upper sewed together. The sole consists of two portions: the insole of soft and the outer sole of heavier leather. The insole, rendered pliant by soaking in water, is first tacked to the last. Next its outer edge a channel, called a feather, is dug about ⅛ inch deep, along which holes for the stitches are pierced obliquely through the leather into the channel. The top is next lasted, an operation requiring great skill. The welt is then placed around the sole as far as the heel, and then the upper welt and insole are sewed together in one seam. The bottom is then leveled up by filling in the depressed portion formed by the welt with tarred paper or other material. The outer sole, first soaked and then thoroughly hammered on the lapstone, is now temporarily tacked to the insole. A narrow channel is then cut around the edge, through which the sole is stitched to the welt. The heel, several layers, or lifts, is now nailed to the sole, and the shoe is ready for final processes: trimming, polishing, etc.

The first invention that materially changed the methods of the shoemaker was the use of wooden pegs instead of thread for fastening soles and uppers together. With their adoption about 1815 on the cheaper grades the development of the modern shoe factory began. At first only a small portion of the work was done in the general factory, the rest being performed in private homes, or in shops as before, but with this difference—that the shoes were to be sold at wholesale, ready-made, and not according to the orders of customers. Shoemaking was divided into three parts: cutting, binding, and bottoming. The cutting was done at the central factory; the uppers sent out to one set of workmen, often women and children, to be sewed in their homes; lastly the bottoms and uppers were sent out to local shoemakers, who, in their little shops, formed what was known as a team of workmen and put the parts together, one man doing the lasting, another the pegging, and a third the trimming.

About 1850 the rolling machine was introduced, by which the sole leather is thoroughly compressed in a minute, a process which had required an hour's time of laborious pounding with hammer and lapstone. Later the Howe sewing machine was adapted to the sewing of the leather uppers. About the same time horse power, and soon after steam power, was applied to the running of shoemaking machinery, and with the adoption of the latter the various branches of shoemaking were gathered under one roof. In 1860 the McKay sewing machine, for sewing uppers and soles together, was introduced and at once revolutionized the business. (See SEWING MACHINE.) An improvement upon this was the Goodyear welt machine, introduced about 1877, by means of which uppers and soles are secured by means of a welt, as previously described. In 1881 the invention of the Reese buttonhole machine still further narrowed the sphere of hand sewing in the manufacture of shoes. Of the other earlier inventions the more important are: the cable screw-wire machine for fastening uppers and soles together (1869); Bigelow's and McKay's heeling machines (1870); and the edge-trimming machines (1876). Since then polishers and trimmers and many other important machines have been added.

In the first room of a modern factory the sole leather is first run through a skiving machine, which pares the leather to a uniform thickness, rejecting thin and ragged portions. It is then solidified in a rolling machine, after which the soles may be cut, either by means of dies operated by a steam hammer or by machine-driven knives, which follow rapidly around a pattern laid on the leather. The heels are also cut by dies and various forms of machinery in use for building them up. The cutting of the uppers, as of the soles and linings, is often done by dies or other cutting machinery. The best work is usually done with a knife by hand, to make sure that the parts are cut the right way of the grain and from a portion of skin of uniform texture. The tips are cut by punching machines with many different dies, according to shape and patterning. In the stitching room the sewing machines are driven by power, often with a separate operator and machine for each seam. In the bottoming room uppers are lasted and soled and then heeled.

By one method of heeling the lifts are nailed together by a nailing machine, which cuts the wire off the reel and drives it through the heel. By another the heel, instead of being built up separately and then secured, is built up on the boot, and when the top piece is on, the heel is pared and the front curve or breast formed. The final shaping of the heel involves several manipulations. In the fifth room final trimming and polishing are conducted, the trimming effected by specially adjusted, rapidly revolving wheels, the final polishing by machine-driven burnishers, sandpaperers, and other devices. Last of all, if desired, the shoe is coated with liquid polish and rubbed with a hot iron. If a dull finish is wanted, as in calfskin, the shoe is rubbed with grease and then with an ebony stick. When shoes are screwed or riveted, the process is somewhat changed. In riveted work no welt is used. In screwing, a reel of stout wire is provided with a screw thread, which is driven by the machine through outer sole, inner sole, and upper, and then cut off evenly. This makes a strong, durable shoe. A great variety of leathers is used in making shoes, including alligator, lizard, snake, and monkey skins, as well as the more common kinds—suède, moose buckskin, deerskin, and patent or enameled leathers, and these may be colored, according to the demands of fashion or the purposes for which they are intended. Cloth is also used for shoes and slippers, according to the vogue.

Rubber Shoes. An important branch of shoe manufacture is the making of waterproof boots and overshoes out of rubber. The raw rubber, received at the factory in crude lumps, is ground and washed and rolled into sheets. The sulphur necessary for vulcanization, lampblack for coloring, and sometimes other ingredients are added, after which the sheets are passed through heated rollers, which reduce them to a thickness of less than one-third of an inch. A cloth backing is then applied by simply laying the rubber on the cloth and subjecting it to great pressure under a cloth-calendering machine. Out of this cloth the rubbers are cut, a different thickness of fabric for sole, heel, and upper, and the parts are skillfully joined over wooden lasts. This is not done by sewing, but by using some solvent, as turpentine, which causes the edges to adhere. The shoes are then covered with a coat of rubber varnish and vulcanized (see RUBBER), after which they are ready for the market.

Statistics. The value of the leather boots and shoes, including cut stock and findings, manufactured in the United States increased from 177 million dollars in 1879 to 245 in 1889, 290 in 1899, 357 in 1904, 513 in 1909, and from 125 million pairs in 1879 to 285 in 1909. The value of rubber boots and shoes manufactured in 1909 was 50 million dollars. The exports of boots and shoes increased from 663 thousand dollars in 1890 to 4 millions in 1900, 8 millions in 1905, 12 millions in 1910, and 24 millions in 1915. The value of rubber boots and shoes exported in 1915 was 3 million dollars. The cities that led in the manufacture in 1909 were Lynn with 47 million dollars, Brockton with 39, St. Louis with 34, Haverhill with 29, Boston with 26.

Consult: W. B. Redfern, *Royal and Historic Gloves and Shoes* (ib., 1904); G. W. Rhead, *Chats on Costume* (ib., 1906); Talbot Hughes, *Dress Design* (ib., 1913); Leno, *Art of Boot and Shoe Making* (London, 1889); Golding, *The Manufacture of Boots and Shoes* (ib., 1902); W. H. Dooley, *A Manual of Shoemaking and Leather and Rubber Products* (Boston, 1912); also "Manufactures," in *United States Census Reports* (Washington).

SHOGUN, shŏ′gōōn (Sinico-Jap., generalissimo). The title adopted in Japan for the general commanding each of the four divisions of the Empire in early times. In 1192 Minamoto Yoritomo (q.v.) was given the title Sei-I-Tai-Shogun (Barbarian-quelling Great General). By degrees the Shogun became independent of the Emperor, so that in the hands of the Tokugawa family (1603–1868) the shogunate became the de facto ruling power in the country. After having been held successively by four great military clans for nearly 700 years, the office was abolished in 1868. For some years after 1853 the Shogun was known to foreigners as the Tycoon.

SHOLAPUR, shŏ′lȧ-pōōr′. The capital of the District of Sholapur in the Province of Bombay, India, 60 miles north by east of Bijapur (Map: India, C 6). The ruins of the old fort, dating from 1345, a high school, two parks, and a large bazar are noteworthy. The city is an important distributing point for the agricultural products of the region and manufactures cotton goods, blankets, silks, etc. Pop., 1911, 61,345. In 1818 Sholapur was the scene of the decisive victory of the British forces under Munro over the forces of the Baji Rao.

SHONTS, THEODORE PERRY (1856–). An American railway official, born in Crawford Co., Pa. He graduated at Monmouth (Ill.) College in 1876. He studied and practiced law, but subsequently engaged in the construction of railroad lines, now parts of the Iowa Central and Burlington systems. In April, 1905, he was appointed by President Roosevelt chairman of the Isthmian Canal Commission and in that connection had an important part in formulating plans for the canal. (See PANAMA CANAL.) He resigned this post in January, 1907, when he became president of the Interborough-Metropolitan (transit) Company, New York City. Shonts served as president also of the Toledo, St. Louis, and Western Railroad after 1904, of the Chicago and Alton in 1909–12, and of the Iowa Central and the Minneapolis and St. Louis in 1909–11. In addition he was chosen president of the New York Railways Company and of the Rapid Transit Subway Construction Company and an officer in other corporations.

SHOOTING. See TARGET AND TARGET PRACTICE.

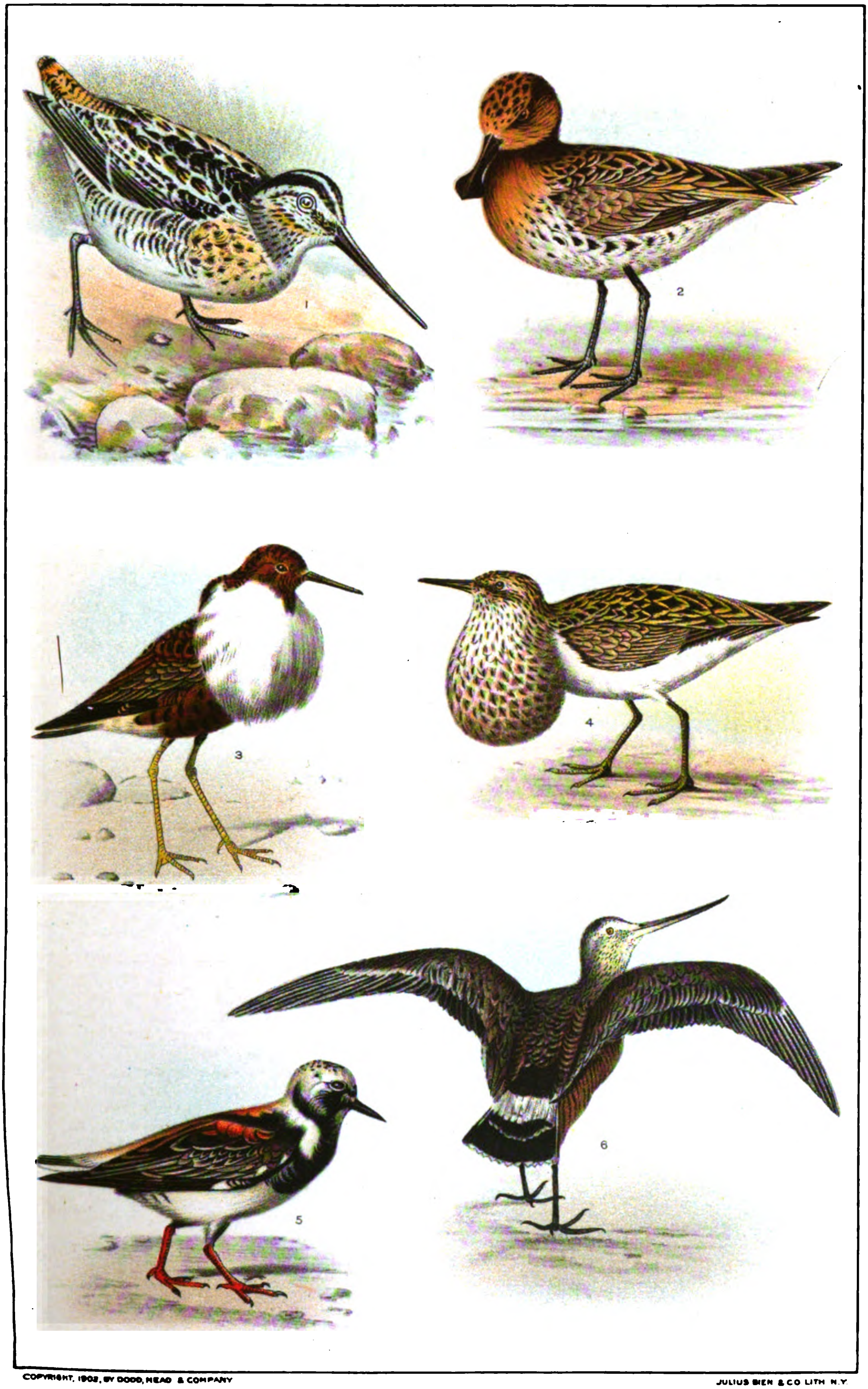
SHOOTING STARS. See METEOR; METEORITE.

SHOOTING STARS. See PRIMULACEÆ.

SHOPHAR, shŏ′fär. See Plate of MUSICAL INSTRUMENTS.

SHORE (probably connected with AS. *sceran*, *sciran*, *sceoran*, to cut off, Eng. *shear*, *shire*). The margin between the land area of the earth and the water area. The outline and general character of continental shores are modified chiefly in two ways. 1. By erosive and transporting action of the sea, whose waves, currents, and tides are constantly removing rock materials in one place and depositing them in another. Thus seaward edges of strata are cut back to form cliffs, sometimes producing an irregular shore line, with headlands and deep reëntrants; the land waste brought down by rivers is distributed over the ocean floor, and beaches and sand reefs are formed. 2. By secular movements of the earth's crust through which the land level, with respect to the sea, is changed. Coastal lands thus upraised from the sea floor are generally formed of soft strata, but, owing to their low position, they markedly resist erosion. Moreover, as the waters deepen gradually offshore, the waves beat up the sands from the bottom, forming long reefs, and the sediments transported by rivers accumulate as deltas, so that such shores have additional protection from wasting action. The coastal plain of Texas affords an example of such a shore line. For most of its length it is low, monotonously level, and fringed by sand reefs, which are so little interrupted that to admit deep-sea vessels Galveston has been built on an outer reef. The peculiar shore line of North Carolina, indented by shallow sounds and bordered by reefs, has been formed by gradual depression of an uplifted and dissected sea bottom. Coastal lands that have been subjected to marked depression are usually charac-

SHORE BIRDS



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1 EUROPEAN SNIPE-(GALLINAGO GALLINAGO)
2 SPOON-BILLED SANDPIPER-(EURYNORHYNCHUS PYGMÆUS)
3 RUFF-(MACHETES PUGNAX)
4 PECTORAL SANDPIPER-(PISOBIA MACULATA) MALE
5 TURNSTONE-(ARENARIA INTERPRES)
6 HUDSONIAN GODWIT-(LIMOSA HÆMASTICA)

terized by an irregular shore line with rocky headlands, numerous harbors, and outlying islands, thus contrasting strongly with the shores of uplifted regions. This follows from the fact that the surface of such lands is diversified through the constant process of erosion, while the ocean floor is comparatively smooth and unbroken. The western coast of Norway owes its irregular outline to the depression of a mountainous land surface by which the valleys have been submerged by the sea forming long, deep reëntrants, called fiords. See Beaches, Raised; Delta; Fiord; Shore Protection.

SHORE, Jane (1445–1527). Mistress of Edward IV of England. She was born in London and was married to a goldsmith named William Shore. She met Edward IV about 1470. After his death she was accused of witchcraft by the Duke of Gloucester (later Richard III) and, suspected of favoring the young princes, was committed for a time to the Tower. She lived till after the accession of Henry VIII and died in penury and obscurity.

SHORE, John. See Teignmouth, Baron.

SHORE, W. Teignmouth (1865–). An English author, educated at Westminster School and at Oxford. He was connected with the editorial department of the publishing house of Cassell & Co. for many years and also with a department of the London *Times*, in 1903–05 was editor of the *Academy* and of *Literature*, and also became known as a business man. Among his writings—novels, biography, travels, plays—are: *The Talking Master* (1904); *Canterbury* (1907); *Kent* (1907); *Charles Dickens and his Friends* (1909); *The Pest* (1909); *Creatures of Clay* (1911); *D'Orsay, or the Complete Dandy* (1911); *John Woolman: His Life and our Times* (1913).

SHORE BIRDS, or Beach Birds. A sportsman's term for those birds which run along the beaches of the sea or inland bodies of water and pick up their food from the edge of the waves. All are of the order Limicolæ (q.v.) and (so far as they interest sportsmen) consist mainly of sandpipers, curlews, stilts, plovers, and their nearer allies. They are shot mainly by hiding in blinds at favorable places and setting out decoys to attract the migrating flocks. Consult, in addition to general ornithologies, any of many special works by both ornithologists and sportsmen, as Seebohm, *Geographical Distribution of the Family Charadriidæ* (London, 1887), in which are described and largely figured all the shore birds of the world; D. G. Elliot, *North American Shore-Birds* (New York, 1898); H. K. Job, *Among the Water Fowl* (ib., 1902).

SHORE'DITCH. A borough of London, England, immediately north of the city nucleus. Within its limits is the immense freight depot of the Great Eastern Railway. The two theatres in London during Shakespeare's time were in Shoreditch. The name is probably derived from Sir John Soersditch, who had his residence here in the reign of Edward III.

SHORE LARK, or Horned Lark. The only true lark (*Otocoris alpestris*), i.e., a lark of the family Alaudidæ, indigenous to North America. It ranges in its migrations over the entire continent, breeding in Canada, Alaska, and the elevated plateau regions of the West and appearing along the coasts, about the Great Lakes, and southward in open districts in winter. It is a small, handsome, and highly variable bird, the characteristic feature of which is an erectile, narrow, hornlike tuft of lengthened black feathers on each side of the crown. The plumage of the adult consists of mingled brown and vinaceous tints above, with the lower parts mainly white and bold black markings on the head and chest. (See Plate of Larks and Starlings.) Those living on the Western plains, where they are numerous and sociable, are far paler than the northern and eastern residents. All make their nests on the ground and lay brown-speckled eggs. These larks have a brilliant song, which is often heard while they flutter high in the air like skylarks. Consult American ornithologies, especially: Elliott Coues, *Birds of the Northwest* (Washington, 1874); L. S. Keyser, *Birds of the Rockies* (Chicago, 1902); H. C. Oberholser, "A Review of the Larks of the Genus Octocoris," in *United States National Museum, Proceedings*, vol. xxiv (Washington, 1902).

SHORE PLANTS. See Beach Plants.

SHORE PROTECTION. The destructive action of ocean and lake waves on beach and shore structure is of two types, that due to the heavy impact of storm waves, and that due to steady wearing away of the foreshore. The former is spectacular and does the more obvious damage because it acts suddenly and with great force, but the latter is far more important as a destructive agency, for it is constant and insidious, and the danger is apt not to be apparent to the nonexpert observer. Storm waves can apparently be combated by construction of heavy sea walls or bulkheads, which while of only temporary value are easily built and act in an easily understood manner. Coast erosion also can generally be prevented by simple measures, but those measures are not so obvious and hence are not so often resorted to.

About nine-tenths of the coast lines of the world are fringed with sand. Under the constant motion of the wind-driven water this sand is moving back and forth on the beach, following the wave track. If these waves always moved parallel to the shore line, the sand movement would be unimportant because it would only move back and forth in one location, but owing to variation in the direction of winds and to inequalities in the submarine shore there are set up littoral currents which carry the sand along the shore in one general direction—tearing down the beach at one place to build it up at another. Thus unprotected coast lines are always changing, to the detriment of such structures as man builds alongshore. The problem of shore protection, then, is not only to provide some material barrier to intercept high seas which occasionally reach beyond the normal shore line, but also to build such structures, or to assist nature to build them, as will prevent the gradual destruction of the natural beach, upon which normally the force of the waves is broken.

If it is necessary to maintain structures near the natural shore line where heavy seas break, a sea wall of some sort must be built. It should be of masonry, to resist the heavy force of breaking water, and should be well founded, generally on piles, to increase its stability and to prevent undermining. Generally it is filled in behind the level of its top and the shore structures built at that level, so that in addition to resisting the sea on one face it has to act as a retaining wall on its land side. Such a wall preferably should be shaped on its water side so as to have three parts, all curving together to make a smooth face best adapted to counteract the driving waves. These parts are an apron, the lowest section of the wall, an almost flat paving gradually approaching the beach below; a deflector, a concave surface which will turn the approaching wave from the horizontal towards the vertical; and a parapet or overhanging top section which will return the water to the sea with a reduction of its energy. Such a wall will turn back heavy seas with the least pressure on itself and the least danger to shore structures from overtopping water.

All large and effective sea walls of the world are built in some variation of this section, but unfortunately many walls are mere bulkheads, vertical barriers of wood or stone which readily fail under the terrific impact of storm waves. The many bulkhead failures in the summer-resort sections of both Atlantic and Pacific coasts are testimony to faulty construction.

As a necessary complement to sea walls where deep water is not required just off the wall, and as a sole defense against erosion at those locations where a long sloping beach without shoreline structures is permissible, some sort of protection can be built to prevent the destruction or movement of the foreshore under the littoral currents. The accepted form of such construction is the groin, sometimes miscalled jetty (q.v.).

Groins are low walls or fences extending out into the ocean from the beach to be protected. Their purpose is to intercept littoral currents and confine the movement of the foreshore sand to a backward and forward movement up and down the beach. There are two results of this action: the existing sand never moves from its restricted location between the adjoining groins, and the sand carried in suspension by the incoming waves is deposited between the groins by the slowing of the currents there. In consequence, when correctly built, groins not only prevent erosion, but in fact build up the beach. Groins should be built of some strong material such as timber or reinforced concrete in the form of a closed fence, i.e., with frequent posts spanned by boards reaching down into the sand. They should extend from the high to the low water line and on occasion out into low water and should be spaced about as far apart as the distance from high to low water. In general they should extend at right angles to the shore, because any other direction tends to concentrate the component of the littoral drift along the groin and to cause erosion there. As to height, there is some argument among experts, but the more accepted practice is to build them at first on a slope parallel to that of the beach and not over 2 or 3 feet high and to add to their height as the sand builds up around them. High groins have to be built stronger to resist wave impact; quite often they tend to develop irregular accumulation of the built-up sand.

Another method of preventing shore erosion is to assist nature to build up a sand dune on shore to form a natural bulkhead or sea wall. This can be done only where the immediate shore is not in use. To create a sand dune a fence with horizontal palings an inch or two apart can be erected parallel to the shore some 100 feet inland. Sand carried onshore is piled up naturally on both sides of this fence, and a dune forms. This dune may then be protected against erosion of wind and wave by planting tough, hardy grasses. A further precaution sometimes resorted to is the construction of an offshore wave screen either in the form of a heavy masonry breakwater or a timber fencing. The former is very expensive and is permissible only where harbor requirements demand smooth water; the latter is fragile and rarely can be built strong enough to resist storm conditions. For modern shore protection, consult the current files of the engineering press, such as *Engineering News* (New York), *Engineering Record* (ib.), *Engineering* (London), and proceedings of the various engineering societies.

SHO'REY, PAUL (1857–). An American classical scholar, born at Davenport, Iowa. After graduating from Harvard in 1878 he studied at Leipzig, Bonn, Athens, and Munich (Ph.D., 1884). From 1885 to 1892 he was professor of Greek at Bryn Mawr College and thereafter at the University of Chicago. In 1901–02 he was professor in the American School of Classical Studies at Athens, and in 1913–14 he was, by appointment of Columbia University, Roosevelt professor in the University of Berlin. From 1908 he was managing editor of *Classical Philology* and a frequent contributor to its columns. He was made a member of the National Institute of Arts and Letters. His studies are chiefly in the field of ancient philosophy, particularly Platonism. He published: *De Platonis Idearum Doctrina* (1884); *The Idea of God in Plato's Republic* (1895); *The Unity of Plato's Thought* (1903); an edition of Horace's *Odes and Epodes* (1898; revised, with Laing, 1910).

SHORT. A term used to denote brokers, dealers, and speculators in stocks, certificates of indebtedness, or any commodity, who agree to sell or contract to deliver shares, etc., which at the time they do not own, and who to do so are forced to borrow the same for a consideration and eventually to cover by actual purchase or by an equitable settlement with the buyer. If the market value of the stock or commodity falls, the short profits by purchasing the same at a lower price, thus making the difference, whereas on a rising market he will lose, as he is forced to pay more for the stock or commodity than he received in the original sale. See CORNER; MARGIN DEALS; STOCK EXCHANGE.

SHORT, SIR FRANCIS JOB (1857–). An English engraver and water-color painter. He was born at Stourbridge, Worcestershire, and was trained to be an engineer, but in 1883 turned to art and studied at the South Kensington and Westminster schools. One of the foremost engravers of his time, he made himself master of every medium, but accomplished most in mezzotint. His work is characterized by harmonious simplicity of line and delicacy of tone. He frequently combines mezzotint and etching, as in his plates after Turner's *Liber Studiorum* (1885), his first work of importance. Among his original mezzotints are "Nithsdale," "Ebb-Tide, Putney Bridge," and the "Weary Moon." As a professor of engraving at the Royal College of Art he greatly influenced the younger generation. In 1910 he became president of the Royal Society of Painter-Etchers, and in 1911 he was elected a Royal Academician and was knighted. He received gold medals at Paris in 1889 and 1900.

SHORT, WILLIAM (1759–1849). An American diplomatist, born at Spring Garden, Surry

Co., Va. In 1784 he went to France as Secretary of Legation under Jefferson. In 1790 he was appointed a commissioner to negotiate European loans for refunding the national debt. He was Minister Resident at The Hague in 1792, and later that year he and William Carmichael were appointed commissioners plenipotentiary to treat with Spain concerning the navigation of the Mississippi, boundaries, and commerce. Short's commission was changed in 1794 to Minister Resident at Madrid, where he remained until 1796. He returned to America in 1802. His residence abroad and his relations with the French nobility made him unpopular at home. In 1808 Jefferson nominated him as the first United States Minister at St. Petersburg, but the Senate refused confirmation, and in 1810 he returned to the United States.

SHORT BALLOT. See ELECTORAL REFORM.

SHORTER, CLEMENT KING (1858–). A London journalist and literary biographer. He was born in London and from 1877 to 1890 was in the civil service. Afterward he was editor of the *Illustrated London News* (1891–1900), the *Sketch* (1893–99), and the English *Illustrated Magazine* (1894–1900). In 1900 he established the *Sphere*, an illustrated literary weekly. Shorter is best known for his Brontë studies, comprising *Charlotte Brontë and her Circle* (1896), a new edition of Mrs. Gaskell's *Charlotte Brontë* (1900), *Charlotte Brontë and her Sisters* (1905), *The Brontës: Life and Letters* (2 vols., 1907), and *Complete Poems of Emily Brontë* (1911). He published besides: *Sixty Years of Victorian Literature* (1897); *Immortal Memories* (1907); *George Borrow and his Circle* (1913); etc. For his wife, see SHORTER, DORA.

SHORTER, DORA (SIGERSON) (1872–). An Irish novelist and poet, daughter of Dr. George Sigerson (q.v.), born in Dublin. She became identified with the Irish Literary Revival. (See IRISH LITERATURE, *Irish Literature in English.*) In 1896 she married Clement K. Shorter. Her first distinction is as a lyric poet of spontaneity, with an unmistakable note of nationality in her verse. Her publications include: *Verses* (1894); *The Fairy Changeling and Other Poems* (1897); *Ballads and Poems* (1899); *The Father Confessor* (1900); *The Woman who Went to Hell* (1902); *The Country House Party* (1905); *Through Wintry Terrors* (1907); *Collected Poems* (1909); *Madge Lindsley and Other Poems* (1913). Consult S. A. Brooke and T. W. Rolleston, *Treasury of Irish Poetry* (New York, 1900), and William Archer, *Poets of the Younger Generation* (ib., 1902).

SHORTHAND. A common English word used for any system of writing sufficiently brief to enable a writer to keep pace with human utterance. It usually differs from longhand by providing a single stroke, either straight or curved, to represent each distinct sound in the language and by the omission of silent letters. The various systems are usually separated into the following divisions: (*a*) the alphabet, including characters for the representation of consonants, vowels, and diphthongs; (*b*) expedients, making use of auxiliary material such as compound strokes and strokes of varying lengths and thicknesses to secure a maximum of brevity without diminishing legibility; (*c*) abbreviating principles whereby the most suggestive part of a word may be substituted for the complete outline; (*d*) the union of two or more words in one outline, technically known as phrasing. The hand of the average trained shorthand writer is capable of executing from 400 to 500 pen motions per minute. By dividing this number by the rate of speed desired the number of motions which may be allotted to each word is determined. Existing practical systems of to-day are enabled to meet the demands of legibility by an average of from two to three motions per word.

Early History. In common with many other valuable acquisitions of mankind the origin of the art of brief writing is clouded in mystery. From references made to skilled writers in ancient literature some have inferred that the art was practiced long prior to the Christian era. No authentic record exists, however, establishing its practical use much before the first century B.C.

From sources whose authority cannot be questioned we learn that the art flourished extensively throughout the Roman Empire during the first century B.C. and continued to be practiced for at least 400 years afterward.

The pioneer of Roman shorthand was Marcus Tullius Tiro, the secretary and librarian of Cicero. Tiro was born about 103 B.C. at Arpinum, a city south of Rome. He was a slave belonging to the father of Cicero. At the age of seven he was brought to Rome and educated on equal terms with the children of his master. On the death of Cicero's father (68 B.C.) Tiro became the confidential secretary of the great orator. Six years later he received his freedom and, as was the custom, took the name of his former master. The system of shorthand devised by him was at first little more than an extensive list of abbreviations. Subsequently it was improved to such an extent that by writing in relays the reporters of the period were enabled to keep pace with a speaker. Roman poets, among them being Martial and Ausonius, make frequent reference to shorthand writers.

The chief use of shorthand in Roman times was made by the leaders in the Church and by the officials of the government. The official titles used were *notarii* for those who took dictation, *librarii* for those who transcribed notes, and *exceptores* for functionaries attached to the civil officers of the government. Church dignitaries making conspicuous use of shorthand were St. Augustine, Origen, and St. Jerome. The latter employed 10 shorthand secretaries. All of the Roman emperors employed shorthand writers, and several of them attempted to learn it, notably Titus and Julius Cæsar.

Tironian notes gradually fell into disuse from the fifth to the ninth centuries, at which time Latin was being displaced by the common tongue. The system grew from a vocabulary of 5000 characters in the time of Seneca to more than 13,000 when it ceased to be used.

The art was entirely lost to view from this time to the end of the fifteenth century, when John Trithemius, abbot of Spanheim, discovered a codex in the cloister at that place. He also discovered a copy of the Psalms in the library at Wolfenbüttel, Germany. Trithemius did not succeed in resolving the characters of the Tironian notes into their alphabetic elements. That was not accomplished until nearly 300 years afterward. Among those to whom we are indebted for our knowledge of the Tironian notes are Jan Gruter, 1603; Kaspar Schott, 1644; Montfaucon, 1708; Carpentier, 1747; Ulrich Frederick Kopp, 1817; Mabillon, 1881.

Modern Shorthand. This dates its birth from 1588, when Dr. Timothy Bright produced a system to which he gave the title *Characterie; the art of short, swift, and secret writing, by character. Printed at London, in 12mo, by J. Wandate, an assign of Timothy Bright, with the privilege of the Queen, forbidding all others to print the same.* This treatise was dedicated to Queen Elizabeth. The book contains a table of several hundred words with their abbreviations. By writing a line in various directions and by using certain appendages the author was enabled to compile a system of abbreviations to represent the more frequently occurring words. As a practical method of writing, however, the system was a total failure.

Fourteen years afterward alphabetic shorthand made its appearance. John Willis in 1602 gave to the world his work, entitled *The Art of Stenographie, or Short Writing by Spelling Characterie.* This system was the foundation for all subsequent ones. But two copies of the first edition of this famous work are now known, one in the Bodleian Library at Oxford and the other in the British Museum. A character is provided for each letter of the alphabet. An acute angle opening downward represents the letter *A;* the same angle opening to the right represents *E;* the same angle opening to the left represents the letters *J* and *G.* Fourteen editions of this work were published.

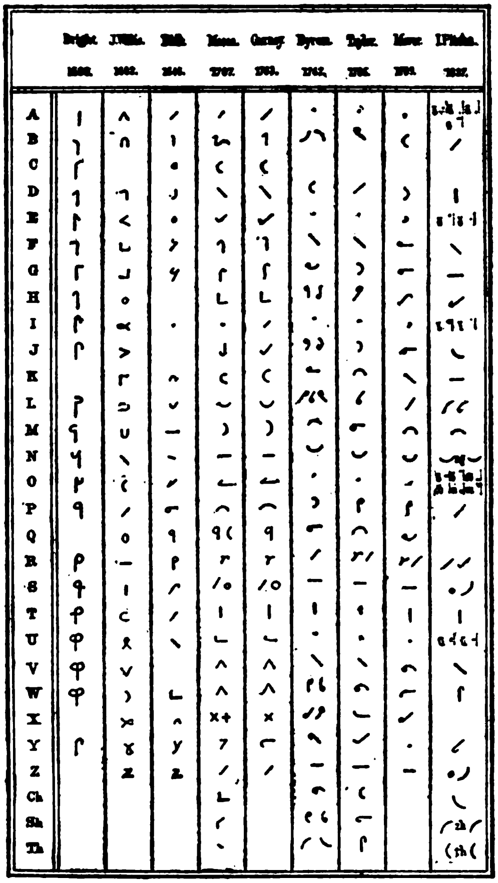
The work by Willis was followed soon after by that of Folkingham and Edmund Willis, 1618; Thomas Shelton, 1620; Witt, 1630; Mawd, 1635; Metcalf, 1635. These authors contributed very little in the way of improvement on the system by John Willis. The system of Thomas Shelton is of chief interest at the present time from the fact that the celebrated *Pepys Diary* was written in this style.

In 1642 William Cartwright produced a system which marked a great step in advance. The system was published by the nephew of the author, Jeremiah Rich. Cartwright had evidently been a writer of Shelton's system. He called his work *Semography.* A copy is now to be seen in the British Museum. In 1646 Jeremiah Rich made some slight modifications and reprinted the system under the title *Semigraphy.* Cartwright reduced the number of vowels to four, placing a dot above the stroke in order to represent *A,* a dot near the head to represent *I,* a dot near the bottom to represent *O,* a dot underneath the character to represent *U.* Cartwright was the first to employ different lengths to represent different letters, e.g., a long dash represented *M,* a short dash *N.* To Cartwright and Rich all subsequent authors of geometric shorthand are greatly indebted.

From 1642 to 1707 very little improvement was made in the theory of the art. On the latter date William Mason produced his third and best work on shorthand, entitled *La plume volante.* Mason had long been a teacher and writer of shorthand, his first work appearing in 1672 under the title *A Pen Plucked from an Eagle's Wing.* This was a reprint of the Cartwright-Rich system with a few modifications. In 1682 his second work appeared, and to this he gave the title *Arts Advancement.* A number of improvements appeared in this volume. In the 1707 edition he gave alphabetic signs for *ch, sh,* and *th,* and also the small circle as a duplicate character for *s.* He reduced the vowels to three. By placing a dot at the beginning of a character he represented *A* and *E;* by placing a dot in the middle of a character he represented *I* and *Y;* by placing a dot at the end of a character he represented *O* and *U.* Mason also introduced phrasing in a small way.

From the time of Mason to 1767 some 50 systems made their appearance. Those which possessed any practical value and which were destined to survive the life of the author were based upon the system of Mason, which in turn was an improvement upon the Cartwright-Rich system. Among those worthy of mention were Elisha Coles, 1674; James Weston, 1727; Aulay Macaulay, 1747; Thomas Gurney, 1750; Holdsworth and Aldridge, 1766. The system of Thomas Gurney is used to the present day to a limited extent in England.

TABLE I


Bright.
J. Willis.
Mason.
Gurney.
Byrom.
Taylor.
I. Pitman.
A
B
C
D
E
F
G
H
I
J
K
L
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O
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Q
R
S
T
U
V
W
X
Y
Z
Ch
Sh
Th

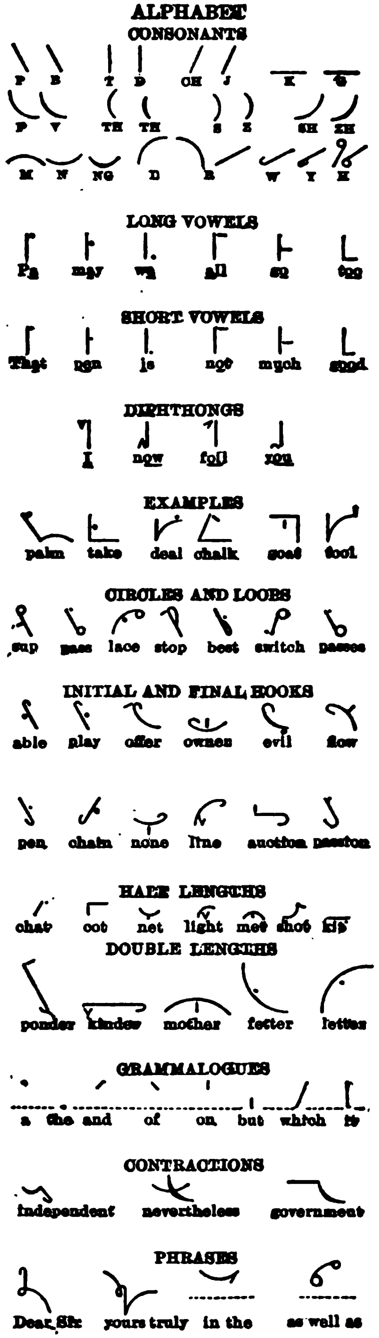
John Byrom, one of the great lights in shorthand history and known by his followers as the Grand Master, was born in 1691. He entered Trinity College at the age of 16. In 1715 he went to France to pursue a course in medicine and about this time took up the study of shorthand. Possessing a discerning mind and tremendous zeal, he was destined to make by far the greatest contribution to the art since the time of John Willis and William Cartwright. His opinion of the then existing systems was expressed in the following words: "First, they are ugly, and second, they are arbitrary." Among the many improvements he made should be mentioned (*a*) adherence to the principle of lineality. (*b*) The pairing of consonants, as follows: *P B, S Z, T D, K G, F V, Sh Zh, Th Dh, Ch J.* He did not attempt, however, to represent these letters by paired strokes and permitted one character to represent both letters in some cases. (*c*) The elimination of shading or thickening of strokes. (*d*) Duplicate characters were provided, e.g., *L* is represented by three different strokes. (*e*) Vowels were indicated by dots in five different positions, initial and final vowels only being expressed. (*f*) The use of position writing, a detached sign deriving its meaning from its position with relation to the writing line.

Byrom was a fellow of the Royal Society and founded the first Shorthand Association. Considerable rivalry existed between him and a contemporary, James Weston, an author who brought out two or three editions of a very elaborate, complicated, and impractical system. This rivalry finally resulted in a public contest of shorthand skill, of which Byrom was the victor. Byrom's system was not published until four years after his death. He always exacted a pledge from his students that they would not divulge the principles of his system. As he depended upon teaching it for his livelihood, he adopted this means to safeguard his inventions.

Other publications followed Byrom in rapid succession. Among these should be mentioned Joseph Gurney, 1773; Graves and Ashton, 1775; Mavor, 1778; Blanchard, 1779; Hodgson, 1780. Samuel Taylor was the next author to appear upon the shorthand horizon. His work, entitled *An Essay Intended to Establish a Standard for a Universal System of Stenography*, made its appearance in 1786. The following year Simon George Bordley published the first script shorthand. We thus find ourselves at the dawn of a new era, the beginning of the universal use of shorthand and the birth of a new type. The Taylor system rapidly found its way to the Continent and was adapted to practically all of the European languages. Nearly 200 different books have appeared on this system in English, representing the work of more than 100 writers. Among the new features to be found in the Taylor system was the provision for separate characters for the vowels *O* and *U*. He represented *A* by a dot at the beginning of a stroke, *E* by a dot in the middle, *I* by a dot at the end, *O* by a dash at the beginning of the stroke, *U* by a dash in the middle of the stroke. He divided the circle into eight characters to represent eight different consonants, and then used compound strokes for the other consonants. He advocated writing "according to sound" for the consonants, but his system was not entirely phonetic because he did not have a character to represent each of the vowel sounds as they are usually understood. An edition of the Taylor system was published in Boston in 1809 by S. G. Snelling.

The next landmark in the development of the art is the invention of Isaac Pitman of Bath, England, in 1837. From the time of Taylor to that of Pitman nearly 200 systems came into existence. Most of them were improvements upon either Taylor or Mason, and few survived the first edition. Isaac Pitman (q.v.) was a student of the Taylor system, beginning the practice of the art at the age of 16. At 24 he gave to the world his *Stenographic Sound Hand* and in 1840 published his *System of Phonography*. He brought to his work in this field a mind well trained in the science of phonetics and a consuming desire to benefit his fellowmen by simplifying the art of writing and opening up opportunities for education among the lower classes. Distinctive features claimed for his new system were: (*a*) a sign for each sound, including the vowels; (*b*) light and heavy strokes for the paired sounds; (*c*) no compound or modified strokes; (*d*) the joining of

TABLE II. ISAAC PITMAN SHORTHAND



little words together—phrasing. Provision was made in the first edition for the representation of the liquids *l* and *r* by hooks. The halving principle, whereby a stem is shortened to represent the letters *t* or *d*, was introduced in the second edition (1840). Intersected words, contractions, and phrases appeared in the fifth edition (1842). The representation of the letter *n* by means of a hook was given in the sixth edition (1844). Final hooks for *f*, *v*, and the termination *shun* were published in the tenth edition of 1857. Other modifications and improvements have been made almost yearly up to and including the Centenary edition of 1913.

The fundamental features of all the Pitmanic systems are quite similar, so that a description of one will answer for all. The consonant alphabet is derived from the circumference and radii of the circle. There are 26 characters representing 24 sounds. Duplicate characters are provided for *r* and *h*. Twelve vowel sounds are represented by dots and dashes. Long vowels are represented by heavy characters, short vowels by light characters. The consonants are written first, and then the vowel is placed in its proper position. Vowels placed to the left of a vertical stroke, or above a horizontal stroke, are read before; when placed to the right of a vertical stroke or below a horizontal stroke, they are read after the stem. The diphthongs are represented by acute angles pointed in various directions. The sound of *u* is represented by a semicircle opening downward. Silent letters are omitted. The letter *s* occurs more frequently at the beginning or end of syllables than any other consonant. To represent this sound the circle, the most distinctive auxiliary material, is used as a duplicate form of this letter. The circle is lengthened slightly to indicate a following *t*. It is made twice its usual size to represent *sw* at the beginning of words and *ses* at the end of syllables. A small hook placed at the beginning of a stroke represents *l* or *r*, depending upon which side it is written. A small hook at the end of a stroke represents *n*, *f*, or *v*, depending upon the side it is written. A large final hook represents the termination *shun*. By making a stroke half its usual length the sound of either *t* or *d* is indicated. Doubling the length of a stroke indicates the sound of *ter*, *der*, *ther*. The most suggestive sound in a word is used to represent that word if it is one that occurs very frequently, such as the articles *a*, *an*, and *the* and the prepositions *of* and *on*. Words having these brief signs are called grammalogues. When the word is long two strokes are employed. Such words are called contractions. Where two or more words are joined in one outline, they are called phrases. Any system of shorthand seems at first to be vague and complicated, but with a little study the beauties of the art become apparent.

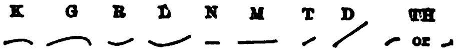
Graphic, Script, or Cursive Shorthand. In 1787 there appeared a system of shorthand based upon principles hitherto overlooked. The author of this system was Simon George Bordley. He wrote under the pen name of Cadmus Britannicus. The characters used were conformable to the written letters of ordinary longhand. In 1802 Richard Roe published a system of a similar nature. This was followed in 1814 by another cursive system, the author being James Adams. Thomas Oxley published a system in 1816. By some students of the subject it has been thought that the German script hand of Gabelsberger, which made its appearance first in 1824, was based in part upon the Oxley system. Other graphic systems produced in rapid succession were Henry Upington, 1825; J. and J. Aitchison, 1832; Daniel Cadman, 1835; J. Clarke, 1840; Fayet, Paris, 1832; Dujardin, Paris, 1834; Gabelsberger, Munich, 1834; Richter, adaptation of Gabelsberger to English, 1886; Stolze, 1841; Arends, 1850; John Thompson, 1863; Rundell, 1883; Thomas Anderson, 1882; Mares, 1885; Davies, 1887; Malone, 1886; Kingsford, 1888; Gregg, 1888; Callendar, 1889.

Gregg Shorthand. The system of shorthand invented by John Robert Gregg and which now bears his name was first published in Liverpool, England, in 1888 under the title *Light Line Phonography, the Phonetic Hand Writing*. The system was introduced in America in 1893 in the city of Boston by the author. Later Mr. Gregg removed to Chicago, where he established a school and began the publication of a series of textbooks and a magazine. The system is radically different from the geometric style, the characters being based upon the movement used in longhand writing. Its characteristic features are: (*a*) the absence of shading or thickening principle; (*b*) a uniform motion of the hand, resulting from the fact that the characters are similar to the strokes used in longhand; (*c*) the insertion of the vowels without the necessity of lifting the pen, or writing the outline above, on, or through the line to indicate them; (*d*) uniform lineality by reason of the nature of the alphabetic strokes; (*e*) facility of execution by reason of the predominance of curved strokes; (*f*) individuality of form, there being few outlines which are not distinctive; (*g*) the systematic blending of frequent consonant combination to eliminate obtuse angles. The alphabet of the system and some of the principles of abbreviation are illustrated below.

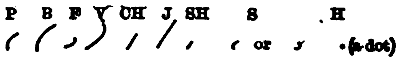
TABLE III. GREGG SHORTHAND

THE CONSONANTS

Written from left to right:

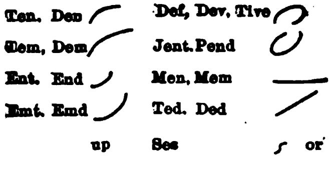


Written downward:



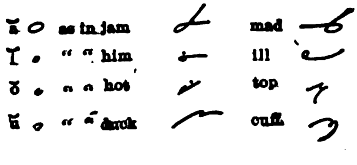
BLENDED CONSONANTS

By eliminating the obtuse or blunt angle the following blends are obtained:



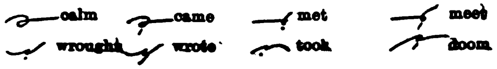
THE VOWELS

Short vowels:



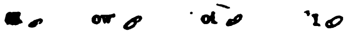
Medium and long vowels:

The medium and long sounds of each group (ă, ā; ĕ, ē; oŏ, ōo) are distinguished, when necessary, by a dot for the medium and an oblique dash for the long sound; thus:



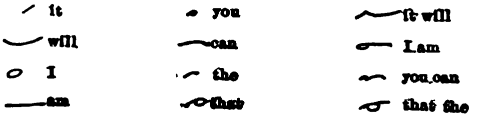
THE DIPHTHONGS

Diphthongs are expressed by joining the signs for the vowels of which they are composed:

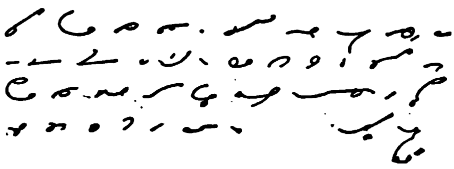


WORD SIGNS AND PHRASES

Brief forms called word signs are provided for frequently occurring words. Phrases are formed by joining word forms.



SPECIMEN



KEY

I do believe that within a century correspondence will be carried on in some form of shorthand. I regard this as a certainty, because I believe that the stress and the pressure of life will make it absolutely necessary, whether we wish it or not.—*Lord Rosebery.*

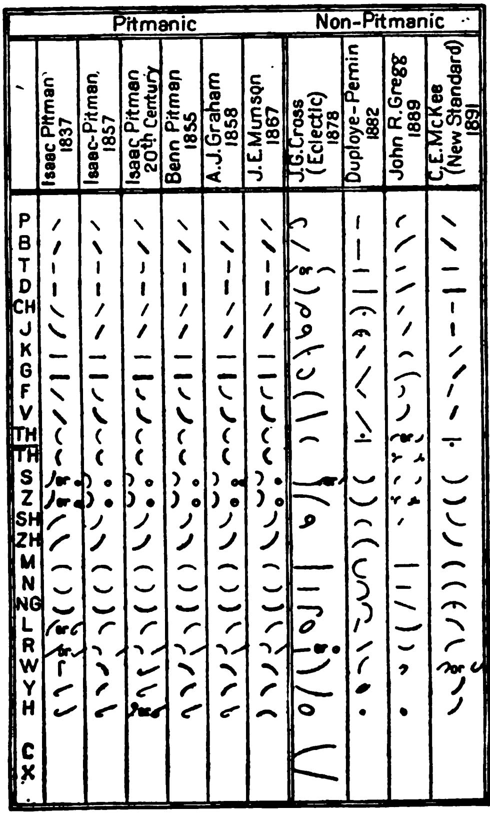
America. Early in the nineteenth century adaptations of Taylor were published in the United States. Phinehas Bailey published his system in 1819 and Keyes A. Bailey in 1831. It was not until 1843, however, that any active effort was made to spread a knowledge of the art. During that year Stephen Pearl Andrews visited London as a participant in the World's Antislavery Convention. While there he came into possession of some books and pamphlets describing the Isaac Pitman system. These he studied on the return voyage and resolved at once to become a propagandist of the new style of writing. He soon enlisted the services of Augustus F. Boyle and Oliver Dyer. In 1844 Andrews and Boyle published their first textbook of the system. Within five years from this time the phonographic art was being taught in a large number of high schools of the United States. They continued their efforts along this line until 1852, when Benn Pitman, a brother of Isaac Pitman, came to America and took charge of the work. In a few years adaptations of the Isaac Pitman system were published by American authors. Among these were Andrew J. Graham, James E. Munson, Elias Longley, Epinetus Webster, James C. Booth, Isaac S. Dement, George W. Davis, Alfred Day, and others. Benn Pitman began a series of textbooks of his own in 1855. Since the year 1887 these publications have been edited and issued by Jerome B. Howard and Benn Pitman in collaboration.

An original graphic system, the Eclectic, was produced in 1877 by J. George Cross. It gained wide popularity for a time, but is not extensively used at the present time. In the same year H. M. Pernin of Detroit published an adaptation of the French system, Duployé. It is used largely in parochial schools. A connective vowel system by C. E. McKee (1889) and one by W. E. Scovil of Canada (1855) were other important contributions to the increasing literature of shorthand.

Julius Ensign Rockwell, the noted American bibliographer, has listed the names and dates of 1070 works on shorthand in the English language. At least one-third of these have appeared in America. In addition to the textbooks on the subject a number of magazines have been published, their careers running from a few issues to 40 years. Each of the leading systems has its own official organ.

Machine Shorthand. Beginning in the last quarter of the nineteenth century a number of machines, designed for the purpose of writing as fast as the demands of dictation would require, have appeared upon the market. The more successful of these have been the Anderson, the Stenograph, the Stenotype, and the National. These machines are so constructed that all of the keys may be depressed simultaneously. A code is developed, so that an entire word may be written at one stroke. After the abbreviations are memorized the operator

TABLE IV


Pitmanic
Non-Pitmanic
Isaac Pitman 1837
Isaac-Pitman 1857
Isaac Pitman 20th Century
Benn Pitman 1855
A.J.Graham 1858
J.E.Munson 1867
J.G.Cross (Eclectic) 1878
Duploye-Pernin 1882
John R.Gregg 1889
C.E.McKee (New Standard) 1891
P
B
T
D
CH
J
K
G
F
V
TH
TH
S
Z
SH
ZH
M
N
NG
L
R
W
Y
H
C
X
or

is enabled to write quite as fast as one can with shorthand. Much time and money are being spent in an effort to develop this department of rapid writing.

Germany. F. X. Gabelsberger, known as the father of shorthand in Germany, was born in Munich, Feb. 9, 1789, and died Jan. 4, 1849. He submitted his method to the Minister of Public Instruction in 1824 and five years later received an order to teach his system. He published his complete work in 1834 and an improved edition in 1843. For this he received high praise from the Academy of Science. His system was based upon the ordinary longhand. Soft sounds are represented by small and round signs, while hard sounds are represented by signs much larger. The vowels are represented symbolically by means of signs on a system of lines resembling those in written music, i.e., by a position higher or lower than the one preceding or following. Consonant strokes are written in three different sizes. To obtain rapidity in writing the vowels may be largely omitted.

This system has been successfully adapted to almost all the languages of Europe. Out of the Gabelsberger system have sprung several valuable offshoots which are used throughout Russia, Hungary, Austria, Holland, Norway, Sweden, and other countries.

France. In 1593 Lambert Thomas Schenckel published a system of brief writing based upon a similar idea to that of Timothy Bright, viz., word representation as distinguished from either syllabic or alphabetic representation. The first alphabetic system dates from 1651, Abbé J. Cossard being the author. But three copies of this work are known to be in existence, one in the New York public library, the others in the National Library in Paris.

In 1790 M. Bertin published an adaptation of the English system of Taylor, and this was the beginning of practical shorthand in France. Improvements on this system were made by Prevost (1826) and Aimé Paris (1822). These two authors were the leaders of two distinct schools of writing. The system of Prevost was improved by Delaunay (1878), while that of Paris was modified by Guenin (1884) and Duployé (1867). The system of Prevost and Delaunay is employed chiefly by professional reporters, while that of Duployé is more popular among amanuenses and those who pursue the study for personal use. The Duployan system was adapted to the English language by J. M. Sloan (1882) and A. J. Pernin (1877). The latter edition was brought out in America.

Shorthand is used in every part of the globe where business is transacted. In England, since 1588, more than 300 separate systems have appeared. There are also four Welsh systems. In France 145 authors have made contributions. More than 200 systems have been published in Germany, 70 in Italy, 36 in Spain, 9 in Portugal, 11 in Holland, 3 in Denmark, and a similar number in Turkey, Bulgaria, Finland, and Greece. The art was introduced to continental Europe the latter part of the eighteenth century. In so limited a field it is almost beyond the range of human possibility that an author should originate every character and principle. To a certain extent, since the times of John Willis in 1602, each has builded upon the foundation laid by his predecessors. This does not detract in the least from the merit of the contribution. From the first each author claimed his product to exemplify the perfected stage in the development of the art, but each succeeding year witnesses new improvements upon old systems and the appearance of new styles sufficiently original to warrant the use of the term "system."

Bibliography. Large collections of books pertaining to shorthand are to be found in various libraries of the world. Original manuscripts written in Tironian notes may be seen in the libraries of Turin, Milan, Naples, Vienna, and Rome. The libraries of Germany and France also contain fine collections of these manuscripts. Of the modern publications, dating from 1588, copies of practically every book and magazine may be found in the library of the Royal Stenographic Institut at Dresden, the Bodleian Library at Oxford, and the British Museum. Other libraries worthy of mention are the ones at Birmingham and Manchester, England; the National Library of Paris; the Beale Library of New York City; the library of the Phonographic Institute, Cincinnati; the Congressional Library, Washington. Consult: J. H. Lewis, *Historical Account of the Rise and Progress of Shorthand* (London, 1816); M. Levy, *The History of Shorthand Writing* (ib., 1862); J. W. Zeibig, *Geschichte und Literatur der Geschwindschreibekunst* (Dresden, 1878); Thomas Anderson, *History of Shorthand with a Review of its Present Condition and Prospects in Europe and America* (London, 1882); J. E. Rockwell, *Teaching, Practice, and Literature of Shorthand* (Washington, 1885); I~~saac P~~itman, *History of Shorthand* (London, 1891); J. E. Rockwell, *Shorthand Instruction and Practice* (Washington, 1893); M. Guenin, *Histoire de la stenographie* (Paris, 1908); M. Navarre, *Histoire générale de la stenographie* (ib., 1909); also: *Transactions of the International Shorthand Congress* (London, 1887); *Proceedings of the International Shorthand Congress* (Chicago, 1893); Willis-Byrom Club, *Bulletin* (Washington, 1915 et seq.); *The Book of the Silver Jubilee of Gregg Shorthand* (Chicago, 1913).

SHORTHORN. See CATTLE, and Plate of CATTLE, DAIRY.

SHORTHOUSE, JOSEPH HENRY (1834–1903). An English novelist, born at Birmingham. He was educated at private schools and by business was a chemical manufacturer in his native city. In 1881 he became widely known for his romance, *John Inglesant* (previously issued for private circulation, new ed., New York, 1903), which at once took a high rank among English historical novels for the beauty of its style and the vivid fidelity of its historical portraiture. It is a sort of Anglo-Catholic tract. It was succeeded by *The Little Schoolmaster Mark: A Spiritual Romance* (1883); *Sir Percival* (1886); *A Teacher of the Violin and Other Tales* (1888); *The Countess Eve* (1888); *Blanche, Lady Falaise* (1891). The *Life and Letters* of Shorthouse appeared in London in 1905. Consult P. E. More, in *Shelburne Essays* (3d series, New York, 1905).

SHORTSIGHTEDNESS. See MYOPIA; SIGHT, DEFECTS OF.

SHORTT, ADAM (1859–). A Canadian political scientist. He was born at Kilworth, Ontario, and was educated at Queen's University, Kingston, where he graduated in 1883, and also at Glasgow and Edinburgh universities. At Queen's he was a member of the faculty from 1885 to 1908, being professor of political science from 1892. In 1908 he was appointed

Dominion Civil Service Commissioner. In 1911 he was created C.M.G. He published: *Imperial Preferential Trade from a Canadian Point of View* (1904); *Documents Relating to the Constitutional History of Canada, 1759–61* (1907), with A. G. Doughty; *Lord Sydenham* (1908), in the "Makers of Canada Series." Shortt and A. G. Doughty were general editors of *Canada and its Provinces* (22 vols., 1914).

SHOSHENK. See Shishak.

SHOSHONE, shô-shō'nê (probably from *Shishinowits*, snake, the name given to the related Comanche by the Cheyenne). The tribe, calling themselves simply Nömö (people), from which the Shoshonean stock (q.v.) takes its name, formerly holding the mountain country of western Wyoming and Montana, central and southern Idaho, a small strip of Utah, northeastern Nevada, and eastern Oregon. The earliest notice is due to Lewis and Clark, who encountered a band in southwestern Montana and later visited a village on the Lemhi River. In common with their neighbors, the Banak and Piute, the Shoshone have frequently been known under the collective term of Snake Indians, a name which seems to have its origin in a misapprehension of the tribal sign in the sign language—a waving outward motion of the index finger. Although commonly interpreted as snake, this sign is said by good authorities to have been originally intended to indicate a peculiar style of brush-woven lodge formerly used by the Shoshone. They were divided into several bands with little cohesion. Culturally they represent the Plateau type, the simplest in America, with a superimposed stratum derived from the Plains area. The eastern bands had horses and sometimes hunted the buffalo, but usually were kept close to the mountains by their fear of the more warlike Plains tribes. The more western bands depended chiefly upon camas and other roots, seeds, nuts, rabbits, fish, and other small game. None of them were agricultural. Their dwellings varied from the skin tepee in the east, doubtless adopted in recent times from the Plains Indians, as a substitute for the older grass lodge, to the merest brush windbreak in the west. There was no head and very little show of authority of any kind. Physically they are shorter and rather more plump than the people of the Plains tribes. In 1909 they numbered about 3500, viz., Banak and Shoshone or Fort Hall Agency, Idaho, 1766, including 474 transferred from Lemhi Agency, Idaho; Western Shoshone Agency, Nevada, 243, besides about 750 unattached; Shoshone Agency, Wyoming, 816. Consult R. H. Lowie, *The Northern Shoshone* (New York, 1909).

SHOSHONE (shô-shō'nê) **FALLS.** A magnificent cataract of the Snake River (q.v.) in southern Idaho, exceeded in grandeur, in the United States, only by the Niagara and the falls in the Yosemite valley (Map: Idaho, D 7). After flowing through a cañon 800 feet deep the river, here nearly 1000 feet wide, first falls 30 feet through several rocky channels and then in a single sheet makes a plunge of 190 feet into a dark-green lake at the bottom of a gorge over 1000 feet deep. The falls are formed by a ridge of hard rock uncovered by the wearing away of superimposed lava beds. The height exceeds Niagara, and during the spring floods the volume of the cataract is not far short of that of the more celebrated falls. Consult Roberts, *Shoshone and Other Western Wonders* (New York, 1888).

SHOSHO'NEAN STOCK. An important group of cognate tribes originally holding most of the territory from the central Rocky Mountain region, across the interior basin, to the Sierras and extending on the southeast into the Texas prairies and on the southwest across south California to the Pacific. At one time also they held the south bank of the Columbia, but were driven off by the invasion of Shahaptian tribes within the past hundred years. Their principal tribes are the Banak, Comanche, Mono, Hopi, Kawia, Mission Indians (chiefly), Piute, Paviotso, Chemehuevi, Ute, Pahvant, Panamint, Serrano, and Shoshone proper. Their general line of migration seems to have been southward between the two great mountain chains, the Comanche alone becoming a prairie tribe by separation from the Shoshone, while other bands of Piute connection penetrated southern California by displacing the weaker natives. Only the Hopi were sedentary, the rest being roving and subsisting upon hunting, fishing, or gathering roots and seeds. The Ute and Banak were noted for their fighting temper, but the others as a whole were rather below the warlike standard of the eastern tribes. With the exception of the Hopi, whose culture was that of the Pueblos generally, the Shoshonean tribes were characterized by a democratic looseness of organization and lack of elaborate ceremonial. They numbered in 1915 altogether 16,842. It is now held by some competent linguistic authorities that the Shoshonean, Tañoan (including Isleta, Jemez, and other Pueblos), Piman, and Nahuatlan are all but branches of one great linguistic stock, which Brinton designates as the Uto-Aztecan. Consult A. L. Kroeber, "Shoshonean Dialects of California," in University of California, *Publications in American Archæology and Ethnology*, vol. iv (Berkeley, 1907), and Edward Sapir, "Southern Paiute and Nahuatl," in *Journal de la Société des Américanistes de Paris*, vol. x (n. s., Paris, 1913).

SHOSTAKOVSKY, shôs'tá-kôf'ski, Peter Adamovitch (1853–). A Russian pianist. After his début at 15 he studied at the St. Petersburg Conservatory and in Germany under Kullak and Liszt (qq.v.). He held a professorship at the Moscow Conservatory, but soon resigned, owing to differences with Nicholas Rubinstein, founding (1878) a music school of his own. In 1883 this became the nucleus of the Moscow Philharmonic Musico-Dramatic School, recognized by the government as a conservatory in 1886. For many years Shostakovsky was its director and also conducted the Philharmonic concerts. From 1889 to 1894 he was director of Italian opera at Moscow. After 1898 he lived outside Russia.

SHOT. See Ammunition; Projectiles.

SHOT BORER. See Pin Borer.

SHOTGUN. A hand firearm, commonly equipped with one or two smoothbore barrels, from which are fired charges of small shot, as distinguished from the rifle, which fires a single bullet that closely fits a grooved bore. (See Rifle, Hunting; Small Arms.) The shotgun is used chiefly in the hunting of small game, especially birds, but with large shot it is sometimes used in the pursuit of big game.

Shotguns light enough to be used as hunting weapons were made as early as the middle of the seventeenth century. The first of these weapons had no rib between the barrels and was fired by a wheel lock. The rib and a flintlock firing device wefe added early in the eighteenth century, and this form of the arm was being generally used in the first quarter of the nineteenth century. The practical application of the principle of detonation as a firing medium was due, curiously enough, to the inventive genius of a Scottish clergyman, Alexander John Forsyth (1769–1843), who perfected a detonating appliance for a fowling piece in 1805 and patented it in 1807.

The first practical double-barreled breech-loading shotgun was made in 1836 by a French gunsmith, Casimir Lefaucheux (1802–52). Though this was a crude weapon in most respects, it is a remarkable fact that its inventor utilized, for the first time, the principle of having the barrels tip downward from a hinge near the breech, a form which has never been improved upon and is used to-day by practically all shotgun makers. Lefaucheux also invented a pin-fire paper cartridge which, at the instant of its discharge, expanded at the base, thereby sealing the breech joint and preventing the escape therefrom of gases generated by the combustion of the powder, a dangerous imperfection which had hitherto been inherent in all breech-loading mechanisms.

In 1847 Houiller, also a French gunsmith, patented a gas-tight, central-fire cartridge case, from which the present shotgun cartridge is directly descended and which made possible the production 10 years later by G. H. Daw, an English gunsmith, of a practical and efficient breech-loading shotgun. Of the futile attempts to improve upon Lefaucheux's breech action, the principal ones were the Bastin-Lepage action, in which the barrels, actuated by a lever, were moved forward and backward on the fore part of the stock; the turnover breech, in which the barrels revolved on a pinion to the right far enough to admit of the cartridges being inserted; and the side motion (invented by W. Jeffries about 1862), in which the barrels were turned, i.e., swung, on a pivot by a lever pivoted vertically under the breech action. This principle, minus the lever, was adopted by the American manufacturers of the Fox gun, but was soon seen to be defective and was abandoned. Of improvements in the firing mechanism up to about this time, the most important was the rebounding lock, devised by W. W. Greener, the English gunsmith, in 1864. By this device the hammers, upon striking the firing pins, were automatically thrown back to half cock, thus permitting the opening of the breech and giving considerable protection against accidental discharge. The top-lever action for locking and unlocking the barrels, which is now almost exclusively used, was introduced in successful form about 1860.

The next radical improvement in the efficiency of the shotgun was effected by chokeboring the barrels, i.e., boring them so that their diameters are suddenly reduced within a few inches of the muzzle. (The term "cylinder bore" is also often applied to a shotgun barrel, but is generally a misnomer, for practically all barrels taper slightly from breech to muzzle.) The degree of this constriction is spoken of in such terms as full choke, half choke, and quarter choke. Manufacturers and gunsmiths are apt to be secretive as to the precise lines and degrees of this constriction which they use, but in a general way it may be said that for full choke it varies from about 20 to about 40 thousandths of an inch, according to the gauge of the gun. The practical effect of this expedient is suddenly and violently to throw the charge together as it leaves the muzzle of the gun, with the result that it flies in a smaller cloud, and with greatly increased range and penetrative power, as compared with a corresponding charge fired from a gun which is cylinder-bored or practically so.

It appears that the principle of chokeboring was understood and practiced, roughly at least, as early as 1781 in France, and an article published in the *St. James's Gazette* in 1789 indicates that attempts were then being made to put the principle into practice in England. Its actual practical application has been claimed for an American, Jeremiah Smith, a gunsmith of Southfield, R. I., who is said to have successfully applied the principle to a shotgun in 1827; but this does not seem to have been clearly proved. On the other hand W. W. Greener, the celebrated English gunsmith, though not claiming to have discovered the principle, declares flatly (speaking of himself in the third person) that "the form of choke he produced, which has now been generally accepted, and the method of producing it, are of his own invention" (p. 251 of Greener's book cited below).

The term "hammerless" as applied to modern shotguns means simply that the strikers which explode the cartridge are entirely concealed within the lock frame. This principle was understood and applied to shotguns as early as 1831, but it was then employed only as a means of exploding a certain kind of pin-fire cartridge and disappeared with the perfection of the gas-tight central-fire cartridge case, which required the outside hammer mechanism. In 1862 Daw (above mentioned) produced a hammerless weapon, but it was a clumsy arm in comparison with his own hammer gun and therefore could not compete with it. The first really successful gun of this type was made by T. Murcott in 1871, and at about this time Needham, an English gunsmith, was the first to utilize the weight of the barrels, turning on the hinge pin, to cock the piece, the principle upon which all hammerless locks are now made. The opposition in turn to the detonating principle, to the breech-loading gun, and to the central-fire cartridge was expressed once more, and with even greater vehemence, against the hammerless gun, which was at first denounced as a veritable invention of the devil; but as before the outcry subsided within a few years, and no sensible person now questions the immense superiority of the hammerless over the hammer gun. The latest substantial improvement in shotgun lock mechanism is the single trigger device, by means of which either barrel may be fired from one trigger, the other being altogether dispensed with.

There remain to be mentioned three types of single-barreled magazine shotguns, two operated by hand and the other self-loading. One of the hand-operated guns is equipped with a lever action, like that of the ordinary repeating rifle, and the other has the pump or trombone action. Both of these actions are described under Rifle, Hunting. With these guns from five to ten shots can be fired very rapidly. The mechanism of both types of this gun is fairly reliable, and they are much used in trap shooting, many experts asserting that it is possible to shoot more accurately with them, because they are single-barreled, than with any double-barreled gun; but both have the inherent defect of a changing balance as the cartridges are withdrawn from the magazine under the barrel. The self-loader, or automatic, utilizes the recoil from the explosion of the cartridge to reload and recock the piece, which may be fired much more rapidly than any hand-operated weapon. For moral rather than for mechanical reasons many conservative sportsmen are strongly opposed to weapons of this type and even to pump guns, on the ground that because of the rapidity with which they may be fired they may be highly destructive even in the hands of a tyro, while they can be and have been used by professional market hunters with such deadly effect as to threaten the extermination of game birds, especially the waterfowl. In the United States this opposition has made itself felt by the prohibition of the use of such guns in Pennsylvania and New Jersey (where even pump guns are barred), while the use of the automatic is forbidden in all of the provinces of Canada excepting the Yukon.

A rather remarkable modern tendency is towards the substitution of small, even very small, bore guns for those of larger gauge. Under this influence the 8, 10, and 12 bore weapons have been giving way to those of 16, 20, and even 28 gauge. Although it seems doubtful whether this movement is entirely justified, it is probably true that with smokeless powder a 16 or even a 20 will do most of the work of a 10 or a 12 and that the days of the very large bore gun are numbered.

Consult: Charles Askins, *The American Shotgun* (New York, 1910); Horace Kephart, *Sporting Firearms* (ib., 1912); for a history of the evolution of the shotgun, W. W. Greener, *The Gun and its Development* (ib., 1907).

SHOT'WELL, James Thomson (1874–). An American historical scholar, born at Strathroy, Ontario, Canada. He graduated from Toronto University in 1898 and received his Ph.D. in 1903 from Columbia, where after 1907 he was professor of history. In 1904–05 he was joint assistant editor of the *Encyclopædia Britannica* in London, and in 1906, while on the staff of the London *Times*, he organized a reference department for the more adequate handling of foreign news, from which resulted the new indexes of the *Times*. He became editor of the *Records of Civilization*, a series of 20 volumes of studies and sources intended to cover the whole field of history, and he published *The Religious Revolution of To-Day* (1914).

SHOULDER BLADE. See Scapula.

SHOULDER JOINT (AS. *sculdor*, OHG. *scultirra*, Ger. *Schulter*; of unknown etymology). A ball-and-socket joint formed at the junction of the humerus and scapula. The large globular head of the humerus is received into the shallow glenoid cavity of the scapula, by which arrangement extreme freedom of motion is obtained, while the apparent insecurity of the joint is prevented by the strong ligaments and tendons which surround it, and also by the arched vault above formed by the undersurface of the acromion and coracoid processes. (See Scapula.) As in movable joints generally, the articular surfaces are covered with cartilage, and a synovial membrane lines the interior of the joint. The most important connecting medium between the two bones is the capsular ligament, which embraces the margin of the glenoid cavity above and is prolonged upon the tuberosities of the humerus below.

The morbid affections of the shoulder joint may be divided into (1) those arising from disease and (2) those dependent upon accident. The shoulder joint is not as liable to disease as the other articulations; it may, however, become the seat of a synovial inflammation, active, subacute, or chronic, and less often of tuberculous, syphilitic, or rheumatic disease. There may be fracture (1) of the acromion process, (2) of the coracoid process, (3) of the neck of the scapula, or (4) of the superior extremity of the humerus; or two or more of these accidents may be associated. Again, the head of the humerus may be dislocated from the glenoid cavity in a direction above, below, in front, or behind this cavity. The anterior variety is most frequent.

SHOULDER STRAPS. See Military Insignia.

SHOVEL, Steam. See Steam Shovel.

SHOVELBOARD. See Shuffleboard.

SHOVELER (so called from the shape of its bill). A cosmopolitan fresh-water duck of the genus *Spatula*, remarkable for the expansion of the end of the mandibles, the lamellæ of which are long and very delicate. The legs are placed near the centre of the body, so that these birds walk much more easily than many of the ducks. The common shoveler (*Spatula clypeata*) is smaller than the mallard, but rather larger than the widgeon. The male has the head and neck fuscous, glossed with green, the back fuscous, upper and under tail coverts dark green, lower neck and breast white, and the belly chestnut. The female is much duller. See Plate of Ducks, North American Wild.

SHOV'ELL, Sir Clowdisley (1650–1707). An English admiral, born in Cockthorpe, Norfolk. He entered the navy in 1664 and served against the Dutch and against the Barbary pirates. In 1689 he commanded the *Edgar* in the battle of Bantry Bay, was soon after knighted, and was put in command of a squadron in the Irish Sea. In the following year he was promoted to be rear admiral of the blue. In 1704 he participated with the fleet under Sir George Rooke in the capture of Gibraltar and in the action off Malaga. In the following year he was appointed admiral and joint commander with the Earl of Peterborough of the expedition which captured Barcelona. In 1707 he coöperated with the Duke of Savoy in the attack on Toulon, and, although the town was not taken, Shovell destroyed a great number of French vessels. On the way back to England his flagship was wrecked on one of the Scilly Islands. He was cast ashore in a helpless condition and was murdered. Consult W. L. Clowes, *The Royal Navy: A History* (6 vols., Boston, 1896–1901).

SHOWBREAD. See Shewbread.

SHRA'DY, George Frederick (1837–1907). An American surgeon and medical journalist. He was born in New York City, where he was educated (M.D., 1858, College of Physicians and Surgeons) and where he opened a practice in 1859. From 1860 to 1863 he was associate editor of the *American Medical Times*, and from 1866 until his death he was editor of the *Medical Record*.

SHRADY, Henry Merwin (1871-). An American sculptor. He was born in New York, graduated at Columbia in 1894, and first studied law, but gave it up for sculpture, in which art he was self-taught. In 1901 he won the competition for a $50,000 equestrian statue of Washington for Brooklyn, unveiled in 1906, and in 1902 the competition for the Grant Memorial in Washington, D. C. He received also a commission from the Holland Society of New York for an equestrian statue of William the Silent. His work is monumental and spirited in conception and broadly and simply handled.

SHRAP'NEL. A form of projectile extensively used in field guns and to a less extent in naval guns, invented by Col. Henry Shrapnel of the British army. It consists of a shell containing a number of balls, a bursting charge, usually of black powder, and a combination time and percussion fuse. (See Fuse.) The bursting charge may be located either in the front or in the rear of the shell, whose walls are thinner than in the case of ordinary shell. The bursting charges may also be contained in a central tube. The balls may be placed either in metal or wooden frames or plates or in a matrix of resin. Shrapnel is designed for use against troops in open country or for clearing covered spaces, destructive effect over a considerable area rather than penetrative power being desired. In naval warfare shrapnel is used against attack by torpedo boats or small boats.

Shrapnel, for field guns filled and fused, weighs from 12½ to 18 pounds, these being the weights for the British horse artillery gun and the British light field gun respectively. The thin steel case, whose length is approximately three times its diameter, is filled with lead balls (from 238 to 350 for the light field gun), each about one-half inch in diameter and weighing from 140 to 180 grains (36 to 50 to one pound). When the bursting charge of a few ounces of powder is ignited by the action of the fuse it expels the balls, increasing their velocity over that of the projectile at the instant of burst by approximately 300 foot seconds. The fuses, which are described and illustrated under Fuse (q.v.), are mechanically set in terms of the range, with certain corrections for atmospheric and other local conditions, and the distance at which the projectile will burst in front of the target is so regulated before firing. The effect is to transform the single projectile into a flying mine, which discharges upward of 300 bullets, any one of which is capable of putting a man hors de combat anywhere within 400 yards of the point of burst, according to American and German standards, which estimate a striking energy of 58 foot pounds as ample. French estimates in this respect are considerably more conservative. This projectile is particularly adapted for living targets (men and horses), and when properly adjusted can make the portion of the field untenable as long as the ammunition supply holds out. The area covered by a single well-adjusted shrapnel at a range of 3000 yards is about 250 by 20 yards.

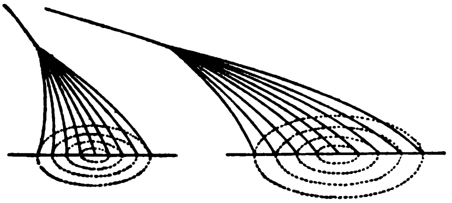
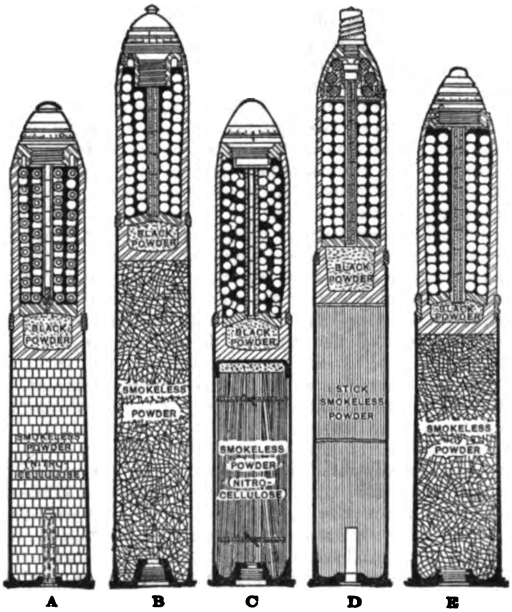


Diagram showing cone of dispersion of bursting shrapnel. Dotted lines show section of cone at the ground in the form of an irregular oval. The dimensions of this area will vary with the angle of fall, the height of burst, and the relation between the velocities of translation and rotation at the moment of burst. (After Lissak.)



TYPICAL SHRAPNEL, 1915. (From *Machinery*, New York.) *A*, American 3-inch; *B*, Russian 3-inch; *C*, German 77-millimeter (3.03"); *D*, French 75-millimeter (2.95"); *E*, British 18-pounder (3.29").

The manufacture of shrapnel during the Great War became an important industry not only among the belligerent countries of Europe, but also was taken up by a number of manufacturers in the Dominion of Canada and in the United States. The two most important methods for the manufacture of the cases involved either the use of treated rough-turned bars which were machined in turret lathes, or employing forgings machined to the approximate dimensions of the case and then heat-treated. In the first case, while more expensive material was required to enable the lathes to work up the cases satisfactorily, yet when they left the machine they required no further care. In the second method individual forgings were taken and machined to the proper dimensions, though this of course required careful treating. Still another method was to use rough-rolled bars about ½ inch greater in diameter than the finished case, and from them turn the cases, treating them before finishing, just as in the case of forgings. Special machinery was developed for making shrapnel in many large plants, and the vast number expended in constant artillery fire necessitated the operation of huge plants night and day. The technical methods of manufacture received full attention in the engineering press during the war, and the *American Machinist* (New York, weekly) and *Machinery* (ib., monthly) are two of the engineering journals which may be consulted with profit. See PROJECTILES and the bibliography there given.

SHRAPNEL, HENRY (1761–1842). An English soldier and inventor, born at Bradford-on-Avon, Wiltshire. In 1784 he began to study hollow projectiles. He was stationed at Gibraltar in 1787–91. In 1803 his shot case or shell was recommended for adoption into the service and in the following year was first employed at Surinam. The results of its use in the Peninsula War were highly satisfactory to Wellington. Shrapnel also improved the construction of howitzers and mortars and invented the brass tangent slide. In 1837 he was promoted to be lieutenant general. See PROJECTILES; SHRAPNEL.

SHREVE, HENRY MILLER (1785–1854). An American inventor and steamboat builder, born in Burlington Co., N. J. He was reared in western Pennsylvania and became a river boatman early interested in steam navigation on the Ohio and Mississippi. In 1814 he participated in the battle of New Orleans. In 1815, in the *Enterprise*, he made the first steamboat trip from New Orleans to Louisville. His river steamboat *Washington* had many points of improvement over the Fulton model. The success of the *Washington* was followed by lawsuits brought by Fulton, who claimed exclusive right to steam river navigation, but the cases were decided in Shreve's favor. From 1826 to 1841 he was employed by the government as superintendent of improvements on Western rivers and opened the Red River to navigation. He invented many improvements in steamboat machinery and construction.

SHREVEPORT. A city and the parish seat of Caddo Parish, La., 170 miles east of Dallas, Tex., on the Red River, at the head of navigation, and on the Texas and Pacific, the St. Louis Southwestern, the Kansas City Southern, the Houston and Shreveport, and other railroads (Map: Louisiana, B 2). Among the noteworthy features of the city are the Charity Hospital, Genevieve Orphanage, Golf and Country club, State Fair Grounds, St. John's College, Centenary College, St. Vincent's Convent, St. Mary's Convent, sanatoriums, Youree Hotel, Commercial National Bank Building, the United States post office, city hall, the courthouse, and seven public-school buildings. Shreveport is in a rich cotton and stock-raising region and is of considerable commercial importance. It carries on a large wholesale trade, especially in groceries, dry goods, lumber, and hardware. This trade in 1914 amounted to $70,000,000. In addition to several establishments connected with cotton—cotton factory, large compressors, and warehouses—there are molasses works, foundries and machine shops, glass and bottle factories, lumber mills, etc. Large natural-gas and oil fields 20 miles north of the city were first developed in 1906 and in 1914 yielded a product valued at almost $15,000,000. The government is vested in a mayor and four commissioners. Pop., 1900, 16,013; 1910, 28,015; 1915 (U. S. est.), 34,068.

SHREW (AS. *scrēawa*, shrew; connected with OHG. *scrōtan*, Ger. *schroten*, to cut, gnaw, bruise, AS. *screādian*, Eng. *shred*). A small nocturnal quadruped of the family Soricidæ, and especially of the genus *Sorex*, which includes the smallest of all mammals. The shrews are often confounded with mice, but belong to an entirely different order, the Insectivora (q.v.). The head is very long, the snout elongated, attenuated, and capable of being moved about. The eyes are minute, the ears small, the tail long, and both body and tail are covered with fine, short hair of a dark color without distinctive variegations. They abound in dry fields, woods, and gardens, and some species are semiaquatic. They feed chiefly upon insects and worms, especially earthworms, and, as they are able to obtain food at all seasons of the year, they do not hibernate. The northern species are hardy, ranging far towards the Arctic, and abroad during all winter. Most species make no burrows, but grub about among roots of herbage, make runways beneath fallen leaves, and hide in old stumps and beneath rotting logs. They are useful in gardens. The males fight fiercely in spring, often killing one another. They form the prey of weasels, foxes, hawks, owls, shrikes, and many other animals and are frequently caught by household cats, but seldom eaten by them, probably on account of their strong musky odor. Although harmless, this animal has long been regarded with dread and hatred by the peasantry of Europe, who believe it to be poisonous and attribute to it other evils. The numerous American species of shrews fall into three genera, *Sorex*, *Neosorex*, and *Blarina*. The largest is the swamp-haunting water shrew, 6 inches in length, including the tail; it is found from Massachusetts to the Rocky Mountains and northward. Of other American shrews the one most common in the eastern United States is the short-tailed or mole shrew (*Blarina brevicauda*), a blackish, stout-bodied, ravenous little animal, which feeds largely upon flesh of every kind and often kills the young of small birds. It takes its name of mole shrew on account of its unusual habit of frequently forcing its way through the loose topsoil like a mole. Perhaps the best-known American form, however, is the long-tailed shrew mouse (*Sorex personatus*), smaller, lighter in color, and most numerous about marshes and streams. An Italian shrew is the smallest of all known mammals, having a body only 1½ inches in length. It is a member of the genus *Crocidura*, which also includes the largest known shrew, one Oriental species of which is that known in India as the muskrat (q.v.). Consult standard zoölogies, especially F. E. Beddard, "Mammalia," in *Cambridge Natural History*, vol. x (London, 1902); also: Merriam and Miller, "American Shrews," in *North American Fauna*, No. 10 (Washington, 1895); E. T. Seton, *Life-Histories of Northern Animals* (New York, 1909); G. S. Miller, *Catalogue of Mammals of Western Europe* (London, 1912); Stone and Cram, *American Animals* (new ed., New York, 1914). See JUMPING SHREW.

SHREW MOLE. Any of the American moles of the genera *Scapanus* and *Scalops*. See MOLE.

SHREWSBURY, shrōōz′bĕr-ĭ *or* shrōz′-. The capital of Shropshire, England, on the Severn, by which it is nearly surrounded, 42 miles west by north of Birmingham (Map: England, D 4). The town, irregular in plan, contains many ancient timber-built houses of picturesque appearance. St. Mary's Church was founded in the tenth century. There are a market house (1595), the shire hall (rebuilt 1883), and the new market hall (1868). The town has interesting remains of ancient walls, a castle, two monasteries, and a Benedictine abbey.

It has manufactures of agricultural implements and linen thread, iron foundries, glass-staining works, and malting establishments, and a large trade in cattle.

Shrewsbury, called by the Welsh Pengwern, was named by the Anglo-Saxons Scrobbes-Byrig, of which the modern name is a corruption. The town was taken by Llewellyn the Great, Prince of North Wales, in 1215, during the troubles between King John and the barons; and in July, 1403, Henry IV here defeated the insurgent Percy with great slaughter, Henry Hotspur being among the slain. The battle is described in Shakespeare's *Henry IV*. The town was taken by the Parliamentarians in 1645. Pop., 1901, 28,400; 1911, 29,389. Consult: Pidgeon, *Historical Handbook of Shrewsbury* (Shrewsbury, 1857); Phillips, *Shrewsbury during the Civil War* (ib., 1898); Thomas Auden, *Shrewsbury* (New York, 1907).

SHREWSBURY, EARLS and DUKE OF. See TALBOT.

SHREWSBURY SCHOOL. One of the great public schools, at Shrewsbury, England, founded by King Edward VI in 1551 and opened in 1562. Its scope was largely increased by Queen Elizabeth. Under the vigorous administration of Dr. Samuel Butler (1774–1839) it attained a great reputation as a classical school, which was continued under his successor, Benjamin Hall Kennedy, who modernized this school. Its endowment produces more than £3000 a year. In 1882 it was removed to new buildings erected on a site covering 58 acres. The attendance since removal has increased from 170 to nearly 400. Consult G. W. Fisher, *Annals of Shrewsbury Schools* (London, 1899).

SHRIKE (AS. *scric*, Icel. *skrīkja*, shrike, from *skrīkja*, to shriek, titter; connected with Gk. *κρίζειν*, *krizein*, to creak). A predatory, insectivorous bird of the family Laniidæ, having a short, thick, and compressed bill, the upper mandible curved, hooked at the tip, and furnished with a prominent tooth, the base of the bill beset with hairs, which point forward. About 200 species are known, most of them natives of warm climates.

The typical shrikes or butcher birds are those of the subfamily Laniinæ, which are mainly inhabitants of northern countries and closely resemble one another in size (9 to 11 inches in total length), colors (pearl gray and white, set off with black markings on the face, wings, and tail), and in boldness and rapacity. Two species inhabit North America. These birds prey mainly on large insects, especially grasshoppers, in summer, but also on small mammals, birds, young snakes, frogs, and crayfish. Those not eaten at once they impale on thorns, splinters, etc., and in confinement they make use of a nail or cage wires. The German peasants believe nine such victims are regularly accumulated by each bird and call a shrike ninekiller. The practice originated, probably, in an effort to fix their food firmly while tearing it; it is not properly speaking food storage, since often the bodies are not again touched. Large numbers of mice and English sparrows are killed in winter, so that the bird is a public benefactor. The typical European species is the great grey or sentinel shrike (*Lanius excubitor*). The common or great northern shrike of North America (*Lanius borealis*), familiar in the northern United States in winter and breeding northward in a rude nest placed in a tree, is closely similar; while the loggerhead shrike of the Southern States (*Lanius ludovicianus*) has much the same colors, but is smaller.

The large, bald, and strikingly colored piping crows (q.v.) represent an Australian group called Gymnorhinæ. Those of the subfamily Malaconotinæ are small, brilliantly dressed, forest-dwelling birds of Africa and India, some of which are notable singers. A third group (Pachycephalinæ) includes a series of small tree-dwelling, usually yellow, birds of the Malayan Archipelago and Australia, with the habits of flycatchers. Better known are the East Indian wood shrikes of the subfamily Prionopinæ, of which the graceful and familiar Australian magpie lark and the queer helmet bird of Madagascar are also members.

Consult: Alfred Newton, *Dictionary of Birds* (New York, 1896); A. H. Evans, "Birds," in *Cambridge Natural History*, vol. ix (ib., 1900); and the authorities therein cited.

SHRIMP (assibilated form of *scrimp*, small; connected with MHG. *schrimpfen*, Ger. *schrumpfen*, AS. *scrimman*, to shrink, shrivel, *scrincan*, OHG. *screnchan*, Ger. *schränken*, Eng. *shrink*). A genus (*Crangon*) of macrurous decapod crustaceans of the family Carididæ, closely allied to crayfish and prawns. The form is elongated, tapering, and arched as if hunchbacked. The claws are not large, the fixed finger merely a small tooth, the movable finger hook-shaped. The beak is short, affording ready distinction from prawns. The whole structure is delicate, almost translucent; the colors are such that the creature may escape observation, whether resting on a sandy bottom or swimming. Their quick darting movements betray them to one who looks attentively into a pool left by the tide. When alarmed they bury themselves in the sand, by a peculiar movement of the fanlike tail fin. The common shrimp (*Crangon vulgaris*) is abundant in the North Atlantic Ocean on the shores both of America and of Europe, wherever the bottom is sandy. It is about 2 inches long, greenish gray dotted with brown. It is esteemed in Europe as an article of food and is taken by nets. The shrimp industry of the southern Atlantic coast of the United States amounts to more than $500,000 annually, while that of San Francisco Bay alone is worth half as much. The latter industry consists wholly in the capture, drying, and export to China of *Crangon franciscorum*.

SHROP'SHIRE, or SALOP. A border county of west England (Map: England, D 4). Area, 1346 square miles. Pop., 1901, 239,297; 1911, 246,306. The Severn, the principal river, pursuing a southeast course of 70 miles across the county, is navigable throughout. To the north and northeast of the Severn the county is generally level and is under tillage; to the south and southwest it is hilly and mountainous, in the Clee hills rising to an altitude of 1800 feet, and here cattle breeding is extensively carried on. A breed of horned sheep is peculiar to this county. Shropshire is remarkable for its mineral wealth. Coal, iron, copper, and lead fields at Coalbrookdale, Snedshill, Ketly, etc., are extensively worked, and there are important iron industries. Capital, Shrewsbury.

SHROVE'TIDE' (from AS. *scrifan*, to shrive + *tīd*, time). The name for the days immediately preceding Ash Wednesday, which were anciently days of preparation for Lent; the chief part of the preparation consisted in being shriven, or confessing. In the modern Roman Catholic church a trace of this is still preserved, as in many countries the time allowed for the annual confession, which precedes the Easter communion, commences from Shrovetide. In Europe it became a time of amusement and sports, preceding the fast of Lent. In England festive banquets of the day are still represented by the pancakes and fritters from which Pancake Tuesday took its name. For the English customs of Shrove Tuesday, consult R. Chambers, *Book of Days* (new ed., Philadelphia, 1911). See Carnival; Collop Monday.

SHRUBBY BITTERSWEET. See Waxwork.

SHRUBBY TREFOIL. See Hop Tree.

SHRUBS (variant of *scrub*, from AS. *scrob*, *shrub*). Plants which differ from herbs in possessing much woody tissue and which differ from trees chiefly in height, but partly also in the development of numerous primary shoots of approximately equal value. The distinction is largely artificial, since many transitions exist between these groups.

SHTCHEDRIN, shtchĕd-rĕn′, Mihkail Yevgrafovitch (pseudonym of Count Saltykov) (1826–89). A famous Russian satirical writer, born in the Government of Tver. He studied at the lyceum in Tsarskoe Selo and obtained a government position. In 1847 appeared his first sketch, *Contradictions*, followed in 1848 by *A Complicated Affair*. For these he was exiled to Viatka, where he remained from 1848 to 1856 and acted as chief assistant to successive governors, until permitted to return to the capital, upon the accession of Alexander II. The experiences of his long exile he embodied in his *Sketches of Provincial Life* (1886–87). In 1858–60 he was acting Governor at various places; he resigned from the service in 1862 and later joined the editorial staff of the *Contemporary*. Pecuniary straits compelled him to reënter the service in 1864–68, after which he became coeditor of *The Annals of the Fatherland* with Nekrasov (q.v.) and on the latter's death in January, 1878, editor in chief. Just before his death he wrote the famous *Forgotten Words*—his last message to the dormant conscience of the Russian intellectuals. Shtchedrin lashed bureaucratic corruption as unmercifully as he denounced the idle talk of would-be reformers. His characteristics were brought into still greater relief by his pathetic and loving treatment of the common people. In his *Trifles of Life* and his *Innocent Tales* (1887) he reached a larger conception of life than in his previous writings. His best work is *Messrs. Golovliev*, which can be enjoyed merely as a work of art.

SHTIPLIE. See Istib.

SHU′BRICK, William Branford (1790–1874). An American naval commander, born on Bulls Island, S. C. In the War of 1812 he served on the *Hornet* and *Constellation*, became lieutenant in 1813, assisted in defending Norfolk, and was attached to the *Constitution* at the time she captured the *Cyane* and the *Levant* in West Indian waters (1815). He took part in the Mexican War, commanding the naval forces in the Pacific and capturing ports on the coast. In 1853 he became chief of the Bureau of Construction. In 1859 he commanded a fleet sent to Paraguay to exact reparation for firing on the United States steamer *Waterwitch* and obtained both apology and indemnity. He remained with the Union in the Civil War, though a South Carolinian by birth. He was retired with the rank of rear admiral in December, 1861.

SHUFELDT, sho͞o′fĕlt, Robert Wilson (1850–). An American ornithologist and surgeon, born in New York. He was educated at Cornell and at Columbian (now George Washington) University (M.D., 1876). During the Civil War and later in frontier Indian wars he was an army surgeon, retiring in 1891, but being promoted to major in 1904. In 1882 he was curator of the Army Medical Museum, Washington, and later was honorary curator of the Smithsonian Institution. He wrote extensively in the fields of medicine, travel, anthropology, and especially ornithology, having made notably important researches in bird anatomy. Besides some 1200 articles and monographs, he published among other books: *Contributions to the Anatomy of Birds* (1882); *The Myology of the Raven* (1890); *Lectures on Biology* (1892); *Osteology of Owls* (1900); *Osteology of Pigeons* (1901); *Osteology of Herodiones* (1901); *Osteology of Birds* (1907); *Further Studies of Fossil Birds* (1913); *America's Greatest Problem: the Negro* (1915).

SHUFFLEBOARD, or **SHOVELBOARD.** An indoor game played by two or four persons with iron weights. These weights are slid along a board. The board is about 30 feet long; the weights or pieces used in the game are two sets of four each, weighing about a pound each. The players are divided into opposing sides, each side using one set of pieces. The board is sprinkled with fine sand and has lines drawn across it 5 inches from each end, one for the starting line and one for the finishing line. Each player in turn slides his piece along the board, which if it projects partly over the edge scores three points for the player, and if it lie on the finish line or between it and the edge of the board it will score two points, and is said to be in; the piece nearest the line scores one. In every round the players change ends. The game is for 21 points. When played on ocean steamers a figure is chalked on the deck and wooden weights are used. Instead of being pushed by hand, a long staff with a curved end is used, each player taking his turn, but nothing being scored till the end of the round. In both games an enemy's weight may be knocked out of the game altogether or a friend's shoved in by a blow from the succeeding player. In the steamer game the winner must make exactly 50 points, all in excess of that number being subtracted instead of added.

The origin of shuffleboard is probably similar to that of bowling, quoits, and curling. It was so popular during the reign of Henry VIII of England, that it was forbidden by law because it turned the people from the practice of archery.

SHULCHAN ARUCH, shụl-kän′ ä-ro͞ok′. See Talmud.

SHULL, George Harrison (1874–). An American botanist, born in Clark Co., Ohio. He graduated from Antioch College in 1901 and from the University of Chicago (Ph.D.) in 1904, served as botanical expert to the United States Bureau of Plant Industry in 1902–04, and thenceforth was a botanical investigator of the Carnegie Institution at the Station for Experimental Evolution, Cold Spring Harbor, Long Island, giving special attention to the results of Luther Burbank's work. He is author of contributions on variations, heredity, and plant breeding.

SHULLUHS, shŭl-lŭz′, **SHILLUHS**, shĭl-lŭz′, **SHILHAS**, shĭl-hŭz′ *or* shĭ-lŭz′, or **SHLUHS**, shlŭz. The name applied to the Berber tribes on the Adrar Mountains in the western Sahara and the northern slopes of the Atlas Mountains in Morocco. They are Hamitic, but have an infusion of Semitic and of negro blood. In somatic and cultural respects they differ so little from their kinsfolk, the Haratin, Kabyles, and Tuaregs (see Haratin; Kabyles; Tuareg), that all four may be classed together as Berber (q.v.) or Imazighen (q.v.).

SHUMAGIN (shōō′mȧ-gēn) **ISLANDS.** A group of islands southwest of Kodiak, Alaska (Map: Alaska, F, G 8). They were discovered by Bering in 1741 and were named for one of his sailors, who was there buried. Unga, the largest, is a Federal judicial station. The group is suited to fox farming, and under the provisions of an executive order of 1904 the following islands have been leased for such purpose: Bird, Big Goose, Chernabuna, Little Koniuji, Popof, and Simeonof. The headquarters of the Alaskan codfishery is located on Unga.

SHUMLA, shụm′lȧ (Bulg. *Sumen*, shōō′mĕn). A town in the Kingdom of Bulgaria, situated among the foothills of the Balkans about 60 miles west of Varna (Map: Balkan Peninsula, F 3). Its position at the converging of several roads and near some of the principal passes over the Balkans gave it formerly great strategical importance, and it is still an important military centre. The Turkish quarter of the town has a number of interesting mosques and other public buildings, while the Christian part is rather poorly built. The principal products are wine, silk, copper ware, and cloth. Pop., 1900, 22,928; 1910, 22,225, of whom about one-third were Turks. Shumla fell into the hands of Sultan Amurath I towards the end of the fourteenth century. It was strongly fortified in the eighteenth century and withstood three attacks by the Russians, in 1774, 1810, and 1828. The Russians occupied it in 1878.

SHUN-CHIH, shụn′chē′ (1638–61). The reign title (1644–61) of Fu-lin, the first Emperor of the present Manchu dynasty—the ninth son of T'ien-tsung, under whom the Manchus came into possession of Peking. T'ien-tsung died in September, 1643, and, his successor being a child, the government was taken by his uncle as Regent, who immediately set about consolidation of Manchu power, acting with wisdom until his death in 1651, when Shun-chih himself ruled. He continued the policy of conciliation, leaving the Chinese officials in control of the civil administration and falling in with Chinese ideas, customs, ceremonies, etc. Only one sign of servitude was insisted on—that of shaving the head and wearing the queue. Shun-chih treated Roman Catholics with favor and continued Adam Schall in his position of President of the Tribunal of Mathematics. He died in 1661 and was succeeded by his son, the famous K'ang-hi (q.v.). Consult H. A. Giles, *China and the Manchus* (Cambridge, 1912).

SHUNT (probably a variant of *shunden*, from AS. *scyndan*, OHG. *scuntan*, to hasten, urge). A branch or a parallel circuit for the passage of a portion of an electric current flowing between two points on a conductor. As the amount of current flowing through the shunt depends upon its resistance, it is so constructed that this quantity is some definite fraction of the resistance of the principal conductor. Thus, with a galvanometer it is customary to employ a shunt having $\frac{1}{9}$, $\frac{1}{99}$, or $\frac{1}{999}$ the resistance of the galvanometer, allowing but $\frac{1}{10}$, $\frac{1}{100}$, or $\frac{1}{1000}$ part of the current to flow through the coils and making it necessary to multiply the deflection observed on the tangent scale by 10, 100, or 1000, in order to determine the deflection that the entire current would produce. In a shunt-wound dynamo (see Dynamo-Electric Machinery) there is a branch circuit current through the field coils from the armature, so that only a portion of the current passes through these coils, though there is the same difference of potential as at the commutator of the armature. Consult J. A. Fleming, *Handbook for the Electrical Laboratory and Testing Room* (London, 1902), and S. P. Thompson, *Elementary Lessons in Electricity and Magnetism* (rev. ed., New York, 1915).

SHUR. See Moonja.

SHURI, or **SHIURI**, shōō′rē′. The capital of the Kingdom of Luchu until the islands were entirely incorporated into the Empire of Japan. (See Luchu; Okinawa.) It stands about 3¼ miles inland from Napa (Map: Japan, G 7). It is a straggling town, with the castle or King's palace perched on a hill about 500 feet high in the centre. Pop., 1908, 25,141.

SHURT′LEFF, Roswell Morse (1838–1915). An American landscape painter. He was born at Rindge, N. H., and graduated from Dartmouth College in 1857. Beginning as an architect, lithographer, and illustrator, he studied painting at the Lowell Institute, Boston, and at the National Academy of Design, New York. After the Civil War, in which he participated—being held a prisoner in the South for nearly eight months—he illustrated books and magazines in New York for several years and in 1870 first attempted oil painting. In 1890 he was elected a member of the National Academy. Good examples of his work, which are usually sunlit forest interiors rendered in a broad and lucid manner, are: "The First Snow" (Corcoran Art Gallery, Washington); "The Mysterious Woods" (National Gallery, Washington); "A Mountain Stream" (Metropolitan Museum, New York); "Through Woodland Shades" (1908); "The Edge of the Wood" (1911); "Autumn Forest" (1914).

SHUSAN, shōō′sȧn. See Susa.

SHUSHA, shōō-shä′. A district town in the Government of Yelizavetpol, Transcaucasia, 80 miles south of Yelizavetpol (Map: Russia, G 7). It produces mainly silk, leather, and costly carpets. Pop., 1911, 46,687, chiefly Armenians.

SHUSHWAP, shōō′swŏp (properly *Súqapmuq*). An interesting tribe of Salishan stock occupying territory extending from the main divide of the Rocky Mountains to Fraser River and from Quesnelle to Shushwap Lake, southern British Columbia. They are divided into several village communities; their houses were circular dugouts about 4 feet below the ground and roofed with logs and thatch covered with earth. Their dress was of furs or buckskin, and tattooing was practiced by both sexes, together with the wearing of nose pendants. They excelled in the making of pine-root basketry and mats woven from rushes. They used sea shells and copper bracelets as currency medium, obtaining copper by trade or from diggings. The tribe did not have the clan system. Inheritance was in the male line, and there was an order of hereditary chiefs, who regulated the division of labor and parceled out the fish and berry harvest, but did not lead in war, that duty falling upon elective war captains. Their weapons were the bow, lance, stone club, and a sort of bone sword, and they had body armor of quilted elkskin or strips of wood. Slaves were held by war and purchase and were frequently either killed by the grave of their owner or buried alive with the corpse. The mourning period lasted for a year, ending with a feast at the grave, on which occasion the son adopted his dead father's name. There were many peculiar marriage, puberty, and hunting ceremonies and tabus. With the exception of a few families all are now civilized and Christianized by the effort of Catholic missionaries and are reported by their agent to be generally industrious, law-abiding, progressive, healthy, and increasing in numbers. See Salishan Stock.

SHUSTER, shōō′stẽr, or **SHUSHTER** (anciently *Sostra*). A city in the Province of Khuzistan, Persia, on the Karun, 30 miles southeast of Dizful (Map: Persia, C 6). It is poorly built, with narrow unpaved streets and houses of mud and stone. On an abrupt sandstone hill above the city stands the citadel, partly in ruins. Among the mosques is the imposing Masjed i Juma. In the early part of the nineteenth century Shuster was the capital of the province and had a population of 45,000. Pop., 1910, about 12,000.

SHUSTER, W(illiam) Morgan (1877–). An American financial expert, born in Washington, D. C. He studied for a time at Columbian (now George Washington) University and Law School. Between 1899 and 1906 he was in the customs service in Cuba and Manila. In 1906–09 he was a member of the Philippine Commission and secretary of public instruction in the islands. While treasurer general and financial adviser of Persia in 1911–12 a fearless and honest administration of his office involved him in difficulties with the Russian and British governments. His criticism of Russian intrigues in Persia made him for a time an outstanding figure in international politics; finally, with the occupation of Persian territory by the Russian troops, the situation became so acute that Shuster was compelled to resign. In 1916 he visited the Philippines. He wrote *The Strangling of Persia* (1912).

SHUTE, Henry Augustus (1856–). An American author. He was born at Exeter, N. H., graduated from Harvard in 1879, was admitted to the bar in 1882, and after 1883 was judge of the police court at Exeter. His books, amusing and among the most successful of their kind, include: *The Real Diary of a Real Boy* (1902; 12th ed., 1906); *Sequel* (1904); *Letters to Beany and Love Letters of Plupy Shute* (1905); *Real Boys* (1905); *A Few Neighbors* (1906); *A Profane and Somewhat Unreliable History of Exeter* (1907); *The Country Band* (1908); *Farming It* (1909); *A Country Lawyer* (1911); *Plupy "the Real Boy"* (1911); *The Misadventures of Three Good Boys* (1914).

SHUTT, Frank Thomas (1859–). A Canadian agricultural chemist. He was born in London, England, removed to Canada in early manhood, and graduated at Toronto University in 1885. He was demonstrator in chemistry in that university in 1885–87 and in the latter year was made chemist of the Dominion experimental farms. He made noteworthy researches in maintaining and increasing soil fertility and in the conservation of soil moisture. He was elected a member of several learned societies in Canada and abroad.

SHUTTLE. See Loom; Sewing Machine.

SHUT′TLEWORTH, Edward Buckingham (1842–). A Canadian pharmacist. He was born at Sheffield, England, and was educated in Dublin and at the Royal School of Science. Going to Canada, he began research work in chemistry and bacteriology and was prominently identified with the development of the chemical industry in Toronto. In 1866, with others, he founded the Canadian Pharmaceutical Society, which became the Ontario College of Pharmacy and in which Shuttleworth was dean and professor of chemistry in 1882–91. He was also a member of the medical faculties of Trinity and Victoria universities and professor in the Ontario Medical College for Women.

SHUTTLEWORTH, Sir James Phillips Kay-. See Kay-Shuttleworth, Sir J. P.

SHUVALOV, shụ-vä′lôf, Paul Andreyevitch, Count (1830–1908). A Russian statesman, brother of Count Peter Shuvalov. After graduation from the Military School for Pages, he took part in the Crimean War. In 1867 he was appointed chief of the staff of the guards; later was commander of the military district of St. Petersburg; served with distinction in the Russo-Turkish War of 1877–78; and from 1885 to 1894 was Russian Ambassador at Berlin. After two years as governor-general of the Warsaw military district he was appointed (1896) a member of the Imperial Council. During his long and brilliant career Count Shuvalov received many honors.

SHUVALOV, Peter Andreyevitch, Count (1827–89). A Russian diplomat, brother of Count Paul Shuvalov. He was born in St. Petersburg, served in the army, and in 1864 was appointed Governor of Courland. Two years later he was made minister of police and in 1873 was sent on a diplomatic mission to London. Soon afterward appointed Russian Ambassador to England, he displayed much ability during the strained relations at the time of the Russo-Turkish War of 1877–78. When a break between England and Russia seemed inevitable, he succeeded in arranging with Lord Salisbury for the Congress of Berlin. He was recalled in 1879.

SHUYA, shōō′yȧ. A district town in the Government of Vladimir, Russia, situated on the Teza, 186 miles northeast of Moscow (Map: Russia, F 3). It has extensive cotton mills. Pop., 1911, 30,702.

SHY′LOCK. The Jew usurer in Shakespeare's *Merchant of Venice*, the central figure in the play, standing for the vengeful spirit of an oppressed race.

SIA, sē′ȧ. See Keresan Stock.

SIALKOT, sē′ȧl-kōt′, or Sealkote. The capital of the District of Sialkot in the Punjab, India, on the Aik River, 72 miles by rail northeast of Lahore (Map: India, C 2). Objects of interest are the ruins of an old fort, and the shrine of Hanak, the first Sikh guru. The city is the commercial centre of a productive agricultural and cotton-growing section and manufactures paper, cotton goods, silks, shawl trimming, pottery, cutlery, etc. Pop., 1901, 57,956; 1911, 64,869.

SIAM, sī-ăm′. An independent kingdom of southeast Asia, between Burma on the west and French Indo-China on the east and opening to the south by the Gulf of Siam. Apart from its long, narrow arm, known as Lower Siam, extending southward in the Malay Peninsula to the Straits Settlements, it forms a compact region, known as Upper Siam, lying approximately between lat. 12° and 20° 40′ N., and long. 98° and 106° E. Both French and English encroachments have been constant until the French claims and boundary line were settled in 1907 and the British in 1909. Area about 195,000 square miles; Malay Peninsula about 45,000.

The western boundary of Siam marks in the main the high granite backbone of the peninsula, although for about 100 miles in the northwest the Salwin River of Burma separates the two countries. In central Siam lies the little-known Korat Plateau. Between these two elevations is the great valley of the Menam River (q.v.) with its large tributary, the Meping. The Menam rises in the mountain district of the Loas country in the north of Siam and flows south, emptying into the Gulf of Siam below Bangkok. This area abounds with swamps and jungles, but the national wealth and commerce are found here, and it constitutes the real Siam, the bulk of the population living along these streams. East of the Korat watershed is the valley of the Nam Mun River. This stream flows eastward and enters the great Mekong, which forms most of the north and southeast frontier. The Laos inhabitants in the north live usually in small communities on the river banks. The geology of the country has not been fittingly studied, but the limestones and dolomitic formations, the basaltic districts and metamorphic schists, represent here in general a broken and complicated geological area.

Siam is in general a well-watered country. The climate is tropical, but not one of great extremes. The humidity makes it trying for Europeans and somewhat unhealthful, especially in the wet season from May to October. The rainfall is in some sections as high as 240 inches; at Bangkok it is about 50 inches. Siam lies in the paths of the monsoons, which determine its seasons. In general the usual temperature ranges from 65° to 90°, the northern and higher regions being drier and cooler, the thermometer at night there often falling below 50°. The cool season begins in November. In the north the teak tree abounds and oak and pine grow. Siam furnishes also rosewood, ebony, and many tropical woods and fruits. Elephants roam wild, and are also useful. The rhinoceros, tiger, leopard, gaur, water buffalo, flying fox, gibbon, and crocodile are plentiful.

Siam is not conspicuous as a mining country, though many minerals are found, including tin, wolfram, copper, iron, zinc, lead, antimony, gold, rubies, and sapphires. The only minerals worked on a commercial scale are tin and wolfram, tin being far the more important. The export of tin and of tin ore expressed in its metal equivalent amounted to 82,256 piculs in 1910–11. Wolfram is worked by a British company in Koh Samui and on a very small scale in Puket; rich deposits elsewhere are known. Gold washing in the streams is carried on in a small way in parts of the country, and some rock mining in Tomoh. Since the cession of the Pailin district to the French in 1907, the gem industry has fallen in importance.

In the northern and middle part of the country large forests abound, of which by far the most valuable tree is the teak. Teak cutting is mainly under British control. The logs are floated down the Menam to Bangkok; in the season of 1913, 99,046 logs passed the duty station at Paknampoh.

Agriculture, still largely in a primitive state, receives most attention in the valleys. The great alluvial Menam Plain, with its inundating features and irrigation facilities, is one of the richest of agricultural regions; but irrigation properly practiced is found mostly in the north. Rice is the chief product, the principal food of the people, and the staple export. Other crops are cotton, hemp, sesame, tobacco, pepper, and fruits. Of considerable importance is the raising of live stock, which includes water buffalo, cattle, horses, and swine.

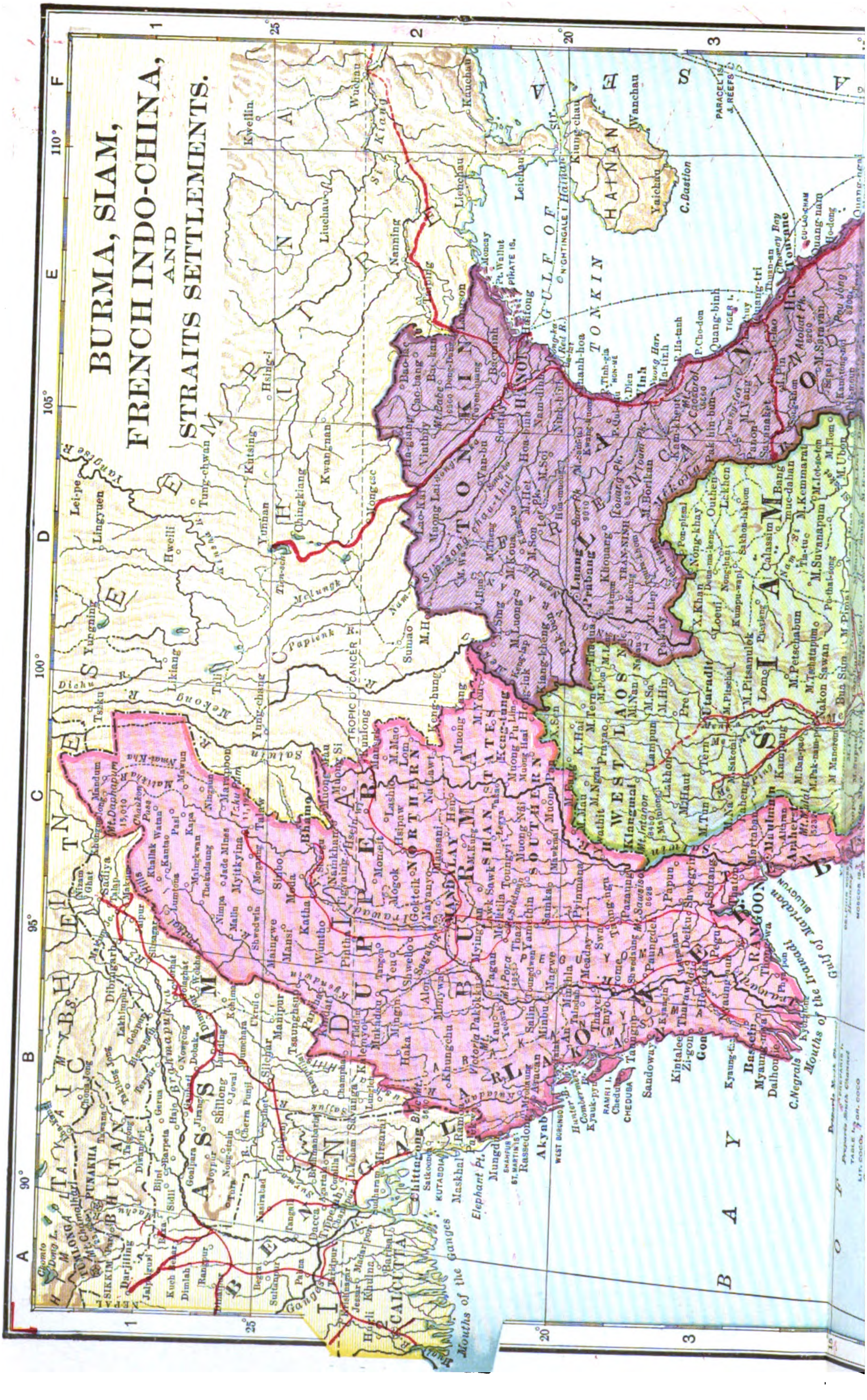
Imports and exports for 1912–13 are stated at 76,225,000 and 81,971,000 ticals respectively. In the latter year the rice export amounted to 65,320,000 ticals, and teak 5,600,000. The largest import is cotton goods; other large imports are oils, sugar, and silk goods. Most conspicuous in the foreign trade are Singapore, Hongkong, the United Kingdom, and China. Trade is largely in the hands of foreigners, notably Chinese.

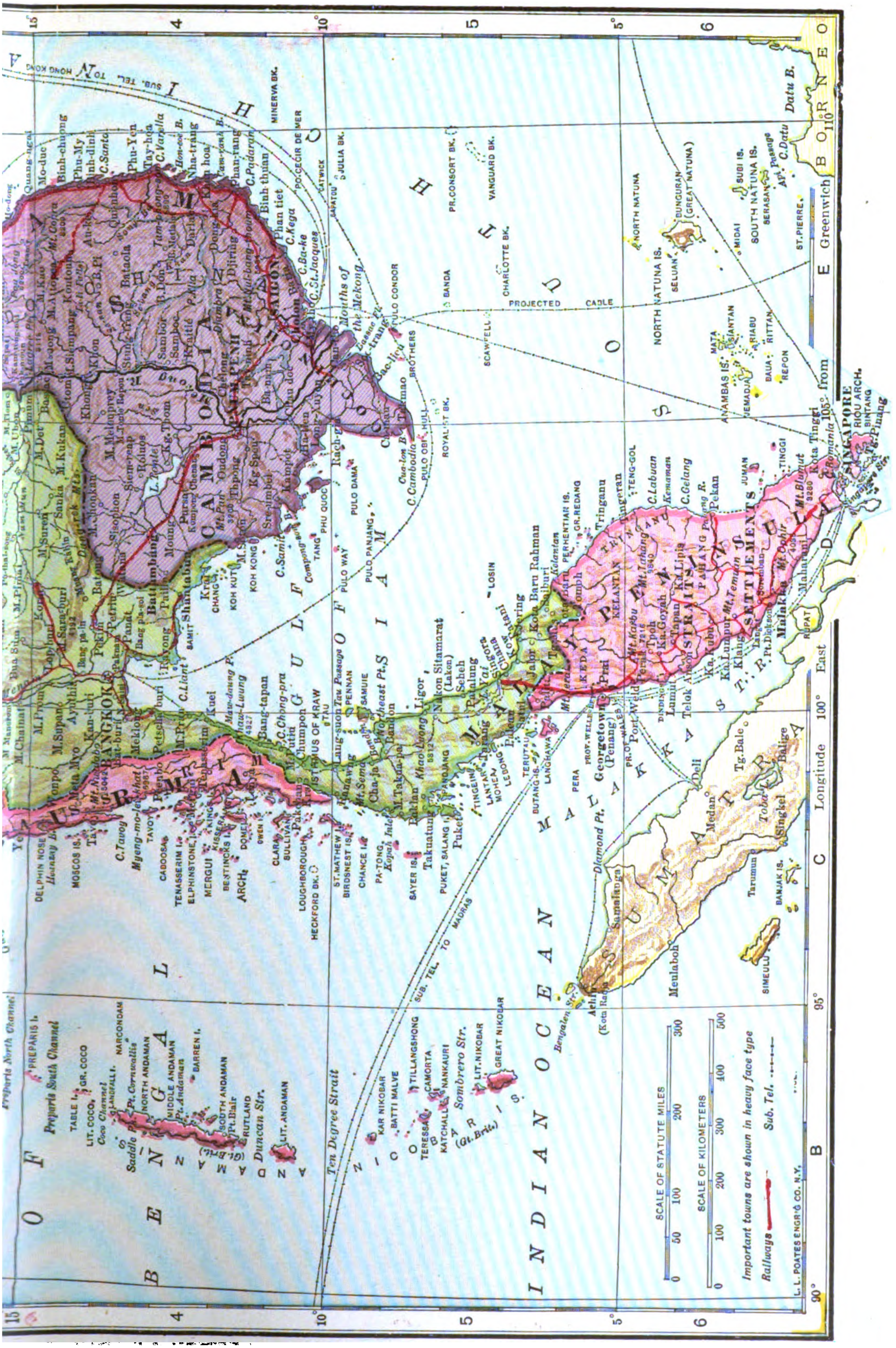
The first railway in Siam, from Bangkok to Paknam, about 12 miles, was opened to traffic in 1893. The first important enterprise was the state line from Bangkok to Korat, which was begun in 1892, reached Ayuthia and Gengkoi in 1897, and was opened to traffic to Korat (164 miles from Bangkok) in 1900. The first section of a line branching from this railway at Ban Phaji (56 miles from Bangkok) was opened to Lopburi in 1901; it has been continued northward through Paknampoh (1905) and Pitsanulok (1908) to a point beyond Utaradit (1909), and will ultimately reach Chiengmai and Chiengsen. These railways, the Northern Line, aggregated 476 miles at the beginning of 1915. A line from Bangkok (39 miles), known as the first section of the Eastern Line, was opened in 1908. Other railways in the south, including the Southern Line, which is projected to reach the west coast at Trang and the Kelantan border, totaled 315 miles at the beginning of 1915. State railways thus totaled 830 miles; in addition there were 65 miles of private railway, the total mileage for the country being 895.

The condition of public finance, for which a British officer acts as adviser, is very favorable. There is an excess of ordinary revenue over ordinary expenditure. For 1913–14 and 1914–15 respectively the estimated revenue was 65,094,000 and 68,000,000 ticals (par value of tical, 37.085 cents); expenditure against revenue, 64,599,000 and 67,997,000; extraordinary expenditure, against capital account (including expenditure from loans), 15,228,000 and 17,327,000. Revenue is derived from the opium tax, customs, railways, capitation tax, land tax, tax on spirits, mines, fisheries, etc. There was no national debt until 1905, when a loan of £1,000,000 was contracted. Railway construction made further loans necessary, and the total debt at the end of 1914 stood at £6,257,400.

The political régime has long been enlightened and progressive. The government is an absolute monarchy, the succession now passing from father to son. The King is assisted by a

BURMA, SIAM, FRENCH INDO-CHINA, AND STRAITS SETTLEMENTS.

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cabinet, whose members are the heads of the several departments of national administration: foreign affairs, finance, justice, interior, war, marine, police, public works, public instruction, etc. These officials are for the most part relatives of the King. Besides the British financial adviser there are foreign advisers in various departments of government. Since 1895 there has been a Legislative Council. It is formed of the cabinet and officials and 12 other persons selected by the King. Its members number upward of 50. Siam is divided into 17 circles (monthons), which are subdivided into provinces (muangs), and the latter into districts (amphurs). The monthons are under the Ministry of the Interior, except the metropolitan monthon of Krung-Thep, which is under the Ministry of Local Government. At the head of each of the other monthons is a high commissioner, to whom the provincial governors are responsible. Over each district is an official responsible to the governor. A general conference of the high commissioners is held annually at Bangkok.

There is an international court in which suits of foreigners against Siamese are brought. The legal code is being modernized, and the police force has been remodeled, extended, and made effective under English guidance. The monetary unit is the tical, par value 37.085 cents. Siam has been on a gold exchange basis since 1908. The chang (catty) represents 2⅔ pounds avoirdupois. Fifty changs make a haph (picul), 133⅓ pounds.

Army. In theory military service is universal and compulsory from the age of 18 to 35. In practice there are many exempted classes, and among certain of the backward tribes service is not required. Service with the colors in the active army is for two years—in the first reserve five years, in the second reserve 10 years. In peace there are 10 skeleton divisions, consisting of two regiments of one battalion each, one regiment of cavalry of two squadrons, two batteries of four guns each, one battalion of engineers. In war the organization expands to two regiments of three battalions, one regiment of three squadrons, one battalion of three batteries, one battalion of engineers. Peace strength, 12,000 men. Arms, infantry, the Mauser rifle; artillery, a German 75-millimeter field gun. See NAVIES.

The population is stated by a census of 1910 as 8,149,487, consisting in part of about 2,500,000 Siamese, 1,600,000 Chinese, 1,350,000 Laotians, 490,000 Cambodians and Annamites, and 750,000 Malays. Bangkok, the capital, is the only large city. Chiengmai, the capital of the Laos country, with over 50,000 inhabitants, is the leading town in the north, where the various tribes of the Thai race are found. In the extreme south are the Malays. The natives have largely intermarried with the energetic Chinese. The Siamese themselves are indolent and indifferent. As the Thai in the limited sense, they form the most important civilized section of the Thai stock of Farther India, akin to the Laotians and Shan tribes of the northern and eastern regions of Siam. The primitive Thai type has been very much changed among the Siamese by intermixture with the Khmers, Kuis, Hindus, and Malays. Physically they are above the average in stature, with very brachycephalic skulls, olive complexions, prominent cheek bones, lozenge-shaped faces, and short flat noses. Their hair is dark. Although polygyny and concubinage are permitted by custom, the mass of the Siamese are practically monogamous, with few divorces. There is no caste. The Siamese language is the "monosyllabic, tonic type," characteristic of the more or less cultured nations of Farther India. The Siamese are generally Buddhists of the orthodox or southern school. The priests have hitherto had complete charge of education. The Malays are Mohammedans. The missionaries are either French Roman Catholics or American Protestants, whose efforts, while not resulting in numerous conversions, have accomplished much philanthropic work. The facilities for modern education have been radically extended during recent years. In Bangkok and the provinces the government maintains many schools and aids in supporting others, among them a normal institution, a home school with English instructors for the sons and daughters of titled and other families, vernacular schools, cadet colleges, and medical, civil service, law and engineering colleges which have now been incorporated into the newly chartered Bangkok University.

History. The fabulous history of Siam goes back to the fifth century B.C. An attempt is made to show the descent of the King from Gautama Buddha and of the people from his immediate disciples. Authentic history begins in the middle of the fourteenth century A.D. Long before, there were many immigrations from the north, with shifting dynasties, frequent wars, and uncertain fortunes. In the middle of the fourteenth century the King, known posthumously as Phra Rama Thiboda, built Ayuthia on the site of an ancient town and made it the capital. He extended the Siamese power southward into the Malay Peninsula and eastward into Cambodia. For 200 years peace and prosperity prevailed. Ayuthia became a large and rich city. In the middle of the sixteenth century it was captured by an army from Pegu and thenceforth for more than 200 years there were wars of varying fortunes with Burma, Pegu, and Cambodia. In the seventeenth century a considerable intercourse with Europe, China, and Japan was carried on. In 1759 the Burmese captured Ayuthia and after a long struggle conquered the whole country (1767). They introduced a king of their own, and upon the withdrawal of their army anarchy ensued. A Chinaman, the leader of a band of freebooters, seized Bangkok and, to the joy of the people, expelled the Burmese. He proclaimed himself King, as P'ya Tak. He extended his power southward and eastward, but was assassinated in 1782 by one of his generals, Yaut Fa, who established the present dynasty, the ruling monarch being seventh in descent from him. In 1820 intercourse with the West was renewed, and in 1825 a treaty was made with the United States and soon after similar treaties with other nations. In 1855 Great Britain made a treaty which established extraterritoriality and put trade on a secure footing. The French protectorate over Cochin-China delivered Siam from its ancient enemies to the east of the Mekong, Cambodia having been previously reduced to the position of a dependency. But France desired access to China by means of the river system of the peninsula, and it presently found a pretext for aggression. It accused Siam of encroaching on the territory of Anam, and sent its fleet to Bangkok (1893), where it dictated terms of peace. Cambodia and all the territory east of the Mekong were to be under French protection; a belt extending for a distance of 25 kilometers west of the Mekong was neutralized, and valuable trade privileges were conceded. Since that time the French sphere of influence has been extended still farther west. By the Franco-Siamese convention of 1904 France obtained control of about 8000 square miles to the west of the Mekong in the south, as well as of the trans-Mekong portion of the Laos State of Luang Prabang in the north. By the Anglo-French convention of the same year the territories to the west of the Menam and the Gulf of Siam were recognized as in the British, and those to the east as in the French, sphere of influence. The two powers also guaranteed the future integrity of Siamese territory. In 1907 more territory was ceded to France, and in 1909 three states were ceded to Great Britain. In 1912 a conspiracy against the King was discovered and put down with great severity.

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SIAM, Gulf of. An arm of the China Sea, lying between the Malay Peninsula on the west and French Indo-China on the east (Map: Siam, D 5). It is 235 miles wide at its entrance and extends inland in a northwesterly direction a distance of 470 miles. Four rivers, navigable for a considerable distance, the chief of which is the Menam, fall into the gulf.

SIAMANG, sē'ȧ-măng *or* syä'măng (Malay *siămang*). The largest of the gibbons (q.v.), distinguished from the others by the circumstance that the second and third toes of the foot are joined together as far as the last joint in the male and to the middle joint in the female; hence the technical name, *Hylobates*, or *Symphalangus*, *syndactylus*. It stands 3 feet high and is glossy black except for a whitish beard. The hair is comparatively long and, unlike that of other gibbons, grows upward from the wrist towards the elbow. The home of the Siamang is Sumatra, where it dwells in troops in the forests, swinging through the tree tops with amazing agility. It is numerous and is frequently captured, but does not endure captivity well.

SIAMESE (sī'ȧ-mēz' *or* sī'ȧ-mēs') **TWINS** (1811–74). A name given to two youths, Eng and Chang, born of Chinese parents in Siam, who had their bodies united by a band of flesh, stretching from the end of one breastbone to the same place in the opposite twin. See Monstrosity.

SI-AN-FU. See Si-Ngan-Fu.

SIANGTAN, syăng'tăn'. A prefectural city of China in Hunan, on the Siang River (Map: China, K 6). It has extensive suburbs and stretches along the bank of the river for 4 miles. It is the commercial centre of Hunan and lies on one of the great water routes from Peking to Canton. Pop., 300,000.

SIANGYANGFU, syăng'yăng'fōō' (the *Saianfu* of Marco Polo). A departmental city of the Province of Hupeh, China, at the confluence of the Han and Pai rivers, the Han giving the town large trade through Hupeh. Otherwise the town is not so important as Fancheng, on the opposite bank of the Han, which has silk, carving, and other industries (Map: China, K 5). Siangyang and Fancheng are both noted for the resistance they offered to the armies of Kublai Khan in 1268–73, surrendering only when Marco Polo's father and uncle came to the assistance of the Mongols. Pop., 50,000.

SIBALÓM, sē'bȧ-lōn'. A town of Panay, Philippines, on the left bank of the river of that name in the Province of Antique, situated 9 miles northeast of Buenavista. Pop., 1903, 12,461.

SIBAWAIHI, sē'bȧ-vī'hē. The current name of Abu Bishr 'Amm ibn Uthman ibn Ķaubr, an Arabic grammarian of the eighth century. He was a Persian and studied at Basra. He returned to Persia and died near Shiraz in 793 or 796. His *Kitāb* (book) is the oldest systematic presentation of Arabic grammar and remains the classic study of the subject. Derenbourg has published his text in *Le livre de Sîbawaihi* (Paris, 1881–89), translated, with Arabic commentaries, by Jahn, in *Sîbawaihi's Buch über die Grammatik* (Berlin, 1894).

SIBBALD, sĭb'ald, Sir Robert (1641–1722). A Scottish physician, geographer, and historian, born in Edinburgh. He graduated at Leyden (M.D.) in 1661 and at Angers in 1662. He practiced in his native city until 1685. In 1667 he opened a botanical garden for the study of the medical properties of herbs and in 1681 was one of the founders of the Royal College of Physicians of Edinburgh (president, 1684). The following year he was appointed physician to King Charles II and geographer of Scotland. His geographical and statistical notes for a description of the natural history of Scotland, *Scotia Illustrata* (1684), was attacked by Dr. Pitcairne (q.v.) and resulted in a controversy. In 1685 he was appointed professor of medicine at Edinburgh University. For two years he was a Roman Catholic and lived in London, because of Scottish hostility to this faith. Sibbald was a prolific writer, especially on geographical and historical subjects. A number of his essays appeared in 1739 under the title *A Collection of Several Treatises in Folio Concerning Scotland*.

SIBBALD'S (sĭb'aldz) **WHALE,** or Blue Whale. A rorqual (*Balænoptera sibbaldi*), the largest known whale, reaching a length of 85 feet or more and exceeding in bulk all other whales and all other known animals living or extinct. It passes most of the year in the open ocean, wandering into every sea, but early in summer approaches northern coasts for the purpose of reproduction. At this time its sole food is a small schizopod crustacean (*Euphausia*), similar to the opossum shrimp, which swarms in the North Atlantic. This whale is dark bluish gray in color with whitish spots on the breast and black baleen. See WHALE.

SIBELIUS, sē-bā′lĭ-ụs, JEAN (1865–). The greatest of Finnish composers, born at Tavastehus. From 1885 to 1888 he studied under Wegelius at the Helsingfors Conservatory. Then he took a course in counterpoint with A. Becker in Berlin and spent 1890–91 in Vienna, studying with Goldmark and R. Fuchs. In 1893 he was appointed professor of composition at Helsingfors Conservatory. His first compositions showed striking originality and attracted general attention, and, to enable him to devote his entire time to composition, the Senate of Helsingfors voted him a liberal annuity. When he visited the United States in 1914 to conduct some of his works at the twenty-eighth Norfolk (Conn.) Festival, Yale University conferred upon him the degree Mus. Doc. The music of Sibelius is founded upon the folk melodies of Finland, his chief sources of inspiration being nature and the national sagas; his characteristics, earnestness and sublimity, with little joy or merriment. His command of technical details is supreme, with instrumentation full of subtle lights and shadows, feeling deep and sincere, artistic taste unerring. His principal works are an opera, *The Maid in the Tower* (1896); incidental music to Paul's *König Christian II*, Maeterlinck's *Pelléas et Mélisande*, Paul's *Die Sprache der Vögel*, Strindberg's *Svanehvit;* four symphonies (E minor, D, C, A minor); the symphonic poems *The Swan of Tuonela*, *En Saga*, *Finlandia*, *Frühlingslied*, *Lemminkäinen zieht heimwärts*, *Nächtlicher Ritt und Sonnenaufgang*, *Pohjola's Daughter*, *The Dryad*, *Belsazar's Gastmal*, *Aallottaret* (Nymphs of the Ocean); *Luonnotar*, a violin concerto in D minor; a funeral march, *In Memoriam;* a pantomime, *Scaramouche;* some choral works; piano pieces; songs, one of which, *Svarta Rosor*, is especially celebrated. Consult Rosa Newmarch, *Jean Sibelius, A Finnish Composer* (Leipzig, 1905).

SIBE′RIA. An opera by Giordano (q.v.), first produced in Milan, Dec. 19, 1903; in the United States, Feb. 5, 1908 (New York).

SIBE′RIA. An Asiatic possession of Russia, embracing more than one-half of the area of the entire Empire—4,831,882 square miles, more than one and one-half times as great as that of the United States (exclusive of Alaska). It is divided politically into four governments, Irkutsk, Tobolsk, Tomsk, and Yeniseisk, and six provinces, Amur, Kamchatka, Primorskaya, Sakhalin, Transbaikalia, and Yakutsk. While most of Siberia has belonged to Russia for some centuries and about 90 per cent of the population is of Russian origin, the Amur lands and the southern part of the littoral (Pacific coast) were not detached from China till 1858 and include only a moderate number of Russians.

Topography. Excepting in the Amur basin and the Pacific littoral the country slopes gently from south to north, carrying the drainage to the Arctic Ocean. The Arctic shore is low, flat, indented in the west, more regular in the east, and only in the Taimyr Peninsula, with low mountain ranges roughly paralleling the coast, is the plainlike character broken. The barren tundra merges gradually near the Arctic circle into the marshes and forest belt to the south, and these in turn in the west merge into the agricultural tracts of southern Siberia. A peculiar feature of the tundra is that the soil is perpetually frozen to great depths, the frost going down near the pole of cold, east of the Lena River, to a depth of 650 feet. Intervening in this frozen soil are layers of clear blue ice, called ground ice. In this frozen mass the remains of mammoths and other animals have lain probably since the time of the great glacial epoch. The surface thaws in summer, covering the northern regions with almost impassable mud, but permitting the growth of short-season flowers. The coast lands of the Pacific frontage, on the contrary, in a region of more abundant rain are fringed by high forest-clad mountain ranges so near the sea that little opportunity is given for deep indentations, there being long stretches of nearly straight shore line. Siberia has only a few islands of much importance, the new Siberian group of the Arctic and northern Sakhalin in the Pacific being most noteworthy. The surrounding seas are shallow, usually for a long distance from the land. South of the Arctic region the Yenisei River divides Siberia into two greatly differing parts. The region to the west, nearly the whole of West Siberia, consists of vast level plains, almost completely covered in the northwest with one of the most extensive swamp regions of the world, in which many rivers wind sluggish and tortuous courses. The region of swampy lands embraces nearly all of the Government of Tobolsk and the northern part of Tomsk; scattered through the swamp area and over the southern plains are thousands of lakes, most of them very small, relics of the ice age. The eastern part of Tomsk belongs in topographic aspects to eastern Siberia, which strikingly contrasts with most of the region west of the Yenisei. The southern part of this region is the chief region of agriculture and population.

As West Siberia is a land of low swamps, plains, and lakes, so eastern Siberia to the Pacific, especially in the south, is a land of low plateaus sloping gradually to the Arctic and surmounted by many ranges of mountains, not high but giving the country a rugged character. The ranges have a general northeast and southwest direction, following the trend of the backbone or central feature of the region—the chain known as the Yablonoi and Stanovoi mountains, which extends unbrokenly from the Chinese border east of Lake Baikal to Bering Strait, about 4300 miles. In the far north the ranges dwindle, so that the great low plain of north Euro-Asia is continued practically without interruption to Bering Sea. The eastern mountains are the region of mining, with agricultural opportunities in many valleys. The highest mountains are the Altai, Sayan, Yablonoi, and Stanovoi mountains, the culminating point, outside of Kamchatka, being the Byelukha, in the Katunski-Altai, which has an elevation of nearly 15,000 feet. The isolated mountain district of Kamchatka reaches in numerous peaks elevations of from 10,000 to nearly 15,000 feet and Mount Makachingu, the highest summit north of the Arctic circle, is 8500 feet high.

Hydrography. The four rivers, the Obi, Yenisei, Lena, and Amur (qq.v.), have great length and very extensive basins and with their numerous tributaries afford about 30,000 miles of interior navigation. The Obi and its tributary the Irtysh are the most important rivers of Siberia, flowing as they do through the most fertile and populous districts in the southwest of the country. The Obi with its affluents supplies more than 9000 miles of navigation. Its estuary on the Kara Sea is very large, but vessels drawing more than 12 feet cannot enter it. Its long tributary, the Irtysh, is also navigable. The Yenisei is navigable for 1850 miles, and ocean steamers might ascend it for 1000 miles. The ice-choked northern sea, however, makes the Yenisei as well as the Obi unimportant in sea trade. Local trade and steam navigation are developing along the river, but its chief importance is as a link in the line of water communication between Lake Baikal in eastern Siberia and Tiumen, near the west boundary—a very important route more than halfway across Siberia. This route is by way of the Angara tributary of the Yenisei from Lake Baikal and Irkutsk by steamer 400 miles to Bratski Ostrog, where rapids obstruct steam navigation, though the improvements required to make steamers available around the worst rapids (1¼ miles) would not be very costly. Thence the route is uninterrupted to the Yenisei, down that river to the Kass, whose source lies near that of the Ket tributary of the Obi. These rivers were canalized and connected by a canal, so that boats pass between the Yenisei and the Obi (586 miles). The route continues on the Irtysh and its Tobol tributary to Tiumen, over 3000 miles by water from Irkutsk. At that point freight is transferred between boat and railroad. The route is at its best a very circuitous one, and it carries the principal products of Siberia to a land which abounds in similar products and in which, accordingly, they have a smaller value than they would have elsewhere.

The Lena is navigable by river steamers for 1750 miles from its mouth and serves considerable local traffic. The Yana and Kolima, other large Arctic rivers, are still little known. The Amur basin supplies 8940 miles of navigation including the Amur, the Shilka and Ingoda, the Seya and its tributaries, the Sungari and its tributaries, and the Ussuri. The great commercial disadvantage of the Siberian rivers is that they are open to navigation only from three to five months in the year. Lake Baikal, the largest fresh-water lake in Asia, is in eastern Siberia. Considerable agriculture is developing around its shores, and the government has constructed a number of ports to facilitate the lake trade.

Climate. The winters are long and very severe, but exceedingly dry; the summers are short and hot. In the agricultural districts of both eastern and West Siberia the mean annual temperature is approximately 32° F. The mean summer temperatures are 62° in the east and 63.5° in the west; the mean winter temperatures are —0.4° in the east and 1.4° in the west. Summer on the farming lands of West Siberia is as warm as in central Russia. The temperatures farther north are much colder. Verkhoyansk, northeast of Yakutsk, for a long time considered the coldest spot in the world, has a mean annual temperature of 3.2° F., a mean in January of —56° F. and a maximum cold of —90° to —93° F. The rivers are frozen from 160 to 200 days in the year. Excepting on parts of the Pacific coast the rainfall is small, sometimes insufficient to mature the wheat crop. The annual rainfall at Aryan (Sea of Okhotsk) is 36 inches; Yakutsk, 10 inches; Kiakhta, 8 inches; Tobolsk, 18 inches.

Flora. The treeless northern tundras have mosses, lichens, and stunted shrubs on their surface. South of the tundras is the wide and extensive forest zone—first the low forests in which birch, larch, and silver fir grow vigorously enough to merit the name of trees; then, farther south, forests of large trees. The woodlands, from the Urals to Kamchatka, are interrupted only by the rivers, peat bogs, marshes, or narrow ravines. Conifers, the prevailing trees, including species common to Europe, and the *Pinus pichta* peculiar to eastern Siberia, is very tall and slender, but little used. The Siberian cedar (*Pinus cembra*), used for furniture, is of value. The most common and hardy tree is the larch, found throughout the forest zone. Many trees common to temperate Europe also occupy large areas. Forest fires have desolated much woodland.

Fauna. All the waters bordering Siberia, as well as its rivers and lakes, abound with fish, which are a large food resource. The real incentive to the Russian conquest of Siberia was the great abundance of animals whose furs in that climate have great softness, warmth, and lightness. Though, owing to overhunting, many of these have become extremely rare, Siberia is to-day the largest source of furs, surpassing Canada and Russia. Among fur animals of the forests are the polar hare and fox, the sable, otter, red fox, ermine, wolf, bear, and the gray squirrel, of which about 1,000,000 skins are taken every year. Burrowing animals are very numerous in the south. The tiger is still found in the south and southeast, especially abundant in the Amur region. The Arctic tribes have the reindeer, and the camel is used in the more southerly parts.

Geology and Mineral Resources. Most of the lowlands are overlaid with recent deposits resting upon Paleozoic or Mesozoic rocks. The extreme northeast is composed chiefly of Paleozoic rocks. The direction of the mountain ranges, chiefly granite, was determined ages ago by the great disturbances that fractured, folded, or upheaved the earth's crust. The high mountains of Kamchatka are distinguished by young eruptive rocks and active volcanoes. Gold mining in Siberia, which produces about two-thirds of Russia's gold, dates back to 1745, but it is only within the past decade that modern mining methods have made this industry important. In 1912 the mines yielded 1,014,157 troy ounces of gold and 134,465 ounces of silver, both amounting in value to $20,687,094. But, for lack of good roads and owing to the high cost of labor, the gold-mining industry is still undeveloped. The quartz deposits had until recently been neglected, and the placers are worked by antiquated and expensive methods. Silver is mined chiefly in Nertchinsk (Amur region) and Semipalatinsk. Coal mining has been greatly stimulated by the opening of the Trans-Siberian railroad, no less than 100,000,000 poods of coal being mined in 1912. The production of copper in Siberia amounted to about 3780 tons in 1911. Little attention has yet been paid to the mining of iron, lead, and tin, though deposits of all these minerals are found. Siberia is particularly rich in graphite, used chiefly for lead-pencil manufacture.

Agriculture. Agriculturally, Siberia must be divided into western and eastern halves. Western Siberia is more fertile and more thickly populated and is chiefly devoted to agriculture (nine-tenths of the inhabitants are tillers of the soil), while mining and hunting are still more prominent in east Siberia. All the land, with unimportant exceptions, belongs to the crown, which leases it to the separate communes, to be redistributed among the inhabitants from time to time. All the best farming land has been taken up, and many immigrants are now trying to make homes by the difficult operation of clearing timber from the southern edge of the woodlands. Farming, in the American sense, can be carried on only in the south (in the west up to lat. 60° N.; in the east to 55°), where most of the ordinary grains, potatoes, onions, melons, etc., are grown. The agricultural or southern belt of West Siberia extends from the western border to Lake Baikal, approximating 180,000 square miles, three-fourths of which is good farming land with an alluvial soil (in the extreme west the soil is black earth like that of the Russian wheat belt) well adapted for the cultivation of wheat, oats, rye, and barley, as well as for cattle raising. The agricultural development of Siberia may be gauged by the enormous demand for agricultural implements and machinery, necessitating in 1913 over 600 warehouses and foreign branches for their sale and involving a turnover of about $5,500,000. It is estimated that 300,000,000 acres, all told, may ultimately be turned into farming lands, of which the Amur and maritime provinces will supply about 69,000,000 acres. The summers in the east, however, are not very favorable for cereal crops on account of excessive moisture. Elsewhere, however, considerable quantities of cereals and pulse are grown, reaching 248,540,000 poods in 1914. Fruit and vines flourish only in a few sheltered localities on the Ussuri River.

Horses, cattle, and sheep are behind agriculture in importance, but stock raising is a growing industry, particularly in West Siberia. In 1911 about 17,500,000 horses and cattle were found in the principal provinces, while in the whole of Siberia the number of sheep and goats in 1913 was 5,195,026. In 1880 no butter was made, but by 1904 there were 2630 factories, while in 1912 these numbered 2294 in the Government of Tomsk alone. The same year the export of butter from Siberia amounted to 77,642 short tons and exceeded in value $30,900,000. In 1913 the quantity of butter exported reached 4,058,650 poods.

Manufactures. Previous to 1890 the manufacturing industries were confined almost entirely to tanning, tallow boiling, distilling, brickmaking, and ore smelting (gold and silver ore treated at Barnaul and Nertchinsk). The building of the Trans-Siberian Railroad gave considerable impetus to manufacturing by making it easier and less costly to import machinery for mills. At the same time the railroad, by enlarging the facilities for the importation of Russian manufactures, injured the household industries, which formerly supplied most of the clothing, furniture, and utensils. Tomsk (pop., 112,000 in 1913) is by far the largest manufacturing centre. Its mills and factories are now supplying porcelain, refined sugar, flour, iron wares, carpets, and other products in considerable variety. Other western towns also are growing in this respect. In the east, in the Amur Province alone, there were in 1911 no fewer than 789 industrial establishments, with a turnover of $5,890,142. Together with the Maritime Province it employed 115,000 workmen in 1912. The chief impediments are lack of good workmen and the high cost of fuel.

Commerce. Few trade statistics for Siberia are published. The enormous distances between different parts of the country have always hampered both the domestic and the export trade, but this situation, mitigated by the development of steam navigation, has been still further improved by the Trans-Siberian Railroad, so that a great deal of grain is now sent from West to eastern Siberia, and more wheat and live cattle are sent to Russia and other European markets. Wheat, which has been exported from West Siberia to European Russia since 1899, constitutes the major portion of the exports of grain. Butter is exported more profitably than cereals, and is handled by Danish, German, and English firms, whose representatives send it to refrigerators along the railroads. Siberia's egg trade is rapidly growing in importance, while its meat is exported in large quantities, some 30,000 tons annually. The carrying trade of Siberia has reached 74,000,000 poods annually. Its home trade has also grown considerably since 1905—from 60,000,000 to 150,000,000 rubles annually. An enormous amount of tea is still transported by sledge in winter and by the river routes in summer. General manufactures, iron and steel, and sugar (practically all from Russia) are the chief imports. The free-trade policy, long maintained in Siberia, ceased in 1900, when the heavy duties levied in European Russia were imposed at the Siberian frontiers and ports. A short free list includes cereals (eastern Siberia not raising all the grain needed) and agricultural and mining machinery. All Chinese products, excepting tea and spirituous liquors, are on the free list.

Transportation and Communication. There were in all 416 steamers in Siberian waterways in 1910. Of these 200 were on the Amur system and 140 on the Yenisei. The Siberian railroad has not yet greatly affected the business of the river routes, excepting in grain transportation.

The Trans-Siberian Railroad, which was begun in 1891 and completed in its main features in 11 years, including a branch across Manchuria to Port Arthur and Dalny, starts from Tcheliabinsk, on the eastern slope of the Urals. Its length to Vladivostok, on the Pacific, is about 4500 miles. The continuous railway route from St. Petersburg to Vladivostok is 5481 miles long. The road cost $172,525,000. It is giving an impetus to agriculture and all other business enterprises of the country, while its branches north and south (all fed by a great river traffic) open up vast new areas to colonization. This railroad proved of great importance to Russia in the War of the Nations, as the only route by which merchandise could be imported during the parts of the year in which the port of Archangel was closed by ice, the Baltic having been closed by mines and German war vessels. The value of merchandise sent from the United States to Russia by way of Vladivostok and the Trans-Siberian Railway was about $45,000,000 in 1915. The sea trade is comparatively small. The vessels clearing from Vladivostok, the commercial port of the Russian Far East, carried 1,145,000 tons in 1911. North of this port is Alexandrovski, which Russia has turned into a coaling station for its warships. A number of merchant vessels have successfully made their way between European ports and the mouths of the Obi and Yenisei rivers through the Kara Sea and Arctic Ocean, but this route is as yet of slight commercial importance.

In 1912 Siberia had 6245 educational institutions with 344,678 pupils, while its university at Tomsk had 1347 students. The opening of the Peoples' University in 1912 (called the Tomsk House of Science), with free instruction to all, marks an important departure in the higher education of Siberia. The predominant religion is Orthodox Greek. The population in 1912 was 9,577,900. The Russians constitute about two-thirds of the population, composed of free immigrants and their descendants and the exiles and their descendants. The Russian immigration to Siberia was 3,970,000 between 1896 and 1910, while the entire number of immigrants in 1913 was 327,430. Many of these, disheartened by their pioneering experiences, returned to European Russia. Next to the Russians in numerical importance are the Kirghizes, Buriats, and Yakuts.

For government and further details, see Russia.

Ethnology. The peoples of Siberia are ethnographically and linguistically very diverse. Apart from the Russians, who number about 61 per cent of the total population, several thousand Poles and about 5000 Germans, besides the Semites and the Aryan gypsies, about 8000 and 5000 respectively, the Siberians are mainly Ural-Altaic in race. The tribes of West Siberia are akin to the Samoyeds (q.v.), who themselves number about 11,000 through the western Finns, while the eastern Siberians belong to the Tungusic group (see Tungus), and there is a large population of the so-called Pale-Asiatic stock. The western tribes comprised under the name of Yeniseians include 6000 Woguls, the Ostiaks, of whom there are about 3500, and the Soiots, numbering some 2000. The Tungusic population amounts to 69,600. The Turko-Tatar division of the Ural-Altaic family in Siberia comprises 230,300 Yakute and 100,000 Tatars proper, while the Mongolic division includes 59,000 Buryats, 30,500 Chinese and Manchus, and 2000 Koreans. The Pale-Asiatic division is represented by 8000 Tchulstchi, 7000 Koriaks and Yukaghirs, 6000 Gilyaks, 4000 Kamchadales, and 1500 Aino. See Ural-Altaic.

History. The history of Siberia, an episode in that of the Russian Empire, is a history of national expansion—of adventure, exploration, settlement, and development—a process still going on in all its phases. The Russian chronicles mention a Russian expedition to the "land of Siberia" under date of 1483. In the sixteenth century a Tatar khanate was formed in Siberia with the capital, Sibir, on the river Irtysh. These khans carried on negotiations with Ivan the Terrible for the recognition of a Russian protectorate over their khanate, but without results. The conquest of Siberia was the work of the enterprising family of Strogonov, who carried on an active trade in eastern Russia near the Urals and who, favored by liberal concessions from the crown, founded towns and developed the country. In 1579, with the Czar's permission, they sent into West Siberia an expedition of about 800 men, under the command of an outlaw, Vassili, commonly known as Yermak (millstone), a Russian who had joined the Don Cossacks. Yermak defeated the Tatars, captured Isker or Sibir, the capital of Kutchum Khan, and won pardon and honor by giving a new empire to Russia. In the spring of 1582 he sent to Moscow the report of his triumph. Yermak was killed in 1584 but Russia held the country he had won. Tobolsk was built on the site of Sibir in 1587, and many forts, or *ostrogs*, were located at strategic points. The Siberian tribes offered little organized resistance to Russian absorption. Southward there was trouble from the warlike tribes of Central Asia, and this determined the direction of Russian expansion eastward along the line of least resistance. In 1636 the explorers and fur traders had reached the mouth of the Yenisei, in 1637 they had moved forward to the Lena, two years later they were on the shores of the Sea of Okhotsk, and before the close of the century the peninsula of Kamchatka had been brought under Russian authority. In this region there was no organized government; its conquest was the peaceful work of the pioneer, interrupted by attacks from hostile natives. Siberia extended then southward to the Irtysh, the boundary of Mongolia, and to the Amur.

When the Russians under Khabarov reached the Amur in 1651, they came into contact with the Manchu power, which had just conquered China, and the struggle began for the control of the Amur and for Manchuria. The advance on the Amur was due to the energy, foresight, and administrative ability of Khabarov, who successfully withstood the Manchus. In 1689, when Russian interests were in less competent hands, the Treaty of Nertchinsk was made between Russia and China, the first treaty made by the latter Empire with a Western power. By this treaty Russia yielded the middle and lower portions of the river, and the struggle for the Amur was not resumed until the middle of the nineteenth century. During this period the attention of Russia was turned more to the west, whither it had been directed by Peter the Great. In 1847 General Muraviev (q.v.) was appointed Governor-General of eastern Siberia. He obtained authority for establishing a post of the Russian-American Company at the mouth of the Amur, for the formation of an effective military force from the Cossack settlers, and finally in 1853 for the occupation of De Castries Bay on the Gulf of Tartary and of the island of Sakhalin. Still the hostile attitude of the Asiatic Department in St. Petersburg embarrassed Muraviev until the outbreak of the Crimean War gave him his great opportunity. With a view to the adequate defense of Russian interests on the Pacific, he was empowered to conduct negotiations with the Chinese government directly, without reference to St. Petersburg, and to open communication by the Amur between Nertchinsk and the coast and thence with the fortified port of Petropavlovsk in Kamchatka. In May, 1854, he led an expedition down the Shilka and thence down the Amur, which had been so long closed to Russia. On August 29 an English and French squadron of eight vessels with 236 guns arrived off Petropavlovsk and began an attack on September 1. This attack was devoid of results. It was renewed on the 24th, when the allies, after silencing some of the batteries, were repulsed in their land assault with loss of about one-third of their 700 men. Knowing that another attack would be made by the allies in greater force, Muraviev ordered the abandonment of Petropavlovsk early in 1855 and concentrated his strength about the mouth of the Amur. Empowered as a plenipotentiary to arrange a treaty with China, he concluded in May, 1858, the Convention of Aigun, which made the Amur the boundary between the two countries, the left bank to belong to Russia, the right as far as the Ussuri to China and from the latter river to Korea.

In 1860, by the Treaty of Pekin, Russia secured the country between the Ussuri and the sea, and in the same year Vladivostok was founded. In 1872 this was made the chief naval station of Russia on the Pacific, in place of Nikolayevsk at the mouth of the Amur. Early travel in Siberia was by the rivers. Russian progress across the continent was followed by the great Siberian post road, connecting the chain of towns which formed the administrative centres of the provinces. The work of Muraviev, the colonization of the rich country beyond the Ussuri, and the acquisition of an available Pacific seaboard brought out the idea of a great transcontinental railway. In 1878 the government took this up and by 1884 had built a road from Perm to Tiumen. Other local projects followed, and in 1891 the construction of a Trans-Siberian railway was authorized and begun. Russia obtained a foothold in the Liaotung Peninsula through intervention after the war between China and Japan in 1895, and there established the strong naval station of Port Arthur and the free port of Dalny. This was connected by the Manchurian Railway, built under treaty between Russia and China, with the Siberian Railway in Trans-Baikalia and with Vladivostok. The history of Siberia during the first five years of the twentieth century is largely connected with the Russian advance in Manchuria and the ensuing Russo-Japanese War (q.v.). The loss of Port Arthur as a result of the war made Vladivostok once more the chief Siberian port.

Until 1900 convicts were exiled to Siberia in great numbers and many barbarities and abuses arose from the system, which was largely mitigated by a ukase of the Czar which substituted imprisonment for exile except in the case of political offenders, for whom transportation was retained, though not necessarily to Siberia. Large numbers of political prisoners were transported during the troubled years 1905–06. During the Great War which began in 1914 the exile system was abolished. See WAR IN EUROPE; YAKUTS.

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SIBERIAN CEDAR. See CEDAR.

SIBERIAN OVAL. See AGONIC LINES.

SIBERIAN PLAGUE. See ANTHRAX.

SIB'LEY, HENRY HASTINGS (1811–91). An American pioneer, born in Detroit, Mich. He was an infant when Detroit was captured by the British and his family fled to Ohio. About 1828 he lived awhile at Mackinac and Fort Snelling as a fur trader for the American Fur Company. From 1849 to 1853 he was delegate to Congress from the Territory of Minnesota, the organization of which was largely due to his efforts. In 1857 he was a member of the Constitutional Convention and the next year became first Governor of the State. In 1862 he commanded the troops gathered for the defense of the frontier against the Indians and at Wood Lake won a victory. For this President Lincoln commissioned him a brigadier general of volunteers. The next year he defeated the Sioux in three battles. In 1865 he was brevetted major general, and in 1866 he was appointed one of the commission to negotiate treaties with hostile tribes. Consult Williams, "Henry Hastings Sibley: A Memoir," in the *Collections of the Minnesota Historical Society*, vol. vi (St. Paul, 1894).

SIBLEY, HENRY HOPKINS (1816–86). An American soldier, born in Nachitoches, La. He graduated in 1838 at the United States Military Academy and took part in the Seminole War. He fought through the Mexican War and served in the Utah and Navaho expeditions. He was promoted to be major, but resigned in order to enter the Confederate army, in which he received a commission as brigadier general. Appointed to command the Department of Mexico, he raised a brigade and in 1862 defeated the forces under Colonel Canby at Valverde, N. Mex. In 1869–74 he was in the service of the Khedive of Egypt and constructed river and coast defenses. He invented a tent, known by his name.

SIBLEY, Hiram (1807–88). An American financier. He was born at North Adams, Mass., and was a millwright and machinist for a time at Lima, N. Y. When telegraphy came into practical use he, in association with Ezra Cornell (q.v.), consolidated 20 smaller telegraph corporations into the Western Union Telegraph Company, of which he was president for 17 years. In 1861 he was the moving spirit in the construction of a transcontinental telegraph line for the promotion of which Congress granted for 10 years an annual subsidy of $40,000. He next projected a telegraph route to Europe by way of Bering Strait and Siberia, but, though wires were strung in Siberia and Alaska, he abandoned the enterprise on the completion of the Atlantic cable. After 1869 he devoted his attention to railroad building and land investments while resident in Rochester, N. Y. He gave $100,000 to the University of Rochester for a library building and at Cornell University founded the Sibley College of Mechanical Engineering.

SIBONGÁ, sē-bông′ȧ. A town of Cebú, Philippines, situated on the east coast, 26 miles southwest of Cebú. Pop., 1903, 25,848.

SIB′THORP, John (1758–96). An English botanist, born in Oxford, where he graduated at Lincoln College. He studied also at Edinburgh, at Montpellier, at Göttingen, and at Vienna. Although he succeeded his father as Sherardian professor of botany at Oxford in 1783, he spent most of his time in botanical exploration on the Continent, especially in Greece. His great work, *Flora Oxoniensis* (1794), shows him to have been an able botanist. *Flora Græca* was published in 10 volumes (1806–40).

SIB′YL (Lat. *sibylla*, from Gk. σίβυλλα, sibyl). The name in Greek and Roman legend of women inspired by Apollo with prophetic power. The early Greek authorities mention but one, probably the Erythræan Herophile. Later poets or local legends increased the number, and finally we hear of 10, the Erythræan, the Samian, the Trojan or Hellespontine, the Phrygian, the Cimmerian, the Delphian, the Cumæan, the Libyan, the Babylonian, and the Tiburtine. Certain verses of vague import were attributed to them. In Roman religious history these oracles played an important part. According to one story (see, e.g., Aulus Gellius, *Noctes Atticæ*, i, 19) an aged woman (the Cumæan sibyl, commonly identified with the Erythræan) appeared before King Tarquin the Proud and offered him nine books at a high price. When he refused her demand she destroyed three books and then offered the remaining six at the original price; again refused, she destroyed three more. The King, deeply moved, bought the remaining three at the price demanded for the nine. These were placed in the cella of the temple of Jupiter on the Capitol and there remained until they perished in the burning of the temple (83 B.C.). A special commission made a new collection, which consisted of about 1000 verses. Later Augustus caused the collection to be carefully sifted, as much spurious material was thought to be present, and had the whole deposited in the temple of Apollo on the Palatine. Shortly after 400 A.D. the Sibylline Verses were burned by Stilicho. For the care and consultation of the books were appointed at first the *Duoviri sacris faciundis*, whose number was raised in 367 B.C. to 10, five patricians and five plebeians, and by Sulla to 15. The consultation could occur only by vote of the senate, and the result was reported to that body. The consultation seems to have been ordered when prodigies showed special need of conciliating the gods. For Christian Sibyllists, see Sibylline Oracles.

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SIBYL, Grotto of the. 1. A cavern near Lake Avernus, a hewn passage, 110 yards long, ventilated from above by a shaft. 2. A cavern at Cumæ supposed to be the grotto described by Vergil in the *Æneid*. It has many openings and subterranean passages, most of which are blocked up. 3. A cavern at Marsala, the ancient Lilybæum, in Sicily. It contains a spring by means of whose waters the sibyl was supposed to give forth her oracles.

SIBYLLINE (sĭb′ĭ-lĭn *or* -lĭn) **ORACLES.** A collection of oracles, written in Greek hexameters, claiming to be the work of an inspired prophetess, who represents herself as having come from Babylon to Hellas or as a relative of Egyptian Isis (v, 52), but denies that she is identical with the Erythræan sibyl or with the daughter of Circe, i.e., the Cumæan sibyl. There is indeed a noticeable difference between these oracles and the fragment of 70 verses from the Roman Sibylline Books preserved by Phlegon, a contemporary of Hadrian (*De Rebus Mirabilibus*, x). But a number of quotations from the Erythræan sibyl by pagan writers which are also found in this collection, such as the lines concerning the alluvial deposits of Pyramus cited by Strabo and also in *Or. Sib.*, iv, 95 ff., show how naturally the suspicion arose. Hermas, Theophilus of Antioch, Clement of Alexandria, Tertullian, Origen, Lactantius, and Augustine are familiar with Sibylline Books containing prophecies of special value for Christians. In the Middle Ages they enjoyed a high authority; the testimony of David was in more than one way supplemented by that of the sibyl. Eight books were published by Xystus Betuleius (Basel, 1545), with a Latin translation by Sebastian Castalio (ib., 1555), by Johannes Opsopœus (Paris, 1599), by Servatius Gallæus (Amsterdam, 1689), and by Andreas Gallandus (in *Bibliotheca Veterum Patrum*, Venice, 1765). Book xiv was published from an Ambrosian codex by Angelus Mai (Milan, 1817), and books xi–xiv from two Vatican manuscripts by him in 1828. In two manuscripts viii, 1–9 appears as book xv, whence it has been inferred that the original collection had 15 books. Books ix and x have not been found. The editions of C. Alexandre (Paris, 1841–56), J. H. Friedlieb (Leipzig, 1852), Aloysius Rzach (Vienna, 1891), and Johannes Geffcken (Leipzig, 1902) contain all the material now known. As early as 1592 Faustus Socinus questioned the existence of the sibyls, the integrity of the text, and the high age of the oracles. Opsopœus regarded a number of passages as of Christian origin. Isaac Casaubon (1614), David Blondel (1649), Anton van Dale (1683), Richard Simon (1685), B. de Fontenelle (1687), J. A. Fabricius (1705), and J. Clericus (1707) assigned the oracles to Christian authors. Hugo Grotius (1644) suggested Jewish authorship for the original oracles, and Isaac Vossius (1679) claimed Jewish authorship and recognition in the synagogue for all of them. Tobias Wagner (1664) and others threw out the suggestion that real pagan oracles were interspersed in the present collection. This was taken up again by Bleek in 1819–20. Thus the main positions of scholarship in the last century were already indicated by the researches of the seventeenth century. It is becoming widely recognized that pagan oracles of the Hellenistic period, ascribed to the Babylonian, Persian, Egyptian, Libyan, Phrygian, Erythræan, and other sibyls, were incorporated in the Judæan, that the Jewish Sibylline Oracles have suffered from Christian interpolations, and that some books are distinctly Christian. Book iii is undoubtedly the oldest. It is supposed to contain large excerpts from the Babylonian and the Erythræan sibyls, sections written by a Jewish author in the middle of the second century B.C., others from the first century B.C., and some Christian interpolations a century later. To this book belongs also a section found in Theophilus' Epistle to Autolycus. Book iv is also held to be Jewish, coming from the year 80 A.D., and likewise Book v, partly written about the same time, partly c.120 A.D. Book vi is clearly Christian, and book vii apparently is Gnostic. Book viii is divided into two distinct parts: 1–216 may well have been originally Jewish; 217 ff. are manifestly Christian, containing the famous acrostic. Books i and ii, once a unit, contain a long abstract from the Jewish work ascribed to Phocylides, and also other parts that seem to be of Jewish origin, but have been recast by a Christian of the third century. As to books xi–xiv there is as yet no consensus of opinion. They are of great interest because they reflect the manner in which the Roman emperors were looked upon by the common people of the provinces, and perhaps all the more so because the allusions do not correspond with the judgments upon these men we should expect from Jews and Christians respectively. The late date makes a Jewish origin and a transfer to Christian hands difficult and yet not impossible.

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SICA′NI. See Sicily, *History*.

SICARD, sĭk′ärd, Montgomery (1836–1900). An American naval officer. He was born in New York City, graduated in 1855 at the United States Naval Academy, and served through the Civil War. He participated in the bombardment and passage of Forts Jackson and St. Philip, and the Chalmette batteries, and in the passage of the batteries at Vicksburg. When later in the South Atlantic blockading squadron he took part in the attacks on Fort Fisher (1864–65) and in the bombardment of Fort Anderson (1865). In 1865–69 he was stationed at the Naval Academy, in 1869–71 was in the Pacific fleet, in 1870 was promoted to be commander, and in 1870–78 was on ordnance duty. During the early years of rebuilding the navy (1881–90) he was chief of the Bureau of Naval Ordnance and rendered great service. He was promoted to be captain in 1881 and rear admiral in 1897. For a time he was commandant of the New York Navy Yard and later (1896–98) in command of the North Atlantic squadron, but later was relieved on account of ill health and appointed president of the strategy board. He was retired in 1898.

SICCARD VON SICCARDSBURG, zē′kärt fōn zē′kärts-bu̇rk, August von (1813–68). An Austrian architect, born in Vienna. He became intimately associated with Eduard van der Nüll (q.v.) and through their coöperation the entire tone of modern Viennese architecture was elevated. The magnificent New Opera House (1860–66) was the principal product of their joint activity.

SICELI. See Sicily, *History*.

SICHEL, sĭk′el, Edith Helen (1862–1914). An English author, sister of Walter Sichel. She was born in London and was educated at home by private teachers. An apprenticeship as a writer for magazines of the better sort led to the more ambitious undertakings: *The Two Salons* (1895); *The Household of the Lafayettes* (1897); *Women and Men of the French Renaissance* (1901); *Catherine de Medici* (1905); *Life and Letters of Alfred Ainger* (1906); *The Later Years of Catherine de Medici* (1908); *Michel de Montaigne* (1911); *The Renaissance* (1914).

SICHEL, Walter (1855–). An English biographer and lawyer, of German descent, born in London and educated at Harrow and at Balliol College, Oxford. He studied law and was called to the bar in 1879. His writings, in addition to two law books and contributions to the reviews, include: *The Squires* [by Aston Ryot (Σ)], *an Aristophanic Burlesque* (1885); *Bolingbroke* (1902); *Disraeli: A Study in Personality and Ideas* (1904); *The Life of Lord Beaconsfield* (1904); *Emma, Lady Hamilton* (new ed., 1905); *The Life of Richard Brinsley Sheridan* (2 vols., 1909); *Sterne: A Study* (1910). In 1910 the *Glenbervie Journals* were edited by Sichel, with an introduction. For his sister, see Sichel, Edith.

SICILIANA, sē′chē-lyä′nȧ (It., Sicilian). In music, a name given to a slow dance, in six-eight or twelve-eight time, peculiar to the peasants of Sicily. It is danced by one couple at a time, the man and the woman alternately choosing new partners, withdrawing in turn. An excellent example of a Siciliana is in Mozart's *Nozze de Figaro.*

SICIL'IAN VESPERS. The name given to the massacre of the French in Sicily, which began at Palermo on the day after Easter (March 30), 1282, while the bells were ringing for the vesper service. Charles of Anjou (q.v.) had deprived the Hohenstaufen dynasty of Naples and Sicily and had parceled out these kingdoms into domains for his French followers, but his cruelty towards the adherents of the dispossessed, his oppressive taxation, and the brutality of his followers excited among the Sicilians fierce resentment. Authorities differ as to whether the uprising was spontaneous. It would seem that the intrigues of Pedro III of Aragon had something to do with bringing it about, but the story goes that on the evening of Easter Monday the inhabitants of Palermo, enraged at outrages, put to the sword their oppressors, sparing none, not even those Italians and Sicilians who had married Frenchmen. This example was followed later at Messina and other towns, and the massacre soon became general. Charles of Anjou made a determined attempt to reconquer the island, but the Sicilians summoned to their aid Pedro III of Aragon, who had himself crowned King of Sicily and destroyed the fleet dispatched by Charles for the reduction of Messina. The Angevins thus lost control of Sicily. Consult: Michele Amari, *Racconto populare del Vespro Siciliano* (Rome, 1882); id., *La guerra del Vespro Siciliano* (9th ed., Milan, 1886; Eng. trans., 3 vols., London, 1850); H. D. Sedgwick, *Italy in the Nineteenth Century,* vol. ii (Boston, 1912).

SICILIES, KINGDOM OF THE TWO. See TWO SICILIES, KINGDOM OF THE.

SICILY, sĭs'ĭ-lĭ (It., Lat. *Sicilia,* Gk. Σικελία, *Sikelia,* from Lat. *Siculus,* Gk. Σικελός, *Sikelos,* Sicilian). The largest island in the Mediterranean Sea, forming part of the Kingdom of Italy. It is southwest of the Italian Peninsula, from which it is separated by the narrow Strait of Messina (Map: Italy, D, E 6). It is triangular, and has an area of 9935 square miles.

Physical Features. The island, like the mainland of Italy, is traversed throughout its entire length by a chain of mountains which may be looked upon as a continuation of the Apennines, and like them the steepest slope faces the Tyrrhenian depression to the north (q.v.). The eastern part of the chain, running westerly from Capo del Faro, is called the Peloric Range, which in Monte Tre Fontane attains the height of 4508 feet. The western and much the longer part is called the Madonian Range, which, in the Pizzo dell' Antenna, rises to an elevation of 6478 feet. In the west the chain breaks up into irregular and often detached masses, and numerous minor spurs extend to the south. About the centre of the chain a range branches off through the heart of the island to the southeast, at first wild and rugged, but afterward smoothing down into table-lands, which slope gradually to the sea. Mount Etna (q.v.), situated near the east shore, is the highest point of the island, rising to an elevation of about 10,750 feet. The north and east shores offer the best harbors. The rivers are mostly short and rapid, and some of them are dry in summer. The principal are the Alcantara, Simeto, Salso, Platani, and Belice. There are few lakes on the island, but many mineral springs. The sulphur springs were famous in ancient times.

Climate. The climate is typically Mediterranean in character. The temperature is moderate and very seldom falls below the freezing point. The island, however, is visited by the sirocco, with its intolerable dry heat. Much of the lower sections are subject to malaria, but the climate is on the whole salubrious. The summers are almost rainless, the aridity aggravated by the fact that the interior is almost deforested, so that there is nothing to retain the moisture of winter and spring rains. The steep northern side of the mountains is composed of Triassic formations. The western and southern parts of the island are overlaid with later stratified rocks, and the southern plateau is mainly Tertiary. Basaltic and other volcanic intrusions occur over large areas, especially in the southeast range, and the immense sulphur deposits as well as the active crater of Mount Etna are further evidences of volcanic nature.

Industries. Sicily is the principal source of the world's supply of sulphur, the output greatly increasing since the formation of the Anglo-Italian syndicate in 1896. Other minerals are rock salt and asphalt. Agriculture is still the main industry, although the island is no longer the granary of Italy, as its present output of cereals is barely sufficient for domestic demands. The growing of cereals is confined almost exclusively to the larger estates, which are found mostly in the interior and along the southern coast. In smaller holdings the land is devoted principally to the cultivation of grapes, almonds, olives, oranges, lemons, beans, sumac, etc. Agricultural methods are primitive. The fisheries (tunny, sardine, coral, and sponge) are extensive, deep-sea fisheries alone giving employment to over 20,000 persons. The making of wine and olive oil, the canning of fruits and vegetables, and the preparation of citric acid are extensively carried on. There are also produced some glassware, metal ware, matches, etc., in the larger cities. Sicily exports sulphur, fruits, and vegetables, sumac, salt, wine, oil, and fish, and imports mainly grain, coal, and iron. Almost the entire trade is sea-borne. At the three principal ports—Palermo, Catania, and Messina—there were entered and cleared, in 1912, 20,989 vessels, of 16,352,860 tons net. The length of railway in operation at the end of 1913 was 971 miles.

Administration, etc. Sicily forms, together with the Lipari and Ægadian groups and a few other islands, a compartimento of the Kingdom of Italy and is divided into the seven provinces of Messina, Catania, Syracuse, Caltanissetta, Palermo, Girgenti, and Trapani. The elementary schools are inadequate. Secondary education is better provided for, and there are universities at Palermo, Messina, and Catania. Pop., 1901, 3,529,799; 1911, 3,672,258. Palermo is the capital. Communal population of the larger cities in 1911: Palermo, 341,088; Catania, 210,703; Messina, 126,557; Marsala, 65,451; Trapani, 59,593; Modica, 55,924. Emigration is very large; emigrants numbered 96,713 in 1910 and 50,789 in 1911. The condition of large numbers of the laboring class, especially those engaged in the sulphur industry, is deplorable. The secret organization known as the Mafia (q.v.) frequently interferes with the execution of the law.

History. Sicily was inhabited at the dawn of history by a people called Siculi or Sicani, who, according to tradition, crossed over into the island from the southern extremity of Italy.

They were members of the great Latino-Italian family. The recorded history of Sicily begins with the establishment of Greek and Phœnician colonies. The earliest Greek colony, Naxos, was founded 735 B.C.; the latest, Agrigentum, about 580 B.C. Between these dates numerous important colonies were established, including Syracuse, Leontini, Catana, Megara, Hyblæa, Gela, Zancle (the later Messana), Acræ, Himera, Mylæ, Casmenæ, Selinus, and Camarina. These cities attained great commercial prosperity. Their governments were at first oligarchies, but afterward democracies or tyrannies; but it is not till the period of the despots that we have detailed accounts. Agrigentum and Gela early acquired prominence; the former, under the rule of Phalaris (q.v.), became for a short time probably the most powerful state in Sicily, and the latter, under a succession of able tyrants, Cleander, Hippocrates, and Gelon (q.v.), forced into subjection most of the other Greek cities. Gelon, however, transferred his government to Syracuse (one of his conquests), which now became the principal Greek city of Sicily—a dignity it retained throughout ancient times. Meanwhile the Carthaginians had obtained possession of the Phœnician settlements in Sicily. (See Carthage.) The Carthaginians first appeared in the island in 536 B.C., but the steady growth of the Greek cities in wealth and power long confined them to the northwestern part, where their principal colonies were Panormus, Motya, and Solois. In the great battle of Himera in 480 B.C. the Carthaginian army was utterly routed by Gelon, and its leader, Hamilcar, was slain. The Gelonian dynasty at Syracuse fell in 466 B.C. For 50 years Sicily had peace. In 410 B.C., however, war between Carthaginians and Greeks for the possession of the island was renewed. The successes of the former were great. Selinus, Himera, Agrigentum, Gela, and Camarina fell into their hands in less than five years, and it was not till Syracuse had a new tyrant, the famous Dionysius the Elder (q.v.), that fortune began to change. Even he, however, could not wrest from the Carthaginians what they had already won, and after the war of 383 B.C. a peace was concluded which left Dionysius in possession of the eastern and the Carthaginians of the western half of the island. Timoleon won a splendid victory over the Carthaginian generals, Hasdrubal and Hamilcar, at the river Crimisus about 340 B.C. Once more Greek influence was in the ascendant, but the rule of the bold and ambitious tyrant Agathocles (317–289 B.C.) proved in the main disastrous to Greek supremacy. After his death Syracuse lost her hold over many of the Greek cities, which established a weak and perilous independence, that only rendered the preponderance of the Carthaginians more certain. Finally Pyrrhus (q.v.), King of Epirus, invited by Sicily to help his countrymen, landed in the island in 278 B.C. The brilliant adventurer for a time swept everything before him. Panormus, Ercte, and Eryx were captured, and, though he failed to make himself master of Lilybæum, he might have forced the Carthaginians to surrender it had he not been thwarted in his designs by discords and jealousies of the people. As it was, Pyrrhus left Sicily in about two years, and in all likelihood the island would have become a Carthaginian possession had not a new power, Rome, appeared to engage the Carthaginians. In 241 B.C., at the close of the First Punic War, Carthaginian Sicily was given up to the Romans, and in 210 B.C., in the course of the Second Punic War, the whole island became a Roman province—the first province Rome ever held. In 135–132 B.C. and again in 103–100 B.C. it was the scene of formidable slave insurrections. Its fertility and the wealth of its citizens and landholders were powerful temptations to greedy and unscrupulous governors.

In 440 A.D. Sicily was conquered by the Vandals under Genseric, who were dispossessed half a century later by the Ostrogoths, in whose hands it remained till 535 A.D., when Belisarius conquered it and annexed it to the Byzantine Empire. In 827–878 the Saracens made themselves masters of the island, which flourished under their rule. In 1038 the Eastern Empire began the reconquest of the island and had partial success. In 1060 the Normans, under Robert Guiscard and his brother Roger, engaged in the conquest of Sicily, which was completed in 1090, a few years after the death of Robert. In 1127 Roger II (q.v.), Count of Sicily, was recognized as Duke of Apulia and Calabria, and in 1130 he assumed the title of King of Sicily.

In 1194 the Norman rule was succeeded by that of the house of Hohenstaufen (q.v.), whose dynasty was overthrown by Charles of Anjou in 1266. In 1282, after the Sicilian Vespers (q.v.), Sicily became independent and chose for its King Pedro III of Aragon, who was connected by marriage with the house of Hohenstaufen. In 1296 it was separated from Aragon and for more than a century was ruled by a branch of the Aragonese dynasty, when it was reunited with that kingdom. Ferdinand the Catholic made himself master of the Kingdom of Naples in 1503, and the Spanish crown retained both countries until the War of the Spanish Succession. By the Treaty of Utrecht (1713) Sicily was separated from Naples and handed over to Victor Amadeus, Duke of Savoy, who ceded it to Austria seven years later, receiving in exchange the island of Sardinia. In 1734–35 Don Carlos established the Spanish Bourbon dynasty in Naples and Sicily (the Two Sicilies), and down to 1860 Sicily was ruled by Bourbon kings. (See Two Sicilies, Kingdom of the.) In 1860 Garibaldi's invasion (see Garibaldi; Italy) resulted in the annexation of Sicily to the dominions of Victor Emmanuel, which in 1861 became the Kingdom of Italy.

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SICKEL, zĭk'*e*l, Theodor, Knight von (1826–1908). A German historian, born at Aken and educated at Halle, Berlin, and Paris. He made researches in the archives of Milan and Vienna for the French government, and became professor of history in Vienna in 1857. He was also director of the Institute for Austrian History at Vienna, counselor in 1876, director of the Austrian Institute at Rome, and a member of the staff of the *Monumenta Germaniæ Historica*. Among his works are: *Monumenta Graphica Medii Aevi ex Archivis et Bibliothecis Imperii Austriachi Coelesta* (1859–69); *Beiträge zur Diplomatik* (1861–82); *Zur Geschichte des Konzils von Trient* (1872); *Kaiserurkunden in Abbildungen* (1881); *Das Privilegium Ottos I. für die römische Kirche* (1883); *Römische Berichte* (1895–1901).

SICK HEADACHE, See Migraine.

SICKINGEN, zĭk'ĭng-*e*n, Franz von (1481–1523). A celebrated German knight, born near Kreuznach. Very early in life he began his military career and speedily became recognized as a champion of the oppressed. He participated in the War of the Swabian League against Ulrich of Württemberg, and when Stuttgart was taken in 1519 he protected the great scholar Reuchlin. Through the influence of Ulrich von Hutten, whose protector he was, Sickingen became an ardent adherent of Luther and sought to found a league of the lesser nobility and the cities to reorganize religious and political affairs in Germany. In 1522 he began war against the Archbishop of Treves, but failed in his attack on the city. He was besieged in his own castle and mortally wounded in May, 1523, dying five days later. Sickingen has become a favorite figure in German legend and literature and is one of the chief characters in Goethe's *Götz von Berlichingen* and in Hauff's *Lichtenstein*. Consult Ulmann, *Franz von Sickingen* (Leipzig, 1872).

SICKLES, sĭk''lz, Daniel Edgar (1825–1914). An American soldier and politician, born in New York City. He was educated at the New York University, studied law, and was admitted to practice in 1846. In the following years he sat as a Tammany Democrat in the State Assembly. In 1853 he was appointed corporation counsel of New York City and was Secretary of Legation at London (1853–55), when he returned to the United States and was elected to the New York State Senate (1856–57) and became a Democratic member of Congress (1857–61). During this period he shot and killed Philip Barton Key, United States District Attorney for the District of Columbia, for adultery with his wife, but was acquitted after a short sensational trial. At the outbreak of the Civil War he raised the Excelsior (New York) Brigade, becoming colonel of the Seventieth New York Volunteers. He served as brigadier general of volunteers (1861) and major general (1862). He commanded a brigade in McClellan's Peninsular campaign and at Antietam, had a division at Fredericksburg, and was in command of the Third Army Corps later. On the second day at Gettysburg (q.v.) his corps sustained the brunt of the Confederate attack, on the Federal left, and Sickles himself lost a leg. He continued in the service, was commander of the Department of the Carolinas in 1866–67, brevetted brigadier general and major general in the regular army for services at Fredericksburg and Gettysburg, and for a time was colonel of the Forty-second Infantry. On April 14, 1869, he was retired with the full rank of major general. He was Minister to Spain from 1869 until 1873 and presented the demands of the United States for reparation for the execution of the captain and crew of the *Virginius*. (See Virginius Massacre.) Sickles was again elected to Congress as a Democrat in 1892 and for several years was President of the New York State Board of Civil Service Commissioners. His last years were clouded by financial difficulties and sickness.

SICOTTE, sê-kôt', Louis Victor (1812–89). A Canadian statesman, born at St. Famille, Province of Quebec. Called to the bar in 1838, he removed to St. Hyacinthe, was soon recognized as one of the leaders of the bar of Lower Canada, and in 1852 was elected Liberal member, for St. Hyacinthe County, of the Canada Legislative Assembly, of which he was Speaker (1854–57). In the Macdonald-Cartier ministry (1857–58) he was Commissioner of Crown Lands. This was a time of political reconstruction, when advanced Liberals were separating themselves from the moderate members of the party. Mr. (afterward Sir) John A. Macdonald, the virtual head of the ministry, was at the same time building up a new Conservative party by eliminating reactionary Tories and attracting moderate Liberals. Sicotte, who belonged to the latter group, refused to coöperate with George Brown in forming a ministry and joined the Cartier-Macdonald cabinet, known as the Short administration, as Minister of Public Works (1858). Resigning from office the same year, he succeeded A. A. Dorion as leader of the Lower Canada Liberal Opposition and formed an alliance with John Sandfield Macdonald (q.v.), the leader of the moderate Liberals of Upper Canada. In conjunction with Macdonald he formed the Macdonald-Sicotte administration (1862–63), in which Sicotte was Attorney-General for Lower Canada. Before long, dissensions arose from the attempt to strengthen the ministry by the admission of advanced Liberals from Lower Canada. Refusing to consent to this, Sicotte, with his Lower Canadian colleagues, withdrew. From 1863 to his retirement in 1887 he was a judge of the Superior Court of Lower Canada. Consult J. C. Dent, *The Last Forty Years* (Toronto, 1881).

SICYON, sĭs'ĭ-ŏn (Lat., from Gk. *Σικυών*, *Sikyōn*, *Σεκυών*, *Sekyōn*). The principal city of a small but fertile state of ancient Greece, Sicyonia, in northern Peloponnesus. The Corinthian Gulf lay to the north, Achaia to the west, Phlius to the south, and Corinth to the east. Between the rivers Asopus and Helisson, on a triangular plateau, was situated, in later days, Sicyon, about 2 miles south of the Corinthian Gulf and 10 northwest of Corinth. The city was situated at first at the foot of the plateau, but it was removed to the plateau by Demetrius Poliorcetes in 303 B.C. Even in the legends a connection appears between Sicyon and Argos, particularly in the story of Adrastus (q.v.). The Dorian invaders occupied Sicyon, but in peaceable fashion, according to tradition, and the original population formed a fourth tribe along with the three Dorian tribes. The rule of the Dorian nobles was overthrown by Andreas, or Orthagoras, a member of a non-Dorian family, who about 665 B.C. made himself tyrant—a position held by his house for about 100 years. Under Clisthenes, early in the sixth century, Sicyon reached a high degree of prosperity and warlike fame. Later, Sicyon regularly appears as a dependency of Sparta, until the rise of Thebes. After its rebuilding by Demetrius it again fell under the rule of tyrants, but was finally freed and brought into the Achæan League (see ACHÆA) by Aratus (q.v.) (251 B.C.). After the destruction of Corinth by the Romans the Sicyonians for a time had charge of the Isthmian games. In later times Sicyon seems to have been an insignificant place. On its site is the modern village Vasilikó. There are still considerable remains of the Roman period and also a Greek theatre, which was excavated by the American School at Athens. The ancient city was famous from early times for its bronze casting and especially for its painting. For the American excavations, consult: *American Journal of Archæology*, vols. v, viii, xx (New York, 1889, 1893, 1905). Consult also: Leake, *Travels in the Morea*, vol. ii (London, 1830); E. Curtius, *Peloponnesus*, vol. ii (Gotha, 1851); and the article "Sikyon," in Friedrich Lübker, *Reallexikon des klassischen Altertums*, vol. ii (8th ed., Leipzig, 1914).

SICYON, CLISTHENES OF. See CLISTHENES OF SICYON.

SICYON, DÆDALUS OF. See DÆDALUS OF SICYON.

SI′DA (Neo-Lat., from Gk. *σίδη*, *sidē*, pomegranate, water lily). A large, widely distributed genus of annual and perennial herbs and shrubs of the family Malvaceæ, mostly natives of warm climates and generally rich in mucilage. Some of the species have strong pliable fibres, which are employed for cordage and for textile purposes. One of the most valuable of these is *Sida rhombifolia*, a perennial tropical shrub also found in Australia and the United States. It is also said to be cultivated as a forage plant. *Sida tiliæfolia*—better known as *Abutilon theophrasti*—is an annual long cultivated in China for its fiber, which is used like that of hemp. In parts of the United States it is a common weed known as velvetleaf.

SIDD EL BAHR KALESI, bä′h′r kȧ-lā′sē. A fortress in European Turkey on the Gallipoli Peninsula at the Ægean end of the Dardanelles. This fortress came into great prominence in the Great War which broke out in 1914. It was unsuccessfully attacked by land and sea by a British and French expeditionary force (1914–15). The allies after a disastrous campaign were compelled to retire from the peninsula (January, 1916). See WAR IN EUROPE.

SIDDHARTHA, sid-härt′hȧ. See GAUTAMA BUDDHA.

SID′DONS, MRS. SARAH (1755–1831). A celebrated English actress. She was the daughter of Roger Kemble (q.v.) and was born at Brecon in Wales. As a child she had the family aptness for acting and in youth played as a member of her father's company in small provincial towns. She married William Siddons, an actor, in 1773. She soon attracted such attention that Garrick heard her praises in London and offered her an engagement at the Drury Lane Theatre, where, Dec. 29, 1775, she made her first appearance, acting Portia. Her beauty and fine person pleased, but as an actress she made no great impression and did not obtain a reëngagement. But Mrs. Siddons returned to London in 1782 to enjoy a career of triumph as indisputably the greatest actress of her time, having spent the intervening years in provincial cities. As Isabella in *The Fatal Marriage*, she reappeared at Drury Lane Oct. 10, 1782. In 1784 her popularity was temporarily obscured by a charge of pecuniary meanness towards certain fellow performers; but with this trivial exception her efforts were a series of successes till on June 29, 1812, in her great character of Lady Macbeth, she took leave of the public. Belvidera, Queen Katharine, Volumnia in *Coriolanus*, which she played with her brother, John Philip Kemble (q.v.), were a few of the many parts in which she captivated audiences. Mrs. Siddons is said to have been strictly a stage genius, but not of high intelligence. In the practice of her art it was power of manner and personality which made her irresistible. As a tragic actress she has probably never been equaled in Great Britain. Her picture as the "Tragic Muse" by Sir Joshua Reynolds is famous.

Bibliography. James Boaden, *Life of Mrs. Siddons* (2 vols., 2d ed., London, 1831); Thomas Campbell, *Life of Mrs. Siddons* (2 vols., ib., 1834); P. Fitzgerald, *Account of the Kemble Family* (2 vols., ib., 1871); H. B. Baker, *Our Old Actors* (ib., 1881); Matthews and Hutton, *Actors and Actresses of Great Britain and the United States* (New York, 1886); John Doran, *Annals of the Stage* (ed. Lowe, London, 1888).

SIDE CAR. An accommodation for a single passenger additional to the driver or operator of a motor cycle (q.v.), located at the side of such operator, a little behind him and on a lower level. The seating is inclosed in a sheet-metal body, often having suggestions of boat or stream lines, and is borne and attached to the frame of the motor cycle proper by a bar frame which is bolted in place. Its side location and its weight necessitate a third wheel, usually smaller than the motor-cycle wheels, and road jars are mitigated by springs. When the side car is removed, the normal motor cycle reappears.

SIDE OATS. See OAT GRASS.

SIDEREAL (sī-dē′rē-*a*l) **CLOCK** (from Lat. *sidereus*, relating to a star, from *sidus*, constellation, star). A clock regulated to indicate sidereal time. (See DAY.) The sidereal clock is a most important aid to the practical astronomer and is one of the indispensable instruments of an observatory. See CLOCK.

SID′ERITE (Lat. *sideritis*, loadstone, from Gk. *σιδηρίτης*, *sidērītēs*, relating to iron, from *σίδηρος*, *sidēros*, iron). A mineral iron carbonate crystallized in the hexagonal system. It has a vitreous lustre and in color is mostly grayish yellow or brown, ranging from pale buff to almost black. It occurs in gneiss, mica, and clay slates and in other rock strata and also frequently with metallic ores. The iron of siderite is often partly replaced by calcium, magnesium, and manganese. It also occurs in crystallized, concretionary, massive, and earthy forms.

The name "siderite" is also applied to a translucent blue variety of vitreous quartz, which is also more commonly called sapphirine. See IRON; METEORITE.

SID′EROX′YLON (Neo-Lat., from Gk. *σίδηρος*, *sidēros*, iron + *ξύλον*, *xylon*, wood). A genus of trees of the family Sapotaceæ, with evergreen leaves and axillary clusters of flowers, natives of and widely distributed in warm climates. They are remarkable for the hardness of their wood, which is sometimes called ironwood and is, at least in some species, so heavy as to sink in water. About 60 species are widely distributed throughout the tropics of both hemispheres, with a few species reaching temperate regions in Australia, New Zealand, etc. A species, *Sideroxylon mastichodendron*, occurs along the east coast of Florida, where it is known as mastic and wild olive.

SIDESADDLE FLOWER. See Sarracenia.

SIDETUS, Philippus. See De Boor Fragment; Philippus Sidetus.

SIDEWALK, Traveling. See Traveling Sidewalk.

SIDE′WIND′ER. The local name in Arizona for the horned rattlesnake (*Crotalus cerastes*), which inhabits open plains and when disturbed moves away sideways. Consult Merriam, *The Death Valley Expedition* (Agricultural Department, Washington, 1893). See Rattlesnake, and Plate of Rattlesnakes.

SIDG′WICK, Arthur (1840–   ). An English classical scholar, brother of Henry Sidgwick. He was born in Yorkshire and was educated at Rugby and at Trinity College, Cambridge. He served as master of Rugby School (1864–79), tutor in Corpus Christi College, Oxford (1879–1902), and university reader in Greek (1894–1906). Of Corpus Christi he was a fellow from 1882 to 1902 and after 1903. His publications include an annotated edition of Vergil's complete works (1890); editions of plays of Æschylus (often reëdited), *Agamemnon, Choephoroi, Eumenides, Persæ, Septem Contra Thebas;* a critical edition of the text of Æschylus, in the *Oxford Classical Texts Series* (1899); textbooks on *Greek Prose Composition* (1876), and on *Greek Verse Composition* (1882); and essays on educational topics such as *On Stimulus* (1908).—His daughter, Ethel Sidgwick, became known as the author of novels of distinction: *Promise* (1910); *Le Gentleman* (1911); *Herself* (1912); *Succession* (1913), a continuation of *Promise; Four Plays for Children* (1913); *A Lady of Leisure* (1914); *Duke Jones* (1915); *The Accolade* (1916).

SIDGWICK, Eleanor Mildred (Mrs. Henry Sidgwick) (1845–   ). An English educator, born in Scotland, the daughter of James Maitland Balfour and Lady Blanche Mary Gascoigne Cecil, and a sister of A. J. Balfour (q.v.). In 1876 she was married to Henry Sidgwick (q.v.). The two were closely associated with the movements for the development of higher education for women and the emancipation of women generally. For the promotion of the former there was established the Association for Promoting the Development of Higher Education for Women (1873), which led to the founding of Newnham College, Cambridge, in 1880. Of this college Mrs. Sidgwick was principal from 1892 to 1910. Her interest in education is further evidenced by her appointment as a member of the Bryce Commission on Secondary Education in 1894, the first instance in which women were included on a public educational commission in England. She was also one of the first members of the Consultative Committee of the English Board of Education (1899). In 1915 she held the presidency of the educational section of the British Association. She published *Health Statistics of Women Students* (1890) and a number of essays and articles on the education of girls, on woman's suffrage, and on psychical research.

SIDGWICK, Henry (1838–1901). An English moralist and economist, born at Skipton, Yorkshire, May 31, 1838. He was educated at Rugby and at Trinity College, Cambridge, was fellow of Trinity College from 1859 to 1869, and lecturer from 1859 to 1875, when he was appointed prælector of moral and political philosophy, and in 1883 he was appointed Knightbridge professor of moral philosophy. His principal works are: *The Methods of Ethics* (1874; 6th ed., 1901); *The Principles of Political Economy* (1883; 3d ed., 1901); *Outlines of the History of Ethics* (1886; 5th ed., 1902); *The Elements of Politics* (1891; 2d ed., rev., 1897); *Practical Ethics: A Collection of Addresses and Essays* (1898); *The Development of European Polity* (1903); *Lectures on the Ethics of T. H. Green, Herbert Spencer, and J. Martineau* (1902); *Philosophy: Its Scope and Relations* (1902); *Miscellaneous Essays and Addresses* (1904); *The Philosophy of Kant and Other Philosophical Lectures and Essays* (1905). He took a prominent part in the promotion of the higher education of women and was one of the founders of Newnham College, Cambridge. He helped largely to support *Mind*, an English philosophical quarterly, of which he was coeditor. He resigned his chair in 1900 on account of ill-health and died August 28 of the next year. In his *Methods of Ethics* he criticizes the ethics of intuitionism (q.v.) and common sense, of egoistic hedonism (q.v.), and of utilitarianism (q.v.), finally giving his adherence to a utilitarianism with an intuitional basis in the abstract moral principles of justice, prudence, and rational benevolence. He was a member of the Society for Psychical Research. He was a brother of Arthur Sidgwick and a cousin of the noted Benson family. For his wife, see Sidgwick, Eleanor. Consult: Bryce, *Studies in Contemporary Biography* (New York, 1903); A. S. and E. M. Sidgwick, *Henry Sidgwick: A Memoir* (London, 1906); W. P. Ward, *Ten Personal Studies* (New York, 1908); A. C. Benson, *Leaves of the Tree* (ib., 1911).

SIDHIA. See Sindia.

SIDI BEL ABBÈS, sē′dė bĕl ȧb′bȧs′. The capital of an arrondissement in the Department of Oran, Algeria, on the Mekerra, 48 miles by rail south of Oran. It is comparatively a modern town and is surrounded by walls. It has a considerable agricultural trade in grain, alfalfa, tobacco, wine, and cattle. Pop. (commune), 1911, 30,942.

SIDI MOHAM′MED (1803–73). Emperor of Morocco from 1859 to 1873. He succeeded his father, Muley Abderrahman. He was soon involved in a war with Spain, caused by the marauding expeditions of the Riff pirates, was defeated by the Spanish under Prim and O'Donnell (1860), and obliged to pay an indemnity of 200,000,000 piasters. His introduction of reforms and the commercial concessions which he granted to foreigners caused several insurrections, in quelling one of which he lost his life. See Morocco.

SIDIS, sī′dĭs, Boris (1867–   ). An American psychopathologist, born in Russia. He came to America in 1887 and was educated at Harvard (A.B., 1894; Ph.D., 1897; M.D., 1908). He was associate psychologist and psychopathologist of the Pathological Institute of New York State Hospitals (1896–1901), and after 1901 practiced medicine in Boston, also becoming director of the Sidis Psychotherapeutic Institute at Portsmouth, N. H. He published *Psychology of Suggestion* (1898); *Psychopathological Researches* (1902); *Multiple Personality* (1905), with S. P. Goodhart; *An Experimental Study of Sleep* (1909); *Philistine and Genius* (1911); *The Psychology of Laughter* (1913); *The Foundations of Normal and Abnormal Psychology* (1914); *Symptomatology, Psychognosis, and Diagnosis of Psychopathic Diseases* (1914).

SIDMOUTH, sĭd′mŭth. A watering place on the south coast of Devonshire, England, at the mouth of the little river Sid, remarkable for its healthful climate and picturesque situation (Map: England, C 6). The esplanade, protected by a sea wall 1700 feet in length, forms an excellent promenade. The interesting parish church dates from 1259. Sidmouth was the residence of Queen Victoria when a child, and her father, the Duke of Kent, died here in 1820. Pop., 1901, 4200; 1911, 5612.

SIDMOUTH, HENRY ADDINGTON, first VISCOUNT (1757–1844). An English statesman. See ADDINGTON, HENRY.

SID′NEY. A village in Delaware Co., N. Y., 44 miles northeast of Binghamton, on the Delaware and Hudson, and the New York, Ontario, and Western railroads (Map: New York, E 6). Noteworthy buildings are the public library, high school, and union station. The chief industrial establishments are silk mills, automobile works, sash and blind, cigar, and novelty factories, etc. Pop., 1900, 2331; 1910, 2507.

SIDNEY. A city and the county seat of Shelby Co., Ohio, 40 miles north of Dayton, on the Great Miami River, the Miami and Erie Canal, and on the Cincinnati, Hamilton, and Dayton, the Western Ohio, and the Cleveland, Cincinnati, Chicago, and St. Louis railroads (Map: Ohio, B 5). The public library, Monumental Building, courthouse, and Wagner's Park are noteworthy features. Sidney is of considerable industrial importance. The manufactures include road scrapers, whips, hollow ware, corn shellers, horse collars, fly nets, poles and shafts, churns, wheels, carriages, iron and wood workers' tools, aluminium ware, brooms, bicycle rims, newspaper folders, and flour. Pop., 1900, 5688; 1910, 6607.

SIDNEY, ALGERNON (1622–83). An English Revolutionary statesman. After his education he accompanied his father, the second Earl of Leicester, on embassies to Denmark and France. His first military service was against the rebels of Ireland in 1641, his father being Lord Lieutenant there. In the Civil War he fought for Parliament. The year 1647 saw him lieutenant general of the Horse in Ireland, and the next year he became Governor of Dover, remaining there more than two years. In 1645 Cardiff had returned him to the Long Parliament, and three years afterward he was appointed a commissioner for the trial of Charles I. He absented himself from the sessions of the court, because he wished to keep himself "clean from having any hand in this business." His objection to the trial of the King was that the House of Lords had not assented to it. But it is said that he afterward spoke of the execution as "the justest and bravest action that was ever done in England or anywhere else." In principle a severe republican, he resented the concentration of power in Cromwell. When the restored Parliament met in 1659, Sidney was again nominated to the Council of State and dispatched to Denmark on a political mission. After the Restoration he lived on the Continent, subjected to enmities, flitting about from place to place. In 1677 Charles II pardoned him and he returned to England.

Holding persistently to his old principles, however, he favored the Duke of Monmouth as successor to Charles II in place of the Duke of York. For this he solicited the aid of the French monarch. His designs were suspected, and when the Rye House Plot was discovered in June, 1683, the opportunity was seized to be rid of a man felt to be dangerous. He was arrested and committed to the Tower and tried for high treason on November 21 before the brutal Jeffreys, who on the merest mockery of evidence condemned him to death. The execution took place December 7 on Tower Hill. His firmness in death awakened the sympathy and the indignation of the public, which has ever since revered him as a patriot hero and martyr. In the history and theory of government Sidney was more deeply learned than any other man of his time. His *Discourses Concerning Government* were published in London in 1698, and his entire works appeared in 1772.

Consult G. W. Meadley, *Memoirs of Algernon Sidney* (London, 1813), and A. C. Ewald, *Life and Times of Algernon Sidney* (ib., 1873).

SIDNEY, SIR PHILIP (1554–86). A celebrated English writer and soldier. He was born at Penshurst in Kent, Nov. 30, 1554, and received his education at Shrewsbury, whence in 1568 he went to Christ Church, Oxford. He left the university without a degree, but with a high reputation for scholarship. In 1572 he traveled abroad. He was in Paris when the Massacre of St. Bartholomew took place, but ran no personal risk, being under protection of the English embassy. He then visited Belgium, Germany, Hungary, and Italy, occupying most of his time in studying languages, literature, history, and politics, and cultivating the acquaintance of eminent men; and in 1575 he returned, an erudite and polished gentleman. His uncle (Dudley, Earl of Leicester) was now in the zenith of his fortunes, and for Sidney a career at court lay open. With Queen Elizabeth he was throughout life an especial favorite. In 1577 she intrusted him with a mission to Heidelberg and Prague and, though he failed in his negotiations, he was warmly commended. Three years after, he had the boldness to address to the Queen a "remonstrance" against her proposed marriage with Henry, Duke of Anjou, a union to which she seemed herself not indisposed. It is significant of his high favor that Elizabeth, imperious in temper and little inclined to brook interference, was satisfied with his short retirement from court. This interval he passed in literary work at Wilton with his sister the Countess of Pembroke. For her entertainment he wrote his celebrated pastoral romance, *Arcadia*, published posthumously by his sister in 1590. In 1583 he consoled himself for the marriage of Lady Penelope Devereux, to whom he had been ardently attached and who figures as Stella in his poems, by marrying Frances, daughter of Sir Francis Walsingham. In 1585 he is said to have meditated sailing with Sir Francis Drake in an expedition against the

Spaniards in the West Indies, but to have been forbidden by Elizabeth through fear "lest she lose the jewel of her dominions." Late in that year, however, she appointed him Governor of Flushing, whither he went to take part in the war then waging between her allies, the Dutch and the Spanish. At the battle of Zutphen in Gelderland a horse was killed under him, and he received a musket shot in the thigh from which after great suffering he died at Arnheim on Oct. 7, 1586. While he was borne from the field, as he complained of thirst, a bottle of water was brought him; but when about to drink, he was touched by the wistful look of a mortally wounded soldier close by, and, taking the water untasted from his lips, Sidney handed it to his fellow with the words, "Thy necessity is greater than mine." The esteem in which Sidney was held by his countrymen was shown in the grief with which the news of his death was received. His body was brought to England and after lying in state was buried with great solemnity in the old cathedral of St. Paul's. The universities of Cambridge and Oxford issued three volumes of elegies on his death, and Spenser, in his *Astrophel*, mourned the loss of his friend.

The love and admiration which Sidney won from his contemporaries were a tribute to the singular beauty of his character. His short life was marked by no brilliant achievement, and his literary genius would scarcely of itself have sufficed to account for the regard he inspired. Sidney's *Arcadia*, overrun as it is with affectations, may still be recognized as a work of great merit. His other well-known work, *Apologie for Poetrie* (1579), republished in 1598 as *Defense of Poesie* (q.v.), will repay the attention of the reader. Many of his shorter poems, more especially some of his sonnets, are also of rare merit. Consult his *Complete Poems* (ed. by Grosart, London, 1877); *Apology for Poetry* (ed. by Shuckburgh, Cambridge, 1891); *Miscellaneous Works* (Boston, 1860; London, 1893); H. R. Fox Bourne, *A Memoir of Sir Philip Sidney* (London, 1862); J. A. Symonds, *Sir Philip Sidney* (ib., 1886); Sir Sidney Lee, "Sir Philip Sidney," in *Great Englishmen of the Sixteenth Century* (New York, 1904), containing a bibliography; Sir Fulke Greville, *Life of Sir Philip Sidney* (Oxford, 1907); Percy Addleshaw, *Sir Philip Sidney* (London, 1909).

SIDNEY SUSSEX COLLEGE. A college at Cambridge, England, founded in 1596 by the will of Lady Frances Sidney, Countess Dowager of Sussex. It was built on the site of the Franciscan or Grey Friars' House, established in 1240, and was called the College of Lady Francis Sidney Sussex. The house of the Franciscans had been suppressed in 1538 and the site given to Trinity College. Trinity transferred it to the new foundation. Sidney Sussex was early a "nursery of Puritanism" and was the first college in Cambridge to admit Scotch and Irish. In 1914 there were a master and 12 fellows, 36 scholars, and about 120 undergraduates. It presents to eight livings. Among the worthies of this college are Oliver Cromwell, Thomas Fuller, and Archbishop Bramhall. Consult G. M. Edwards, *Sidney Sussex College* (London, 1899).

SI'DON (Heb. *Ṣidōn*, from *ṣūd*, to hunt, to fish, or from *Sid*, name of a tribal god). A city of ancient Phœnicia, on the coast of the Mediterranean, about 25 miles south of Beirut (Map: Turkey in Asia, C 4). It was situated on a promontory with an island in front and possessed a double harbor. It was specially famed for its purple dyes, and its inhabitants are said to have discovered the manufacture of glass. Sidon is mentioned in Papyrus Anastasi I. Among the Amarna Tablets are some from its prince Zimridda (c.1400 B.C.). The Phœnicians are called Sidonians by Homer (*Iliad*, xxiii, 743 ff.; *Odyssey*, iv, 613 ff., xv, 460). Sidon sent presents to Asurnazirpal III in 877 B.C. It was subdued by Sennacherib in 701 and severely punished by Esarhaddon in 674. The revolt of Tennes II led to the destruction of the city by Artaxerxes III Ochus in 351 B.C. It was a free city under the Romans. It surrendered to the Moslems in 637 or 638. During the period of the Crusades it suffered greatly and passed back and forth from Mohammedans to Christians, ultimately remaining with the former. Under the Druse prince Faḫr al din (1595–1634) its importance revived; it became the seaport of Damascus and for nearly 200 years had an important trade. The present town of Saida occupies the western portion of the site of the ancient city. It has about 12,000 inhabitants and is relatively unimportant as compared with Beirut, which has become the seaport of the district. Missionary establishments are maintained by both Protestants and Roman Catholics. The many tombs of the ancient city have yielded a large number of interesting sarcophagi, including that of Eshmunazar (1855), now in the Louvre, and 17 other Phœnician and Greek sarcophagi, among them that of Tabnit, the father of Eshmunazar, and the so-called sarcophagus of Alexander, now in Constantinople (1887). See PHŒNICIA; PHŒNICIAN ART.

SIDON, ZENO OF. See ZENO OF SIDON.

SIDO'NIA, ORDER OF. A royal Saxon order of merit for women, conferred for voluntary services in war and peace. It was established in 1870. The decoration is an eight-pointed cross of white enamel, edged with gold, suspended from a crowned wreath inclosing the initial S.

SID'RA, GULF OF (Lat. *Syrtis Maior*). A large open arm of the Mediterranean Sea on the coast of Tripoli (Map: Africa, F 1). It is nearly 300 miles wide at the mouth and extends inward from 75 to 125 miles. Its shores are low and bordered by shallow and dangerous waters, affording scarcely any harbors. The Gulf of Sidra forms the eastern angle of the larger rectangular gulf of the two Syrtes, the western angle being now called the Gulf of Gabes (q.v.).

SIEBECK, *zē'bĕk*, HERMANN (1842–). A German philosopher. He was born at Eisleben, studied philology at Leipzig, Berlin, and Halle, and was privatdocent of philosophy at Halle in 1872–75, and professor of philosophy at Basel in 1875–83 and thenceforth at Giessen. At first he was allied with the Herbartian school of philosophy, but later became known as a Kantian. He published: *Untersuchungen zur Philosophie der Griechen* (1874; 2d ed., 1888); *Das Wesen der ästhetischen Anschauung* (1875); *Das Traumleben der Seele* (1877); *Ueber das Bewusstsein als Schranke der Naturerkenntnis* (1878); *Geschichte der Psychologie* (1884); *Ueber die Lehre vom genetischen Fortschritte der Menschheit* (1892); *Lehrbuch der Religionsphilosophie* (1893); *Aristoteles* (1899; 3d ed., 1910); *Goethe als Denker* (1902; 2d ed., 1905); *Zur Religionsphilosophie* (1907); *Grundfragen zur Psychologie und Aesthetik der Tonkunst* (1909); *Ueber Freiheit, Entwicklung, und Vorsehung* (1911).

SIEBENGEBIRGE, zē'ben-ge-bēr'ge. A group of seven conical heights in the Rhine Province, Prussia, on the right bank of the Rhine, opposite Bonn, 22 miles above Cologne. The chief peaks are the Oelberg (1522 feet), the Löwenburg, and the Drachenfels (q.v.). The scenery is strikingly picturesque, and the region is intimately connected with the history and legend of the surrounding country.

SIEBOLD, zē'bōlt, ADAM ELIAS VON (1775–1828). A German obstetrician. He was born in Würzburg, where his father, Karl Kasper von Siebold (1736–1806), held the chair of surgery at the university and where his elder brother, Johann George Christoph von Siebold (1767–98), was professor of gynæcology. Adam Elias von Siebold received his education in his native town, became professor of medicine at the university in 1799, and was called in 1816 to the University of Berlin to fill the chair of obstetrics. There he was instrumental in the foundation of the obstetrical hospital of the university. Among his works are: *Lehrbuch der Hebammenkunst* (1808; 5th ed., 1831); *Lehrbuch der theoretisch-praktischen Entbindungskunde* (1809; 4th ed., 1824); *Handbuch zur Frauenzimmerkranskheiten* (1811; 2d ed., 1821–23). He also edited from 1813 the *Journal für Geburtshilfe*. See also SIEBOLD, EDUARD and PHILIPP.

SIEBOLD, EDUARD KASPER JACOB VON (1801–61). A German gynæcologist. The elder son of Adam Elias von Siebold (q.v.), he was born at Würzburg, where, as well as at Berlin, he was educated. In 1829 he became professor of gynæcology at Marburg and four years later at Göttingen. He is well known through his classical *Versuch einer Geschichte der Geburtshilfe* (1839–45; 2d ed., 1901). Among his other works may be mentioned *Lehrbuch der Geburtshilfe* (1841; 2d ed., 1854) and *Lehrbuch der gerichtlichen Medizin* (1847). At the death of his father he became editor of the *Journal für Geburtshilfe*.

SIEBOLD, KARL THEODOR ERNST VON (1804–85). A German physiologist and zoölogist, younger son of Adam Elias von Siebold (q.v.). He was born in Würzburg and studied medicine and science at Göttingen and Berlin. He became director of the Obstetrical Institute at Danzig (1835) and was professor of physiology successively at Erlangen, Freiburg, Breslau, and Munich (1853), where later he was transferred to the chair of zoölogy. He did pioneer work in the classification of animals, was the first to define the groups Protozoa and Zoöphyta, and divided Cuvier's group of Articulata into Arthropoda and Vermes. With Kölliker he founded in 1848 the *Zeitschrift für Wissenschaftliche Zoölogie*. His obituary notice in the *Zeitschrift* for 1885 gives a bibliography of 197 titles. Among these were important papers on animal spermatozoa, especially in the insects, and on parthenogenesis in insects. He demonstrated that spermatozoa winter in the seminal receptacles of the female wasp. With Stannius he published *Lehrbuch der vergleichenden Anatomie der Wirbellosen Thieren* (1846–48; 2d ed., 1854).

SIEBOLD, PHILIPP FRANZ VON (1796–1866). A Bavarian physician, naturalist, and traveler, son of Eduard von Siebold. He was born at Würzburg. After studying medicine and science he entered the service of the Dutch East India Company in 1822 and proceeded to Batavia. From Java he went in 1823 to Nagasaki as the leader of a scientific mission to Japan. He quickly mastered the Japanese language and in 1826 reached Yeddo with the Dutch embassy, remaining in that city, but getting into trouble through the purchase of a map, such transfer of knowledge to an alien being then forbidden. He was imprisoned, and banished from Japan in 1830. He had, however, been the teacher of many native physicians. After his return to Europe he spent nearly 30 years in writing his great work, entitled *Nippon, Archiv zur Beschreibung von Japan* (1832–51); in arranging his collections at the museums of Leyden, Munich, and Würzburg; and in the composition of works on the fauna, flora, and bibliography of Japan. In 1859 he revisited Japan and was invited to court by the Emperor and in 1861 entered the Japanese service as a negotiator with the Powers, but difficulties arose which compelled him to retire. He returned to Europe in 1862, where he published various papers relating to Japan. He died at Munich. A monument to him has been erected in Japan by the Japanese. Consult Siebold, *Leben und Wirken von P. F. von Siebold* (Würzburg, 1896).

SIEDLCE, shĕl'tsĕ. A government in the east of Russian Poland, between the Bug on the east and the Vistula on the west (Map: Russia, B 4). Area, about 5535 square miles. It is mostly flat and marshy in the southeast. Agriculture is the principal industry and is carried on by modern methods. Stock raising is also important. The chief manufactures are spirits, sugar, and glass. Toys, agricultural implements, and bricks constitute other industries. Pop., 1912, 1,032,700. In the War in Europe (q.v.) this government was directly affected by the German invasion of Russian Poland.

SIEDLCE. The capital of the Government of Siedlce in Russian Poland, about 50 miles east-southeast of Warsaw (Map: Russia, B 4). It is little more than an administration centre of the government, and its economic importance is slight. Its principal manufacture is agricultural implements. It was for a long time in the possession of the Czartoryskis. Siedlce was captured by the Germans in the Great War which began in 1914. See WAR IN EUROPE.

SIEGBURG, zĕk'bụrG. A town of the Rhine Province, Prussia, at the meeting of the Agger and Sieg, 16 miles by rail southeast of Cologne (Map: Germany, B 3). The Benedictine abbey (1060) is now used as a prison. Siegburg is a manufacturing and mining town. It has a royal projectile factory, pottery works, lignite mines, and stone quarries. Pop., 1910, 17,280. Siegburg was a wealthy and prosperous city in the Renaissance period and famous for the curious and artistic Siegburg pitchers.

SIEGE AND SIEGE WORKS (OF. *sege, siege*, Fr. *siège*, from Lat. *sedere*, to sit; connected with Gk. *ἕζεσθαι*, *hezesthai*, Ger. *sitzen*, Goth. *sitan*, AS. *sittan*, Eng. *sit*). A siege is, as its derivation indicates, the sitting of an army before a fortified place for the purpose of compelling surrender. Siege works comprise all the engineering devices resorted to by besieger and besieged in the attack and defense of a strong fortification. The increase in the size of armies participating in the more recent wars has caused them more nearly to fill the possible fronts and has made it more difficult to develop surprises, flanking, and other manœuvres to the same relative extent as with former smaller armies. As a result mobile armies are more apt to face each other for longer periods over longer fronts. Attention is concentrated on the front attack, and in lieu of some of the lost mobility increasing use has been made of some devices of siege warfare, notably mines and mining, trenches and overhead cover.

The conditions of regular sieges are more alike in different times and places than those of operations with mobile forces, and the best methods can therefore be stated quite definitely. In conducting a siege the enemy is first surrounded and cut off from supplies, reënforcements, and retreat. His position is then said to be invested. The attacking army in doing this usually intrenches itself completely around and outside the land works of the defender and patrols the sea front if there be one. With plenty of time and no prospect of the arrival of relieving forces, an effective investment reënforced by bombardment may cause the defender eventually to starve or surrender without extreme effort by the besiegers. In other cases, as at Mafeking and Ladysmith, the prospective arrival of a relieving force must always be borne in mind and the attacker must use every means at his command to force the issue.

If the defenders are in a position to construct bomb proofs sufficient to enable them to hold out against bombardment, it then becomes necessary to resort to a regular siege. The method of procedure is then as follows: The artillery being in a position best adapted to enable it to fire upon the artillery of the defense, the infantry is established in front of this in intrenchments, and attempts are made to hold down the fire of the defenders and to push infantry intrenchments as close as possible to the work. This is done by the construction of large sections of intrenchments parallel to the main line of the defender. In following the method known as flying sap, a large force of men upon the fall of darkness moves forward the position, carrying gabions or boxes, picks, and shovels. When the line has been moved as far forward as is deemed advisable, the gabions are placed and the men dig the earth from behind them, filling first the gabions and then throwing the earth in front of them. When such advances are not practicable the trenches are pushed forward obliquely by end work. These approaches are so inclined that they cannot be enfiladed by the enemy. This process is known as sapping. Counter attacks by the besieged are kept down by artillery fire. An advanced position having been gained is strongly fortified.

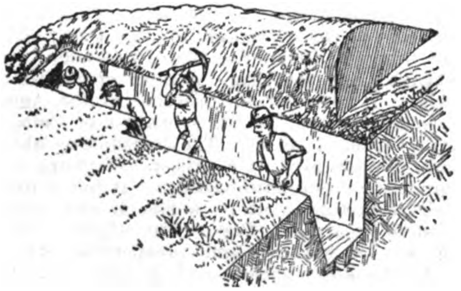


FIG. 1. SAPPING.

By these methods the attack is pushed to a position close to that held by the defenders. If the latter are provided with sufficient provisions and material to enable them to hold out without surrender on account of starvation resort is had to mining (q.v.). Assaults are delivered by the attacking force on the weakest points of the work. These assaults frequently follow immediately after a mine explosion. The assaulting party is provided with explosives to be used in demolishing the palisades and similar obstructions, and with ladders, planks, wire cutters, and other implements to enable it to surmount and cope with the obstacles it may find. From the nature of the case, if the defender is prevented from receiving supplies and the attacker can receive such reënforcements and supplies as he requires, the victory is eventually with the attacker. It may, however, be only necessary for the defender to hold out until a relieving force can reach the place. It is therefore incumbent upon him to resort to means to protract the defense. Having noted, e.g., that an attack will probably be successful upon certain portions of his line, an additional line should be constructed in rear of this portion and so fortified that it can be held even if the first falls. His fire is so directed as to delay the attacker's trench work. His force, while not large enough to defeat the attacker in open combat, may be large enough to threaten him so frequently as greatly to diminish his endurance. Sorties are frequently made at night, surprising the operations of the attacking force, destroying its material, its work, and generally lowering its morale. Searchlights, torches, rockets, and light bombs are used to expose the night operations of the enemy.

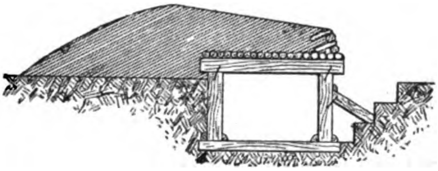


FIG. 2. CASEMATE IN TRENCH.

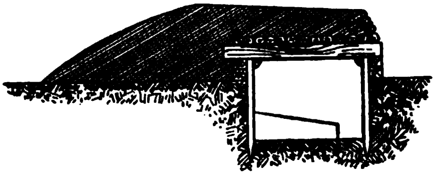


FIG. 3. CASEMATE IN TRENCH (ENTRANCE FROM END).

The location and construction of the emplacements for the siege batteries are works of the greatest importance. Ingenuity should be exercised in adapting batteries to the nature of the ground and in making them as inconspicuous as possible. In view of the development of aircraft it is well to locate them, when possible, in the edges of woods and to screen them from sight.

When the fortified place being besieged is a city or intrenched camp surrounded according to modern practice with one or more lines of forts and redoubts, and the siege is successful, and one or more of the outer forts has first been captured, the attacking force advances through the gap and takes up new positions which assist the attacks on the neighboring forts and ultimately on the central defense.

Given equal interest in the attack and defense, equal opportunity for preparation, and equal ability and training on the part of the troops and the commanders, a fortified place should be able to hold out a long time against siege. Many fortified places may, however, not be attacked. If every improvement were introduced in every fort, the cost would be great. It may therefore readily happen that certain forts will not be abreast of the development of the military art in all particulars, particularly as to size of guns. On the other hand, an attacking army with a limited number of modern guns may, with good roads and transportation facilities, shift them to attack a fort with guns of less range. When the discrepancy in power and range of guns is great, the guns of the fort may be outranged and unable to develop even their true value. If an attack on a fortified place has sufficient superiority, it may therefore be successful without even completing the investment and resorting to a real siege, although such attacks are sometimes spoken of as sieges.

Sieges are comparatively few in a war as compared with the number of battles and other engagements. The siege of Vicksburg is an instance of an investment carried to a logical conclusion. The Confederate army in the city was surrounded and cut off from its source of supplies. The Union army, under General Grant, constructed a line of intrenchments to resist possible attacks by other Confederate troops for the relief of the city. Although General Grant was gradually pressing his lines forward, the place eventually capitulated as the result of starvation. During the Franco-Prussian War of 1871 the sieges of Strassburg, Metz, Paris, and Belfort were carried on under different conditions and with different results. The siege of Fort Wagner, one of the defenses of Charleston, S. C., by the Union troops was unique in certain respects. Assaults having failed, recourse was had to advances by parallels and approaches. The time arrived when it seemed impossible to make further headway by this method. Mining could not be resorted to, since the bottoms of the trenches were already near the level of the ground water. The proximity of the forts to deep water enabled the Union gunboats to add their fire to that of the besieging batteries and so keep down the fire of the fort that the besiegers were able to advance their trenches with great rapidity. In this way the works were carried right up to the fort. The night before the Union troops were to make the second assault the Confederates abandoned the fort. In the Russo-Turkish War (q.v.) Plevna is notable. Geök Tepe is an instance where a large but poorly disciplined and poorly equipped Turcoman army was besieged and overcome by a smaller but aggressive Russian army. The strongly defended position of Port Arthur in the Russo-Japanese War fell in 1904, after a long siege, as a result of investment on the land front and control of the sea on the water front, partly successful assaults, lack of supplies, and the continuous bombardments. The siege and capture of Adrianople by the Bulgarians and Serbians in 1912 is one of the latest modern sieges. The city lay at the junction of three rivers in a gap in a line of mountains which form a natural line of defenses, and its strategic value has always been recognized. In the Great War of 1914 the regular sieges at Namur, Maubeuge, Novo Georgievsk, and Przemysl have furnished much material for technical discussion so far as facts concerning them are available. The same is true of the attacks on some fortified places which were captured without complete investment, as Liége, Antwerp, and Warsaw. See WAR IN EUROPE.

Consult: Mercur, *Attack of Fortified Places* (New York, 1894); *Chatham Manual of Military Engineering*, part ii, *Attack of Fortresses* (London, 1896); *United States Engineer Field Manual* (Washington, 1909); *The International Military Digest* (current, West Point, N. Y.). See also articles on FORTIFICATION; FORTIFICATIONS, ATTACK AND DEFENSE OF; HOWITZER; MINES AND MINING, MILITARY; SIEGE ARTILLERY; TACTICS, MILITARY.

SIEGE ARTILLERY. Artillery used to reduce permanent or semipermanent fortifications during the course of a siege. It usually consists of guns, howitzers, and mortars larger than 6-inch calibre, but not necessarily, since smaller calibre may sometimes be effectively employed in such operations. The term is derived from the special use of the pieces in siege operations rather than from the size of calibre. Calibres up to the 6-inch howitzer may be transported by horse draft and for this reason may accompany the mobile army. Calibres above 6-inch cannot, as a rule, accompany mobile troops and must be brought up by rail, traction engine, or motor trucks for the specific purpose of a siege and there be more or less permanently emplaced on wood or concrete platforms. Yet, as the Great War demonstrated, under modern conditions of transportation there is practically no limit to the size of siege guns.

In European countries siege artillery is handled by a special organization called fortress artillerymen, for which there is no corresponding class in the United States army. In case such artillery was needed in the United States it would probably be manned by personnel detached from the Coast Artillery Corps.

During the Great War the Germans employed, among other ordnance, the following siege pieces: 8.3-inch howitzer, 11-inch siege howitzer, 16.5-inch mortar, the largest ever used in siege or other operations. The Austrians used a 12-inch mortar; the French an 11-inch howitzer, of which there were but few in the beginning of the war. (These are discussed under HOWITZER; MORTAR.) The English largest siege piece, in the early stages of the war, was a 9.2-inch howitzer. In this war guns that once properly would have been designated siege guns were used with great effect against personnel, and it is probable the distinction that the siege gun as used for reducing permanent and semipermanent works will not be sufficient in the future properly to distinguish it from light guns. A more logical designation will probably be that a siege gun is a weapon which is too heavy to accompany small bodies of mobile troops, but which will be sent with field armies.

In the United States army there were two old model siege pieces, viz., the 5-inch siege gun and the 7-inch siege howitzer. A 9.5-inch siege howitzer is the largest calibre included in the project of 1915. The larger calibres in use or under construction embody the principle of the howitzer in that the charges may be varied to obtain steeper slopes of fall of the projectile at shorter ranges than can be obtained with the siege gun proper. See Artillery; Field Artillery; Heavy Field Artillery; Ordnance.

SIEGE GUNS. See Siege Artillery.

SIEGEN, zē'gen. A town in the Province of Westphalia, Prussia, situated on the river Sieg, 47 miles east by south of Cologne. It has two castles of the princes of Nassau-Siegen and an important school of mines. Siegen is an important iron centre, the vicinity abounding in iron, copper, lead, and zinc mines. In and about the town are numerous puddling and rolling mills, machine works, and paper, cloth, and leather manufactories. Pop., 1910, 27,416.

SIEGEN, Ludwig von (c.1609–after 1676). A German engraver, inventor of the art of mezzotint. He was born in Utrecht but early entered the service of the Landgrave of Hesse-Cassel. Later he went to Amsterdam, where in 1642 he produced the first known mezzotint engraving, a portrait of the Landgravine Amalia Elisabeth, Regent of Hesse. This was followed by portraits of William of Orange and Mary his wife (1643–44), and of Eleanora Gonzaga. Siegen then passed into the service of the Elector of Mainz and the Duke of Wolfenbüttel. He kept his invention secret until 1654, when in Brussels he divulged it to Prince Rupert of the Palatinate, through whom it became known in England. Siegen's work, though that of an amateur, has delicacy and charm.

SIEGE PERILOUS. One of the three seats left unoccupied at the Arthurian Round Table, so called because it was reserved for him who was to find the Holy Grail, and any other bold enough to sit in it forfeited his life. See Galahad.

SIEGE WORKS. See Siege and Siege Works.

SIEGFRIED, zēk'frēt. A music drama in three acts by Richard Wagner. It is the third in the tetralogy of the *Ring des Nibelungen* and was first produced at Bayreuth Aug. 16, 1876. The first American production was at the Metropolitan Opera House, New York, Nov. 9, 1887. See Ring of the Nibelungen.

SIEGFRIED, Karl (1830–1903). A German Protestant theologian, born at Magdeburg. He was called to the University of Jena in 1875 as professor of Old Testament literature. In 1885 he was appointed to the Lutheran Consistory. The following publications bear his name: *Spinoza als Kritiker und Ausleger des Alten Testaments* (1867); *Eusebii Canonum Epitome* (1884), with H. Gelzer; *Lehrbuch der neuhebräischen Sprache und Litteratur* (1884), with Strack; *Hebräisches Wörterbuch zum Alten Testament* (1893), with Stade.

SIEGLIND, zēk'lint. In the Nibelungen legend, the wife of Siegmund and mother of Siegfried.

SIEMENS, sē'menz, C. W. See Iron and Steel, *Open Hearth Process*.

SIEMENS, zē'mens, (Ernst) Werner von (1816–92). A German electrical engineer. He was born at Lenthe in Hanover and was educated in the Gymnasium of Lübeck and in the school of artillery and engineering at Berlin, becoming an artillery officer in 1838. He studied chemistry and electromagnetism, and invented a process for electroplating in 1841. In 1848 he became commandant of the artillery arsenal in Berlin. He was the first to explode a submarine mine by electricity (1848). Devoting himself to electrical engineering, he was engaged after 1849 in the establishment of telegraph lines, particularly through Russia, Brazil, Spain, and northern Germany. He was the first to suggest gutta-percha as an insulating material for electrical conductors. In 1856 he devised the improved shuttle armature which increased the efficiency of the magnetomachine, and in 1876 demonstrated that its electromagnets could be used without separate exciters, the current being passed through the field coils. He proposed as the unit of resistance a column of mercury 1 meter long and 1 square millimeter in cross section at 0° C. This was known as the Siemens unit. Siemens was also active in promoting electric traction in Germany, and the first electric railway was erected at the Berlin Industrial Exhibition of 1879 by Siemens & Halske, a firm of electrical engineers and manufacturers founded by him and destined to play an important part in the commercial utilization of electricity. His researches in electricity resulted in discoveries and improvements of great value, one of which was the determining of the locations of injuries in submerged cables and also of charging them in order to reduce the disturbing influence of induced currents. In 1884, by the gift of about $125,000, he made possible the foundation of the Imperial Physico-Technical Institute (Reichsanstalt), which soon became an important factor in German scientific research and manufacturing. (See Laboratory.) He wrote numerous scientific works, collected as *Wissenschaftlichen und technischen Arbeiten* (1889–91). Consult his *Lebenserinnerungen* (Berlin, 1892; 8th ed., 1908; Eng. trans., *Personal Recollections of Werner von Siemens*, New York, 1893).

SIEMENS, Sir William (Karl Wilhelm) (1823–83). An English engineer and metallurgist, born at Lenthe, Hanover, and a brother of Werner Siemens, with whom he was associated in scientific investigations and commercial enterprises. He was educated at Magdeburg and Göttingen and then entered a manufacturing establishment in the former town. He visited England in 1843 to introduce his brother's process of electroplating, and again in 1844, when he endeavored to dispose of the English rights of a chronometric governor for steam engines and the anastatic process of printing. Settling in England, but maintaining connection with his brother, he devoted himself to perfecting a regenerative steam engine, but was not altogether successful and turned his attention to a water meter, which soon came into extensive use. His next and most important invention was the regenerative furnace, which he applied to iron and steel working and to which from time to time he added important improvements. (See Iron and Steel.) He was interested with his brother in electrical enterprises and conducted the British branch of the business, which in 1874 laid the direct Atlantic cable from the ship *Faraday*, a vessel designed by him for that purpose. Sir William played an important part in the application of electricity to lighting and traction in England. Besides many useful inventions, among which were a pyrometer and the bathometer, apparatus for producing low temperatures (see Refrigeration), he also carried on important investigations in pure science. In 1859 he became a British subject, and in 1883 he was knighted. He received many honors, including the Bessemer medal of the Iron and Steel Institute of Great Britain, the French Legion of Honor, and honorary degrees from the universities of Oxford, Dublin, and Glasgow. He was president of the Society of Telegraph Engineers, the Institution of Mechanical Engineers, the Iron and Steel Institute, and the British Association for the Advancement of Science and was a member of many other British and foreign societies. A laboratory of electrical engineering was constructed by his widow at King's College, London, as a memorial. His collected works were published in 1889. Consult William Pole, *Life of William Siemens* (London, 1889), and Richard Hennig, in *Buch der berühmter Ingenieure* (Leipzig, 1911).

SIEMERING, zē'me-rĭng, Rudolf (1835-1905). A German sculptor. He was born at Königsberg and studied at the academy there and afterward under Bläser in Berlin, where he first made a name with his marble statue of King William, for the Exchange. The monuments to Dr. Gräfe, the famous oculist (1882; Berlin), to Frederick the Great (1877; Marienburg), and to Luther (1883; Eisleben), also preceded his two greatest achievements, the War Monument (1888) on the Market Square at Leipzig and the Washington Memorial in Fairmount Park, Philadelphia (1883; unveiled 1897). Among his later works are the marble group of Frederick William I (1900) and the Haydn-Mozart-Beethoven Monument, both in the Thiergarten, Berlin. Siemering marks the transition from the school of Rauch to the modern Realistic school and is noted for severe truthfulness and careful treatment of form. Consult the monograph by Daun (Bielefeld, 1906).

SIEMIRADZKI, syĕ'mē-räts'kē, Henryk (1843-1902). A Polish historical painter. He was born near Kharkov, Little Russia, and studied at the Academy of St. Petersburg, winning the traveling scholarship in 1871. After a short sojourn in Munich he settled in Rome. The subjects of most of his brilliantly colored paintings are scenes from the life of ancient Greece and Rome. He first gained fame with "The Living Torches of Nero" (1876; National Museum, Cracow), but usually chose joyous themes with sunny landscape backgrounds revealing a modern comprehension of light and air, such as "Sword Dance" (1880) and "Phryne at Eleusis" (1889; Alexander Museum, St. Petersburg). He also painted religious subjects, including "Christ with Mary and Martha" (1886; ib.), and decorated several churches in Moscow and Cracow.

SIENA, syĕ'nȧ. The capital of the Province of Siena in Tuscany, Italy, picturesquely situated on the crests of three hills, over 1100 feet above the sea, near the Elsa, 60 miles by rail south of Florence and only about 30 miles in a straight line (Map: Italy, C 3). It is a delightful mediæval city. The climate is salubrious, the weather, owing to the elevation, not being hot in summer. The town is irregularly built, with crooked, steep, and narrow streets, and retains its ancient walls, which inclose an area of about 2½ square miles. The centre of life in Siena is the fine Piazza di Vittorio Emanuele (formerly called Piazza del Campo), containing the (restored) Gaya Fountain by Della Quercia (1408) and bordered by rich palaces. Of these structures the Palazzo Pubblico and the Palazzo del Governo (Piccolomini) are the most striking. The former, begun in 1289, is of brick, with a superb slender tower called Del Mangia, 285 feet high, and is a fine specimen of the Italian civic Gothic style. The interior is rich in mural decorations of the Sienese school (see Painting), and there are a chapel and a porch at the foot of the tower. The Palazzo del Governo, dating from 1469, has an interesting façade and holds the important archives of Siena. The fine brick Gothic Buonsignori Palace is also worthy of mention.

Siena is famous for its cathedral. This edifice, which is situated on the crowning point of the city, was begun in 1243. It has a dome, a campanile, and is irregular in shape. Its façade, begun in 1284 and planned by Giovanni Pisano, is a far-famed rival of that of the Orvieto Cathedral and is composed of black, white, and red marble, varied with profuse decorations. The interior is also remarkable, its pavement ornamented in black inlay with scenes from biblical history being of exceptional interest. There are also in the cathedral a noteworthy portal, Donatello's bronze statue of John the Baptist, and a rare octagonal pulpit by Niccola Pisano and others. The splendid cathedral library was built in 1495 and was decorated by Pinturicchio. The church of San Giovanni, under the choir of the cathedral, was begun in the early fourteenth century and has an uncompleted façade. The Oratorio di San Bernardino is important for its pictures by Sodoma.

Siena is a lively trading and manufacturing town, weaving being the conspicuous industry. Cloth, silk, velvet, and furniture are exported. The university was famous in the Middle Ages, but now has less than 300 students. The Reale Collegio Tolomei (lyceum) deserves to be mentioned. The institute of fine arts is notable for its early Sienese specimens. The Opera del Duomo also possesses an art collection. The school of arts and trades was founded in 1876. The public library contains 83,250 volumes and 5000 manuscripts. Pop., 1901 (town), about 25,000, (commune) 38,665; 1911, 41,673.

History. Siena (Lat. *Sena Julia* and *Colonia Seniensis*) was made a Roman colony in the time of Augustus. The city rose to great importance in the Middle Ages. The people wrested the governing power from the nobles in the twelfth and thirteenth centuries. The city became a Ghibelline stronghold, and in 1260 its citizens defeated the Guelphs of Florence at Monte Aperto. A few years later, however, it was forced by Charles of Anjou to join the league of the Guelph cities of Tuscany. It was at the height of its prosperity at the time of the Renaissance. In 1557 it was annexed to the Florentine dominions. In the history of art from 1200 to 1500 Siena stands in the front rank among Italian cities. Consult: Langton Douglas, *History of Siena* (New York, 1903); Ferdinand Schevill, *Siena: Story of a Mediæval Commune* (ib., 1909); Edward Hutton, *Siena and Southern Tuscany* (ib., 1910); E. H. and E. W. Blashfield, "Siena," in *Italian Cities* (new ed., ib., 1912); E. G. Gardner, *Story of Siena*, in "Mediæval Towns Series"

(London, 1913). See Sienese School of Painting.

SIENA, Council of. A council originally summoned to meet at Pavia by Pope Martin V, as he had promised the Council of Constance, but transferred two months later, because of the plague at Pavia, to Siena, where it sat from July 21, 1423, to March 7, 1424. Owing to the uncertainty of the times, following upon the great schism, it was unable to effect much. It condemned the Wicliffite and Hussite doctrines and took measures for a general suppression of heresy. Before its adjournment Basel was chosen as the place for the next general council. See Basel, Council of.

SIENA, Guido of. See Guido of Siena.

SIENA, Ugolino da. See Ugolino da Siena.

SIENESE (*sē'en-ēz' or -ēs'*) **SCHOOL OF PAINTING.** The principal Italian school of painting, along with the Florentine, during the later thirteenth and fourteenth centuries. As compared with the Florentine school (q.v.) it was more detailed in finish, brighter in color, and more refined in sentiment, but inferior in line and dramatic action and less naturalistic. It appealed to sentiment rather than understanding; its subjects were the ideals and feelings of the Middle Ages, and it retained more of the Byzantine element than did the Florentine. The determinative factor at Siena was the panel picture, at Florence the fresco. The founder of the Sienese school was Duccio (active 1282–1339), and his greatest follower was Simone Martini, who ranked with Giotto in the estimation of contemporaries. In the course of the fourteenth century the influence of the school of Giotto made itself felt, especially in fresco painting, in the works of the brothers Pietro and Ambrogio Lorenzetti (early fourteenth century). During the fifteenth century the painters of Siena, little affected by the Renaissance, both in style and subject, persisted in the art of the fourteenth. The new school which was founded in the sixteenth century by Sodoma (1477–1549), a pupil of Leonardo, was a transplanting of the Lombard manner into Siena. Its chief representatives were Girolamo della Pacchia, the architect Peruzzi, and Domenico Beccafumi. For a more detailed account, see Painting. Consult: Crowe and Cavalcaselle, *History of Painting in Italy* (ed. by Langdon Douglas, New York, 1903); F. H. A. Seymour, *Siena and her Artists* (Philadelphia, 1907); Bernhard Berenson, *Central Italian Painters of the Renaissance* (New York, 1909); the bibliography under Painting, *Italy*.

SIENKIEWICZ, syĕn-kyĕ'vēch, Henryk (1846–). A famous Polish novelist, born in Wola Okrzejska, Government of Siedlce. On graduating from the Realgymnasium at Warsaw he studied philosophy at the university of that city, making his literary début in 1872 with a sketch of Kiev student life entitled *In Vain* and a humorous story, *Nobody is a Prophet in his own Country*. In 1876 he visited California and described his experiences in a series of letters to the *Polish Gazette* (of Warsaw) under the pseudonym Litwos. They attracted much attention by their keen observation, quaint humor, and generally attractive style. His drama, *On a Card* (1879), dealing with the party struggles in Galicia, as well as his stories, *From the Note-Book of a Posen Teacher*, *Hanja*, and *Yanko the Musician*, increased his popularity. In 1880 he produced the novel *The Tatar Bondage*. Its success induced him to continue work in the same line, resulting in his great trilogy *With Fire and Sword* (1884), *The Deluge* (1886), and *Pan Michael* (1888)—by far the greatest novels dealing with the struggle of the Poles and Cossacks. The characters are often untrue to history, but the power of evoking historical personages and surrounding them with a halo of romanticism places Sienkiewicz's works among the most enjoyable historical novels. His *Without Dogma* (1890), written in the form of a diary, is a study in pathological psychology. *The Children of the Soil* (1894) is a novel of contemporary Polish manners. *Quo Vadis* (1895), repeatedly dramatized, brought its author greater fame than all his previous efforts. He sagaciously saw and fully exploited the dramatic possibilities of the remarkable epoch of Nero's reign for an historical novel. His *Knights of the Cross* (1904) takes the reader back to the time of the struggles between the Poles and the Teutonic Order. Other works are: *Life and Death and Other Legends and Stories* (1904); *On the Field of Glory* (1906); *In Life's Whirlpool* (1910); *In Desert and Woodland* (1911). In 1905 he received the Nobel prize in literature. For many years he was editor in chief of the periodical *Slowo*. His works have been translated into many European languages. Consult W. L. Phelps, *Essays on Modern Novelists* (New York, 1910).

SIERO, sē-ā'rō. A town of north Spain, in the Province of Oviedo, situated 10 miles east of Oviedo. There are coal mines in the neighborhood, and the town has considerable manufactures of leather, as well as soap and cloth. Pop., 1900, 22,657; 1910, 25,077.

SIERRA, syĕr'rȧ. See Cero; Spanish Mackerel.

SIERRA LEONE, sē-ĕr'rȧ lē-ō'nē. A colony and a protectorate of Great Britain on the west coast of Africa. The colony comprises a narrow strip 8 to 20 miles wide along the coast from the Great Scarcies River (the boundary line of French Guinea) to the Mano River (the boundary line of Liberia), including also the islands of Sherbro, Banana, Turtle, Yellaboi, and a number of other islets, having an estimated area of about 4000 square miles (Map: Africa, C 4). The protectorate extends inland for about 180 miles. Area, 27,000 square miles. The coast, much indented, is low and marshy and lined with sand banks and lagoons. Hills rise almost from the shore and soon give way to a plateau (culminating in heights of 3000 to 4000 feet) rising towards the north. The region is well watered and traversed by many streams which flow in a southeasterly course to the Atlantic; then offer, however, but a few miles of navigable way. Sierra Leone has long been known as the "white man's grave" on account of its climate, but this characterization is true only of the low coast region, the interior being less unhealthful. The dry season near the coast lasts from January 1 to the end of March, and the true wet season sets in by May and continues to the end of October. The dry season is characterized by a persistent dry northeast wind. The rainfall is heavy, ranging at Freetown on the coast from about 140 to over 200 inches per annum. The mean annual temperature at Freetown is about 80° F. The principal products are palm kernels and oil, cola nuts, and gum copal. Imports and exports in 1905 were valued at £702,-

649 and £563,150 respectively; in 1913, £1,750,303 and £1,730,952. A government railway runs from Freetown to Pendembu, 227 miles; from Boia Junction (64 miles from Freetown) a branch extends to Makene, 83 miles; and a further extension to Baga has been begun. The Governor is assisted by nominated executive and legislative councils. The capital is Freetown. There are about 105 primary schools, under denominational control, with about 7500 pupils; also a number of Mohammedan schools maintained by the government. Revenue, in 1913, £618,383; expenditure, £622,439; public debt at end of 1913, £1,295,676. The population of the colony proper in 1891 was 74,835; in 1911, 75,572, of whom 702 were white. The population of the colony and protected districts was returned at 1,024,178 in 1901 and at 1,403,132 in 1911. Freetown, which has the best harbor in west Africa, had 34,090 inhabitants in 1911.

The coast of Sierra Leone was discovered by the Portuguese in the fifteenth century and settled by the English in the seventeenth century, but soon abandoned. In 1787 a colony of fugitive slaves was sent there by English philanthropists, who had purchased some territory from the natives. The first attempt having proved unsuccessful, a second settlement was established in 1791, and in 1792 the colony was augmented by 1200 fugitive slaves from Canada and the Bahamas. In 1807 the company transferred its territory to the crown, and in 1896 a British protectorate was declared over the hinterland.

Bibliography. Jackson, *The Settlement of Sierra Leone* (London, 1884); G. A. L. Banbury, *Sierra Leone* (ib., 1888–89); Ingham, *Sierra Leone after a Hundred Years* (ib., 1894); A. T. Pierson, *Seven Years in Sierra Leone* (ib., 1897); J. J. Crooks, *History of the Colony of Sierra Leone* (ib., 1903); H. C. Lükach, *Bibliography of Sierra Leone, with Essay on the Origin, Character, and Peoples of the Colony* (Oxford, 1910); T. J. Alldridge, *Transformed Colony: Sierra Leone as it Was and Is* (Philadelphia, 1910).

SIERRA MADRE, mä′drȧ. A name borne in common by the two chief mountain ranges of Mexico, which are nearly parallel to either coast and inclose the great central plateau of Anahuac (q.v.). The western range is often called Sierra Madre Occidental or Sierra Madre del Pacífico; the eastern is called Sierra Madre Oriental. They are widely separated in the north, but converge towards the south. A little to the south of Mexico City the intervening plateau is bridged over by the range of lofty volcanoes known as the Cordillera de Anahuac, and farther south the two ranges merge in the mountains of Oaxaca. The western range is continuous and higher and more rugged than the eastern, some peaks rising above 10,000 feet. The lower slopes are grassy; higher up are oaks, while pine forests cover the high ridges. Both ranges consist of granite, with intrusions of basaltic and other volcanic rocks. The system does not seem to be connected with the South American Andes, and structural connection with the northern Rockies has not been clearly shown.

SIERRA MADRE. A mountain range extending along the east coast of Luzon (q.v.).

SIERRA MORENA, mō-rā′nȧ. A mountain range, the southern escarpment of the great Iberian plateau (Meseta) in Spain, forming the boundary between the provinces of Ciudad Real on the north and Jaén and Cordova on the south (Map: Spain, D 3). It rises but slightly above the plateau, its average elevation being about 3500 feet, but on the south it falls in a steep and imposing cliff towards the low valley of the Guadalquivir. The railroad from Madrid to Cordova crosses it through several tunnels in the romantic pass called the Puerto de Despeñaperros.

SIERRA NEVADA, nȧ-vä′Dȧ (snowy range). A mountain range of south Spain, a part of the Andalusian system of crust folds lying between the Guadalquivir and the south coast, extending from the centre of the Province of Granada about 60 miles eastward into the Province of Almería, its crest being about 28 miles from the Mediterranean coast (Map: Spain, D 4). The loftiest summit of the Sierra Nevada and of all Europe outside the Alps is Mulahacén, with an altitude of 11,420 feet, while Veleta rises to 11,385 feet. Eastward it merges gradually into a lower plateau region. It sends out numerous spurs inclosing deep valleys and on the north falls in wild and rocky precipices towards the Jenil River, on whose banks lies the city of Granada. The range consists mainly of mica slate, and, though the low valleys are covered with a rich vegetation, the bulk of the mountain consists of naked rocks. It is covered with snow a great part of the year, and on the Veleta there are permanent glaciers, the southernmost of Europe.

SIERRA NEVADA, nē-vä′dȧ. A mountain range in eastern California, forming the divide between the Great American Basin and the valley of the Sacramento and San Joaquin rivers (Map: California, E 3). It is a tilted plateau 70 to 100 miles wide and extending in a north-northwest direction for nearly 500 miles to Lassen Peak. In the south it turns westward and merges with the Coast Range, and in the north it is continued into Oregon as the Cascade Mountains. It is a range of great geologic complexity, with rocks ranging from Archean to recent times. The rocks are made up of highly compressed schists and slates with large areas of associated igneous rocks, chiefly granite and diabase, upon which lie unconformably a series of later Cretaceous and Tertiary sediments and volcanics. The average elevation of the crest is over 11,000 feet. The range falls abruptly on the east to the valley floor of the Great Basin, 5000 feet below, while on the west it has a wider and more gradual slope. The Sierra Nevada, whose greatest elevation but slightly exceeds that of the Rocky Mountains, appears much more massive and impressive than the latter range, as it rises from a much lower level. The number of peaks, however, is not as great as in Colorado, though there are a number of peaks over 12,000 feet high. The highest peaks are clustered near the southern end, and here Mount Whitney, the highest point in the United States proper, attains an altitude of 14,502 feet. Other high points are: Fisherman Peak, 14,448 feet; Mount Corcoran, 14,093 feet; Mount Kaweah, 13,752 feet; Mount Brewer, 13,886 feet; Mount Lyell, in the Yosemite Park, 13,090 feet. The higher portions show perpetual snow, and the northern slopes of some peaks are occupied by small glaciers. The snowfall is heavy on the western slope and feeds a large number of streams to the Sacramento and San

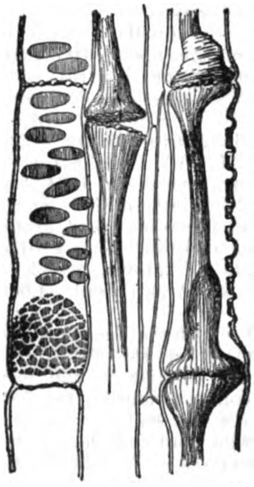
Joaquin rivers. These streams have cut the slope into deep valleys, some of which, notably the Yosemite valley, are remarkable for their scenery. The Sierra Nevada is covered to a height of 9000 feet with dense coniferous forests, which yield to deciduous on the lower west slope. This slope, above the deciduous zone, is the exclusive habitat of the big trees (*Sequoia gigantea*). Though it is practically an unbroken divide, there are several passes leading across the range at altitudes of 4000 to 7000 feet. Of these the Truckee Pass (5818 feet) in the north and the Tehachapi Pass (3966 feet) in the south are traversed by railroads. Consult: Clarence King, *Mountaineering in the Sierra Nevada* (New York, 1902); John Muir, *Mountains of California* (ib., 1911); id., *My First Summer in the Sierra* (Boston, 1911).

SIEVERS, zē'vērs, EDUARD (1850-). A German philologist, born at Lippoldsberg, Prussia. Educated at Leipzig and Berlin, he became assistant professor at Jena in 1871, receiving full professorship in 1876. In 1883 he went to Tübingen, in 1887 to Halle, and was called in 1892 to Leipzig. In 1896 a Festgabe was presented him by pupils and friends. Among the contributions of Sievers to Germanic philology are his editions of *Tatian* (2d ed., 1892), *Heliand* (1878), and *Die althochdeutschen Glossen* (4 vols., 1879-98), in collaboration with Steinmeyer. His original works include *Der Heliand und die angelsächsische Genesis* (1875) and *Angelsächsische Grammatik* (3d ed., 1898; Eng. trans. by A. S. Cook, Boston, 1885; 3d ed., 1903). Among his contributions to metrics are his *Altgermanische Metrik* (1893), *Metrische Studien* (3 vols., 1901-05), and *Amos* (1907), dealing with Hebrew metres, while his *Grundzüge der Phonetik* (5th ed., 1901) is a standard work on phonetics. From 1892 to 1906 he edited Paul and Braune's *Beiträge zur Geschichte der deutschen Sprache und Litteratur* and contributed to Paul's *Grundriss der germanischen Philologie* (Strassburg, 1891 et seq.).

SIEVERS, JAKOB JOHANN, or YAKOV YEFIMOVITCH, COUNT (1731-1808). A Russian statesman, born at Wesenberg, Esthonia. He served in the Foreign Office, was Secretary to the Copenhagen and London embassies, and saw active service in the Seven Years' War. Made Governor of Novgorod in 1764 and afterward Governor-General of Novgorod, Tver, and Pskov, he introduced many important reforms. In 1789, after eight years of retirement, he was appointed Ambassador to Poland and was largely instrumental in bringing about the second and third partitions of that country. Recalled in 1794, he lived in retirement until Czar Paul made him Senator (1796). In 1797 he was intrusted with the direction of water communications. The canal he built (1798-1803) between the Volkhov and Msta rivers bears his name. Consult Blum, *Ein russischer Staatsmann: des Grafen Jacob Johann Sievers Denkwürdigkeiten zur Geschichte Russlands* (Leipzig, 1857-58).

SIEVERS, WILHELM (1860-). A German geographer, born at Hamburg. He was educated at Jena, Göttingen, and Leipzig, was made privatdocent at Würzburg in 1887 after extensive travels in Venezuela and Colombia, and became professor at Giessen in 1903. In 1892 he undertook for the Geographical Society of Hamburg further explorations in South America. The following publications bear his name: *Reise in der Sierra Nevada de Santa Marta* (1888); *Allgemeine Länderkunde* (5 vols., 1891-1907); *Zweite Reise in Venezuela* (1896); *Süd- und Mittelamerika* (1903).

SIEVE VESSELS. Tubelike elongated cells, characteristic of the phloem (q.v.), placed end to end and communicating with one another by means of perforated areas (sieve plates) in the walls. See HISTOLOGY; WOOD.



SIEVE VESSELS OF PUMPKIN.

SIEYÈS, sē'ā'yâs', EMMANUEL JOSEPH, COUNT (1748-1836). A French revolutionary leader and publicist, generally known as the Abbé Sieyès. He was born at Fréjus and was educated at Paris with the Church in view. He was made a canon in Brittany (1775) and later transferred to the cathedral of Chartres, becoming diocesan chancellor and vicar-general. He had liberal opinions on all social and political matters, and in 1789 he issued his famous pamphlet entitled *Qu'est-ce que le tiers-état?* This work, which claimed political recognition for the people, obtained immense popularity and procured his election as Deputy to the States-General from Paris. Through his urgency and influence the representatives of the people took the decisive step of constituting themselves into an independent body, on June 16, 1789, and became the National Assembly. In this body Sieyès figured prominently. In 1790 he was elected its President. By this time bolder and fiercer spirits had passed him in the race for power, and in the Convention of 1792 he refrained from active participation in the debates, and at the King's trial he recorded a silent vote for death without appeal to the people. While Robespierre and his party were in power, he left Paris. On the fall of Robespierre he returned to the Convention, resuming active interest in affairs, becoming a member of the Council of Five Hundred. He was engaged chiefly in the Department of Foreign Affairs and went in 1798 as Ambassador to Berlin to secure the neutrality of Prussia. He became a member of the Directory in 1799 and succeeded in closing the celebrated Jacobin Club. Perceiving that a dictator was needed in France, he sought the coöperation of some powerful military leader, and on Bonaparte's return from Egypt Sieyès entered into a league with him, the result of which was the revolution of the 18th Brumaire (Nov. 9, 1799) and the institution of the provisional Consulate, Sieyès, Napoleon, and Roger Ducos being the three consuls at first. Sieyès and Napoleon differed irreconcilably as to the distribution of power, but Sieyès gave way and finally retired. He received 600,000 francs, the estate of Crosne, and a seat in the Senate. The title of Count of the Empire was conferred upon him. Banished at the second Restoration as a regicide, he went to Brussels and did not return to France till after the revolution of 1830, when he was elected a member of the Academy. His *Reconnaissance et exposition des droits de l'homme et du citoyen* (Paris, 1789) undoubtedly led up to the Declaration of the Rights of Man. His constitution is explained in Boulay, *Théorie constitutionelle de Sieyès* from the *mémoires inédits* of Sieyès (Paris, 1836). Consult: F. A. L. Mignet, in *Notices et mémoires historiques*, vol. i (Paris, 1843); Edmond de Beauverger, "Etude sur Sieyès," in *Tableau historique du progrès de la philosophie politique* (ib., 1858); Bigeon, *Sieyès* (ib., 1873); A. Neton, *Sieyès, 1746–1836, d'après des documents inédits* (ib., 1900); *Cambridge Modern History*, vol. viii (New York, 1904).

SIFFLEUR, sē′flẽr′. See Whistler.

SIFTON, Arthur Lewis (1858–). A Canadian statesman, born at St. John's, Ontario, and educated at Wesley College, Winnipeg, and at Victoria University, Cobourg. He went to the Canadian Northwest in 1875, was admitted to the bar in 1883, and was a member of the Legislature of the Northwest Territories in 1899–1903. After serving as treasurer and later as Commissioner of Public Works in the administration of Frederick William (later Chief Justice) Haultain, he was Chief Justice of the Supreme Court, Northwest Territories (1903–05); from the organization of the Province of Alberta, in 1905, till 1910 he was Chief Justice of its Supreme Court; and in 1910 he became Liberal Premier of Alberta, holding also the offices of Provincial Treasurer and Minister of Public Works.

SIFTON, Sir Clifford (1861–). A Canadian statesman, born in Middlesex County, Ontario, and graduated at Victoria University, Cobourg, in 1880. Removing to Manitoba, he was called to the bar in 1882 and practiced his profession at Brandon. He was a Liberal member of the Manitoba Legislature (1888–96), and in 1891–96 was Attorney-General in the administration of Thomas Greenway (q.v.). Sifton was one of the most prominent opponents of the Manitoba remedial measure by which the Dominion government sought to establish separate schools in Manitoba (q.v.). In 1896–1911, while Minister of the Interior in the Laurier administration, he formulated the immigration policy whereby Canada received an influx of settlers unprecedented in its history. Differing with Sir Wilfrid Laurier in 1911, he resigned his office and opposed the Taft-Fielding reciprocity agreement. In 1903 he was British Agent before the Alaskan Boundary Tribunal and in 1910 was appointed chairman of the Royal Canadian Conservation Commission. In 1915 he was knighted (K.C.M.G.).

SI-GAN-FU. See Si-Ngan-Fu.

SIGEBERT OF GEMBLOUX, sēzh′bâr′ ov zhäN′bloo͞′ (c.1030–1112). He was born in Brabant and spent almost the whole of his life at Gembloux. He is "the best of the universal chroniclers of the Middle Ages," and his works had an extraordinary vogue. Of his numerous writings the best known is his *Chronographia*, or chronicle from 381 to 1111 A.D. The best edition is in the *Monumenta Germaniæ Historica*, vol. vi. Consult Auguste Molinier, *Les sources de l'histoire de France* (6 vols., Paris, 1902–06), passim.

SIGEL, sē′gel, Franz (1824–1902). A German-American soldier, born at Sinsheim in Baden. In 1848 he took a prominent part in the revolutionary movement in Baden and on the renewed outbreak of the insurrection, in the spring of 1849, commanded the troops on the Neckar. In May he was made a member of the provisional government and Minister of War; later he became Mieroslawski's adjutant general and then leader of the revolutionary forces, conducting their retreat into Switzerland. In 1852 he emigrated to the United States. On the outbreak of the Civil War he espoused the side of the North and organized a regiment of infantry and a battery of artillery. In 1861 he was defeated in the battle of Carthage, though conducting a successful retreat; later he took part in the battle of Dug Springs and, after the death of General Lyon at Wilson's Creek, again led an orderly retreat. He was made a brigadier general of volunteers and at the battle of Pea Ridge in 1862 gained the day by a spirited charge. He was then promoted major general of volunteers and was placed in command of Harper's Ferry. He commanded the First Corps in the campaign which terminated with the second battle of Bull Run, and in 1864 was given command of the Department of West Virginia. The same year he led an expedition into the Shenandoah valley, but in May was defeated at New Market by General Breckenridge and was relieved of his command by General Hunter. In the following July he successfully defended Maryland Heights against General Early, but the administration had lost confidence in him, and he was relieved of command. He resigned from the army in 1865. In 1869 he removed to New York City, was register thereof in 1871–74 and United States pension agent in 1886–89. For several years he published the *New York Monthly*, a German-American periodical.

SIGERSON, sĭj′ẽr-son, George (c.1839–). An Irish scholar, poet, and scientist, who took up the work of James Mangan (q.v.), and prepared the way for the Celtic revival of the early twentieth century. He was born at Holyhill, County Tyrone, and studied medicine in Paris. His medical and other scientific works brought him recognition at home and abroad, notably from Darwin and Tyndall, the latter praising especially his *Microscopic Researches on the Atmosphere* (1873). He was appointed professor of botany at the Catholic University and later of zoölogy at University College, Dublin. He wrote also soundly and competently on history, on the Irish land question, and on the care of prisoners; and he was a trenchant leader writer, as his contributions to the *Irishman*, the *Nation* (Dublin), and the *Harp* attest. For a time he served as president of the National Literary Society, Dublin. It is probably as a translator of Gaelic poetry and as a poet on his own account that he will be longest remembered. In these fields his publications include: *The Poets and Poetry of Munster* (2d series, 1860, with metrical translations), signed Erionnach; *Bards of the Gael and Gall* (1897; new ed., 1907); and the selections in *The Treasury of Irish Poetry* (1900), edited by Stopford Brooke and T. W.

Rolleston (qq.v.). He is among the Irishmen introduced, often satirically, in George Moore's *Hail and Farewell* (3 vols., New York, 1911–13). See IRISH LITERATURE, *Irish Literature in English.*

SIGEUM, DAMASTES OF. See DAMASTES OF SIGEUM.

SIGHT (AS. *ge-sihþ*, OHG. *ge-siht*, Ger. *Gesicht*, from AS. *sēon*, OHG. *sehan*, Ger. *sehen*, to see; connected with Lat. *sequi*, Gk. ἕπεσθαι, *hepesthai*, Lith. *sekti*, Skt. *sac*, to follow), DEFECTS OF. Under this head may be considered certain affections of the eyesight due to some known or unknown peculiarity of the optical apparatus (including the optic nerve), as nearsightedness, farsightedness, double vision, color blindness, night blindness, and day blindness. Defects due to errors of refraction include the first two of these.

Nearsightedness, shortsightedness, or myopia is often popularly confounded with dim or weak sight; but in reality short sight applies exclusively to range and not to power of sight, and a shortsighted person may possess acute power of vision for near objects. In this affection rays which ought to come to a focus upon the retina converge to a point more or less in front of it. Its cause probably differs in different persons, but it generally arises from elongation of the globe in its anteroposterior diameter, more rarely from increased curvature of the cornea, increase in refractive power of the lens in the early stage of senile cataract, or from an imperfect power of the eye to adjust itself to various distances. The distance at which objects are perceived most distinctly by the perfectly normal eye ranges from 16 to 20 inches; an eye which cannot perceive objects distinctly beyond 10 inches may fairly be regarded as shortsighted; and in extreme cases the point of distinct vision may be 3, 2, or even only 1 inch from the eye. There is frequently an hereditary tendency to nearsightedness, but it is rarely congenital. It is often acquired by excessive use of the eyes at an early age for reading or other near work, or overstudy under unfavorable circumstances and poor health. As a general rule the inhabitants of towns are much more liable to it than persons living in the country, and students and literary men are most liable of all. The frequency of myopia in the cultivated classes points directly to its principal cause—tension of the eyes for near objects. Prolongation of the visual axis is attributed to (1) pressure of the muscles on the eyeball in strong convergence of the visual axis; (2) increased pressure of the fluids resulting from accumulation of blood in the eyes in the stooping position; (3) congestive processes in the base of the eye, which, leading to softening, give rise to extension of the membranes; (4) the shape of the orbit in broad faces, causing excessive convergence, trouble occurring especially in such persons. That in increased pressure the extension occurs principally at the posterior pole is explained by want of support there from the muscles of the eye. Also, the injurious effect of fine work is, by imperfect illumination, still more increased; for thus the work must be brought closer to the eyes, and the stooping position of the head, particularly in reading and writing, is increased. Hence it is that in badly lighted schoolrooms the foundation of myopia is often laid. On the contrary, in watchmakers, although they sit the whole day with a magnifying glass in one eye, we observe no development of myopia, undoubtedly because they fix their work with only one eye and therefore converge but little.

Shortsightedness is often a progressive affection. Those cases in which myopia develops slightly in young persons and practically becomes arrested are called simple or stationary myopia. Progressive myopia is the form which increases steadily with degenerative changes in the choroid and other deep structures. Persons with uncorrected myopia of any severity have a characteristic vacant expression from inability to see other than near objects.

In the treatment of myopia the principal objects are: (1) to prevent its further development and the occurrence of secondary disturbances; and (2), by means of suitable glasses, to render the use of the myopic eye easier and safer. (1) To effect, if possible, the first object, the patient must look much at a distance, but, as we cannot absolutely forbid his looking at near objects, spectacles must be provided which render vision distinct at from 16 to 18 inches. Moreover, it is desirable that at intervals of a half hour work should be discontinued for a couple of minutes, and no working in a stooping position should be permitted. The patient should read with the book in the hand, and in writing should use a high and sloping desk, with good but not too strong light from behind. If the myopia increases, work should be replaced by outdoor life. (2) The optical remedy for short sight obviously consists in concave glasses of a focus suited to the individual. At first sight it might be supposed that glasses with a concavity exactly sufficient to neutralize the defect in the eye would always suffice; and when the glasses are used exclusively for distant vision, or when the affection is slight and the eye is otherwise healthy, perfect neutralization is admissible; but many require different glasses for distance and reading. An oculist should always be consulted as to the choice of spectacles. Glasses, if injudiciously selected, usually aggravate the evil they are intended to remedy.

Farsightedness, hyperopia, or hypermetropia is an error of refraction in which parallel rays are brought to a focus behind the retina, usually on account of shortening of the eyeball, sometimes from diminished convexity of cornea or lens, absence of the lens (aphakia), or changes in the refractive index of the media. It is more common than myopia, is congenital and often hereditary. As the hyperopic eye is obliged to accommodate for parallel rays, it is constantly strained unless corrected by proper convex glasses. If uncorrected it leads to symptoms of asthenopia or eyestrain, frontal and occipital headaches, pain in the eyes, congestion and burning sensations in the lids and eyeballs.

Presbyopia (from the Greek words πρέσβυς, *presbys*, an aged person, and ὤψ, *ops*, the eye), or old sight, is a change which naturally occurs in every eye between the fortieth and forty-fifth year. On account of loss of elasticity of the lens the power of accommodation is diminished. The stated time for the occurrence of presbyopia has been arbitrarily fixed, as that is the period at which the nearest point to the eye at which ordinary print can be easily read has receded to 9 inches and some discomfort is experienced. The near point really begins to recede at 10 years of age and continues to do so through life. If uncorrected there is difficulty in reading, blurring of print, and symptoms of eyestrain as in hyperopia. Correction is secured by convex spherical glasses, which bring the near print to a comfortable distance with respect to the person's occupation. Allowance must be made for coexisting myopia, hyperopia, or astigmatism, and the strength increased at intervals.

Double vision, or diplopia, may arise from a want of harmony in the movements of the two eyes due to imperfect functioning of the external muscles of the eyes. In squinting (see STRABISMUS), the vision of the most distorted eye is almost always imperfect. Impressions on the two retinæ are similar in kind but dissimilar in form. The mind takes cognizance only of the former, so that a person with a pronounced squint sees objects with the sound eye only. But if the sight of both eyes is nearly equal, as often is the case when the squint is slight, double vision results whenever both eyes are employed together, in consequence of images of nearly equal intensity falling on noncorresponding parts of the two retinæ. This variety of double vision can be corrected by suitable glasses.

Color blindness is noticed under its own name. Night blindness, or nyctalopia (from the Greek, signifying "night sight"), is a peculiar form of intermittent blindness, the subjects of which see perfectly with an ordinary light, but become entirely and almost instantaneously blind as soon as twilight commences. The most probable cause of the affection is exhaustion of the power of the retina from the overexcitement of excessive light, so that this organ is rendered incapable of appreciating the weaker stimulating action of twilight or moonlight. Snow blindness must be regarded as an allied affection to the preceding. Day blindness, or hemeralopia (from the Greek, signifying "day sight"), refers to the condition in which the sight is better in a feeble light, as at dusk, than in bright light. This occurs in amblyopia (q.v.) from overuse of tobacco, and in cases in which there is defective vision of the central portion of the visual field. For example, if there is an opacity of the central portion of the lens or cornea, the dilatation of the pupil which takes place in a feeble light allows the person to see through the unobstructed portion of the cornea or lens surrounding the opacity. Colored vision sometimes occurs either with or without retinal changes. Red vision, erythropsia, may come after extraction of a cataract. Xanthopsia, or yellow vision, may follow the ingestion of santonin, gelsemium, digitalis, chromic and picric acids, and amyl nitrate. Cannabis indica sometimes causes violet vision. Red or blue vision may result from use of iodoform, and cocaine has caused colored vision. Phosphorus is said to cause sparks and flashes of light, and the same is said to occur with belladonna and santonin.

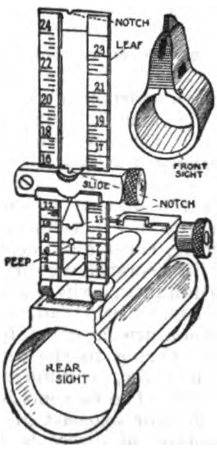
Other defects of sight are described under AMAUROSIS; AMBLYOPIA; ASTHENOPIA; ASTIGMATISM; HEMIOPIA; HETEROPHORIA. See VISION.

SIGHT, SECOND. See SECOND SIGHT.

SIGHTS. The mechanical or optical means of determining when the axis of the gun has the predetermined direction with respect to the line from the gun to the target. The line of sight is an imaginary straight line drawn in continuation of two points of the sight system. It may be fixed in one of two ways. First, by means of two plain or open sights, and second, by means of a telescope, provided with cross hairs, called the reticule.

The open sight is generally not used except on small arms, although large cannon are generally provided with it in addition to the telescope for use in case the latter should become damaged. Similarly telescopic sights are in some cases fitted to small-arm rifles, but generally only for the use of expert marksmen. The principles and uses of the open sight may be learned by examining the open sight as used on the United States magazine rifle. This sight is to all intents the same for the rifles of all countries.

A rifle or gun, to enable the bullet or projectile to reach a certain target, must be given a certain elevation over a line drawn from the gun to the target, and must also be given a certain deviation. The amount of elevation depends on the distance to the target and the weight and velocity of the bullet. A deviation correction is needed, since the rotational velocity of the bullet, imparted to it by means of the rifling, gives it a certain amount of drift. In addition to the above, additional corrections must be made for variations in atmospheric conditions, wind, etc.

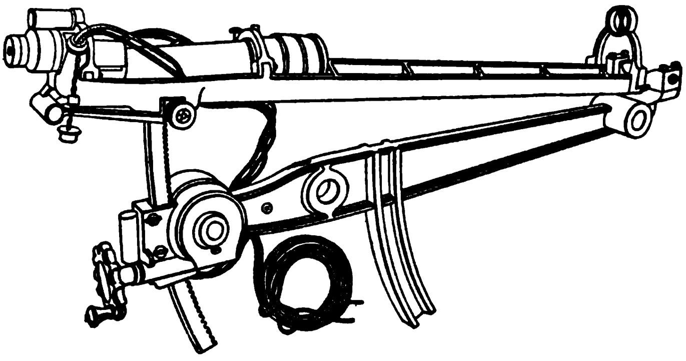


SIGHTS, UNITED STATES SPRINGFIELD RIFLE (1906 MODEL).

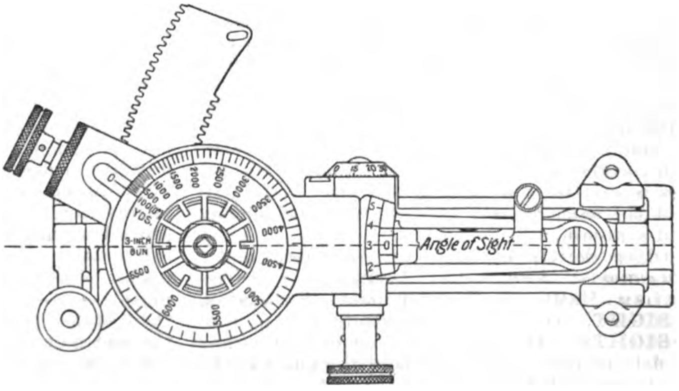
The purpose of the sight is to insure that, when it is correctly set, the gun shall have the correct direction with respect to the line of sight, so that when the line of sight is on the target the projectile will pass through the target.

In pistols and revolvers, where short-range firings are the rule, the sights consist of a notch placed near the rear end and a foresight near the muzzle. For these, corrections for elevation and deviation are not required or provided. In military rifles, however, adjustment must be given to enable the aim to be accurately taken at any range up to 2900 yards. Military sights are all variations of one general type and usually consist of a leaf either lying flat or hinged upon a bed or block fixed to the barrel. The leaf must be raised to secure additional elevation, the distance being regulated by a sliding bar, in the centre of which a notch has been cut, through which the sight is taken over the tip of the foresight.

Automatic correction for drift, which increases with the range, is accomplished by the slide moving in grooves in the leaf. These grooves are cut such that, as the slide is raised, it is also carried to the left. A windage screw is also provided, which is located at the front end of the sight base and by means of which the entire sight is shifted sideways to correct for varying velocities of side winds. Lateral adjustment is rarely necessary at the distances at which sporting rifles are used. Sportsmen sometimes employ a foresight of the covered bead variety or the ivory or copper sight used by African hunters. The Boers, who rank high as practical marksmen, employ the ivory foresight, but European and American sportsmen who have engaged in African or big-game shooting generally use the copper sight. Various forms of rear sight are in use, perhaps the best of which is the platina bar on a more or less open V. Another favorite type is the platina pyramid, which is set below a very open V. Telescopic sights are affixed to sporting rifles and have been found very successful in deerstalking or any form of hill and mountain hunting where game is difficult to locate. See RIFLE, HUNTING.


TELESCOPIC SIGHT USED ON SEACOAST CARRIAGES.

Sights for cannon are in principle the same as sights for rifles. Owing to the different conditions existing, however, a different method is generally employed. The two methods employed in giving large field or seacoast guns the proper direction are method of direct laying and that of indirect laying. Direct laying, the method for rifles, is employed for large guns where the target is in view of the gunner. It is used in naval target practice and to a certain extent in seacoast firings. It may be used for field-artillery fire in cases where the guns are not placed behind covers. On account of the long ranges generally fired at, telescopic sights are generally used, but in any case the graduations and settings of the sights are such that, when they are correctly set and the line of sight is pointing at the target, the line of the axis of the bore of the gun is such that, considering the range, drift, wind, and atmospheric conditions, the projectile will pass through the target.



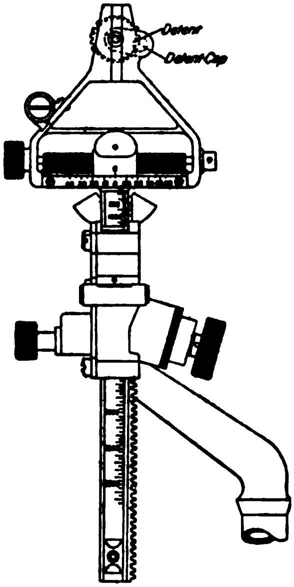
GUNNER'S QUADRANT (UNITED STATES 3-INCH FIELD GUN).

It is evident that, where the target is concealed either by being placed behind cover or by the gun itself being behind cover for protection, direct laying cannot be used. For such a condition the method of indirect laying is employed. This is the condition generally prevailing in field-artillery fire, and the method of indirect laying is therefore generally the one employed. This method consists in separating the giving of direction of the gun into two distinct parts, viz., that of giving the gun the proper elevation for the range and that of giving it the proper direction.

The elevation is given the gun by means of an instrument, generally located on the right side and called the quadrant. This instrument is provided with a range drum so connected to an arc pivoting about a centre that, when the drum is set at the proper range and the level attached to the arc is leveled by moving the gun about its trunnions, the gun will have the proper elevation for the range set on the drum, provided the target is on the same level as the gun. If, however, the target is above or below the level of the gun, the elevation of the gun must be increased or decreased by the angular amount the target is above or below, which amount is called the angle of site of the target. To give the gun this additional elevation, whether positive or negative, the quadrant, instead of having the level mounted directly on the range drum arc, has it mounted on an auxiliary arc, which arc is set to a predetermined setting corresponding to the angle of site of the target.

The proper direction of the gun is given by the panoramic sight on the left side. The objective of this sight is mounted in a hood which can be rotated in a horizontal plane. It is set by using a graduated arc so that, when pointed at a selected visible aiming point, the horizontal angle between the direction of the line of sight, when parallel to the axis of the bore, and its direction when pointing at the aiming point is the same as the angle between the aiming point, gun, and target. This angle is determined by a rapid triangulation by the battery commander.

The unit of graduation used in the United States and many European countries is the mil. A mil is 1/6400 of a circumference, and a mil of arc is approximately 1/1000 of the radius or range. This is convenient in many respects in fire control, since it offers, e.g., an easy means of determining the angular difference there must be between the settings of two guns of a battery when aiming at the same aiming point, but shooting at different parts of the target. For example, for a target having a front of 100 yards and located 5000 yards, there must be a difference of 20 mils between the panoramic sight readings for two guns placed side by side and aiming at the same aiming point and firing at each end of the target.



REAR SIGHT FOR UNITED STATES 3-INCH FIELD GUN. PANORAMIC SIGHT FITS IN SLOT AT TOP.

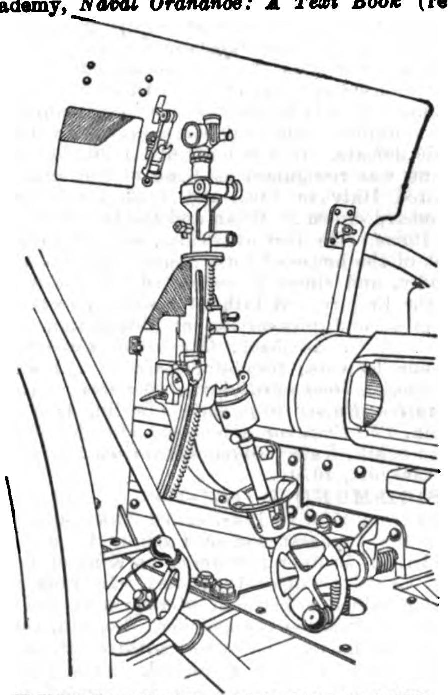
The independent line of sight is a peculiar construction used on field-artillery guns to increase the rapidity of setting. It consists in placing an intermediate carriage between the gun and the carriage proper. The means for giving direction is placed on the intermediate carriage, which is always kept level, while the elevation of the gun is measured between this leveled intermediate carriage and the gun proper.

For direct laying the intermediate carriage may be inclined equal to the angle of site of the target by aiming through the panoramic sight and elevating it until the line of sight passes through the target. For indirect laying the intermediate carriage is leveled, and the difference in elevation of the gun and the intermediate carriage is then the elevation required for the range increased algebraically by the angle of site of the target.

The reason for the resultant increase of speed with the independent line of sight is that, no matter how often and how much the elevation of the gun is changed, the direction or setting of the panoramic sight is not changed, since the latter is fixed to the intermediate carriage, which is always kept level. For the dependent line of sight the panoramic sight with sight shank must be raised in its seat, when the elevation of the gun is changed in order to retain the hood horizontal.

The independent line of sight was used in the French 75-millimeter field gun, employed with great success during the Great War. No other country, however, had adopted it previous to that time. It was adopted generally on new equipment procured by various countries. Italy was using it on their new gun, of the Deport split-trail type, and the new model United States field gun was to be provided with it. A somewhat different construction for the independent line of sight is used in Krupp carriages. In this the panoramic sight is geared to the elevating mechanism of the gun in such a way that, as the gun is elevated, the screw carrying the sight is extended, so that the hood of the panoramic sight is at all times kept level.

The guns of seacoast fortifications are generally aimed for direction by direct laying, while elevation is given them by moving the gun about its trunnion until the proper range is read off on the range disks. It may be aimed entirely by a method of indirect laying, in which case the elevation is set off as before, while the deflection is given to it by traversing the entire carriage until the proper deflection reading is read off on the azimuth circle fixed permanently in place. This deflection is determined by plotting the movement of the target from two towers located a certain known distance apart. Consult: H. G. Bethell, *Modern Guns and Gunnery* (Woolwich, 1910); British Army, *Handbook of Artillery Instruments* (London, 1914); O. M. Lissak, *Ordnance and Gunnery* (New York, 1914); Ommundsen and Robinson, *Rifles and Ammunition, and Rifle Shooting* (ib., 1915); United States Naval Academy, *Naval Ordnance: A Text Book* (rev. ed., Annapolis, 1915). See COAST ARTILLERY; FIELD ARTILLERY; HUNTING; ORDNANCE; RIFLE, HUNTING; SMALL ARMS; ETC.



INDEPENDENT LINE OF SIGHT AS MADE BY KRUPP.

SIG′ILLA′RIA (Neo-Lat. nom. pl., from Lat. *sigillum*, seal). An extinct genus of lycopods that flourished during the Carboniferous period, conspicuous in the swamp flora. They were often trees of great height. Both branches and trunk were crowded with sword-shaped leaves arranged in spiral series. See LEPIDODENDRON; STIGMARIA.

SIGISMUND, sĭj′ĭs-mŭnd, *Ger. pron.* zē′gēs-mụnt (1368–1437). Holy Roman Emperor from

1411 to 1437. He was the second son of the Emperor Charles IV, whom he succeeded in 1378 in the Margraviate of Brandenburg. In 1374 he was betrothed to Mary, heiress of Louis the Great, King of Hungary and Poland, and in 1387 succeeded to the Hungarian crown. In 1396 he undertook a crusade against the Turks supported by a large force of French and German knights, but at Nicopolis, September 28, he suffered defeat at the hands of Bajazet I. In 1401 a formidable uprising drove him from the throne, but he was restored by hired troops and seems henceforth to have ruled with wisdom and moderation. He waged wars to extend the power of Hungary over Bosnia, Dalmatia, and Servia, but, although success at first attended his efforts, Venetians and Turks checked him. He was elected Holy Roman Emperor in 1411 and was crowned at Aix-la-Chapelle in 1414. He now appears in his most celebrated rôle as the author and protector of the Council of Constance and the guiding spirit in its deliberations. He brought about the deposition of Pope John XXIII and showed himself zealous in the course of thorough ecclesiastical reform. Much obloquy, however, has attached to him for his desertion of John Huss (q.v.), whom he granted a safe conduct for the purpose of attending the council and then allowed to be burned at the stake. In 1419, on the death of his brother Wenceslas, the crown of Bohemia fell to Sigismund. But the Hussites (q.v.) were already in arms, and the country became the theatre of a long conflict, in which the forces of Sigismund and the crusading armies of Germany met with terrible defeats. It was not until 1436 that Sigismund was recognized as King of Bohemia. He visited Italy in 1431 and 1433, receiving the Lombard crown at Milan and the Imperial crown at Rome. He died at Znaim, Dec. 9, 1437, the last of the house of Luxemburg. He was gifted, kindly, and sincerely concerned for the welfare of the Empire, but failed from the defects of an amiable and pleasure-loving disposition. Consult: J. G. Aschbach, *Geschichte Kaiser Siegmunds* (4 vols., Hamburg, 1838–45); Eberhard Windecke, *Denkwürdigkeiten zur Geschichte des zeitalten Kaiser Sigmunds* (Berlin, 1893); A. Main, *The Emperor Sigismund* (London, 1903); Otto Schiff, *Kaiser Sigmunds italienische Politik* (Frankfort, 1910).

SIGISMUND I (1467–1548). King of Poland from 1506 to 1548, called THE GREAT. He was the youngest son of Casimir IV and succeeded his brother Alexander as King of Poland and Grand Duke of Lithuania. In 1508 Sigismund gained a brilliant victory over the Russians at Orsha on the Dnieper. Bogdan, voivode of Moldavia, was reduced to submission, and the Tatars were severely punished. Subsequent invasions of the Muscovites were repelled, and a rebellion of the Wallachs was defeated. A war with the Teutonic Knights ended in 1525 by the Treaty of Cracow, in which the Grand Master Albert, Sigismund's nephew, was recognized as Duke of Prussia, which was to be held as a fief of Poland. In 1526 Sigismund aided Hungary against Solyman the Magnificent, and a force of Polish cavaliers fought bravely at Mohács. An important event of Sigismund's reign was the introduction and extension of Lutheranism in Poland. He died at Cracow, April 1, 1548, and was succeeded by his son SIGISMUND II AUGUSTUS (1548–72), who continued the tolerant policy of his father and effected the permanent union of Lithuania and Poland at the Diet of Lublin (1569). He was the last of the male line of the Jagellons. See JAGELLONS; POLAND.

SIGISMUND, JOHN. See JOHN SIGISMUND.

SIGISMUNDA, sē'jēs-mụn'dȧ. The heroine of one of the most widely known tales in Boccaccio's *Decamerone*.

SIGMARINGEN, zēk'mȧ-rĭng-en. A line of the elder or Swabian branch of the house of Hohenzollern (q.v.).

SIGMA XI. A college honorary scientific fraternity. The growth of scientific studies in the universities in America led in 1886 to the organization at Cornell University, Ithaca, N. Y., of an honorary fraternity to which the name Sigma Xi was given, being the initials of the two Greek words *Σπουδῶν Ξυνῶνες*, signifying "companions in zealous research." The Sigma Xi bears the same relation to original research as the Phi Beta Kappa (q.v.) Society does to literary scholarship.

The object of this society is to encourage original investigation in science, pure and applied: by meeting for the discussion of scientific subjects; by the publication of such scientific matter as may be deemed desirable; by establishing fraternal relations among investigators in the scientific centres; by granting the privilege of membership to such students as have, during their college course, given special promise of future achievement.

There were, in 1915, 30 chapters in as many colleges or schools, as follows: Cornell (1886), Rensselaer (1887), Union (1887), Kansas (1890), Yale (1895), Minnesota (1896), Nebraska (1897), Ohio (1898), Pennsylvania (1899), Brown (1900), Iowa (1900), Stanford (1901), California (1902), Columbia (1902), Chicago (1903), Michigan (1903), Illinois (1903), Case (1904), Indiana (1904), Missouri (1905), Colorado (1905), Northwestern (1906), Syracuse (1906), Wisconsin (1907), Washington State (1907), Worcester Polytechnic (1908), Purdue (1909), Washington University (1910), District of Columbia (1915), University of Texas (1915).

The society admits as active members resident professors, instructors, graduate students, and undergraduates of both sexes; as alumni members former active members and any graduate of the institution of not less than five years' standing; and as honorary members scientific workers who have achieved eminence in some work of pure or applied science. The number of undergraduates elected during any one year may not exceed one-fifth of the senior class in the scientific and technical courses. The total membership in 1915 was 9045, of which 2292 were active members.

The badge is a watch-chain pendant or charm, consisting of the monogram formed in gold of the Greek letter Sigma, superimposed upon the Greek letter Xi, the former being somewhat smaller than the latter. The colors of the society are electric blue and white.

A general convention consisting of three delegates from the various chapters and the council (which acts as the executive committee of the society and is composed of the general officers and a member elected by each chapter from its active members) meets annually, at the same time as the American Association for the Advancement of Science.

In 1913 the society issued the *Sigma Xi Quarter Century Record and History, 1886–1911*, compiled by Henry B. Ward (Urbana, Ill.), and since March, 1913, has published the *Sigma Xi Quarterly* (ib.).

SIG'MOID FLEXURE. See INTESTINE; RECTUM.

SIGNAL CORPS, UNITED STATES ARMY. A branch of the army charged with the collection and transmission of military information. It provides the means of transmission of information not only for the army on a peace footing, but must be prepared to supply in case of war a force many times larger; it is required to build and maintain field and garrison lines of telegraph, buzzer, and telephone, to establish and operate at all times fixed radio stations, to devise and use radio apparatus for the field, to supervise the manufacture of and to lay and operate submarine cables, to manage cable ships, to maintain and use field companies for tactical purposes, to organize telegraph companies for practical use, to build up the aëronautical organization for the army, to maintain the fire-control communication system at coast defenses. See SIGNALING, MILITARY.

The United States army is the only army maintaining a separate corps for the collection and transmission of information. In France these duties are performed by the technical troops known as Engineers; in Germany, by the Engineers, subdivided as pioneer troops and communication troops; in England, signal duties are assigned to the Royal Engineers. In European armies military aëronautics are, as a rule, in charge of a separate corps. In the United States aëronautics is only one of the many duties of the Signal Corps.

History. The Signal Corps of the United States army dates officially from the appointment of Major Albert J. Myer in 1860 as chief signal officer. His system of military signals by means of flags was an improvement upon the semaphore telegraph, used since 1790 in Europe and to a slight extent in America. The Signal Corps received a separate and systematic organization by Act of March 3, 1863, and its members served efficiently on all fields of battle and even on naval vessels. At the close of the war it was again reorganized by Act of July 28, 1866, but in a very unsatisfactory manner, and a school of instruction was established at Fort Whipple, now Fort Myer, near Washington, D. C. By Act of Congress, Feb. 9, 1870, the Secretary of War was authorized to provide for the taking of meteorological observations throughout the country and for the prediction of storms; he assigned this to the chief signal officer of the army. It became apparent that the meteorological work was more important than the military work and that it could be well done by civilian organization. Therefore, on July 1, 1891, an Act of Congress took effect by virtue of which a Weather Bureau (q.v.) proper was organized in the Department of Agriculture and all the men and the duties relating thereto were transferred to it from the War Department. On the other hand, the Signal Corps of the United States army was at the same time reorganized so as to contain 10 commissioned officers and 50 enlisted men as sergeants.

Strength. The Signal Corps of the United States army consists of a chief signal officer with the rank of brigadier general, 1 colonel, 2 lieutenant colonels, 6 majors, 18 captains, 18 first lieutenants, 36 master signal electricians, 132 signal sergeants (first class), 144 sergeants, 156 corporals, 24 cooks, 552 privates (first class), 168 privates; total commissioned, 46; total enlisted, 1212; aggregate, 1258. In addition to the above strength 30 officers of the line are detailed to the aviation service under the provisions of the Act of Congress approved March 2, 1912. A 35 per cent increase of pay and allowances is given such of these officers as are actual flyers of aëroplanes. The aviation service is administered by the Signal Corps.

Duties. The chief signal officer is charged with the direction of the Signal Corps of the army; with the control of the officers, enlisted men, and employees attached thereto; with the construction, repair, and operation of military telegraph and telephone lines and cables, field telegraph lines, radio installations, balloon trains, and all other military aëronautics, and electrical communication for fire-control purposes; with the preparation, distribution, and revision of the War Department telegraphic code; with the supervision of such instruction in military signaling and telegraphy as may be prescribed in orders from the War Department; with the procurement, preservation, and distribution of the necessary supplies for the Signal Corps and for the lake and seacoast defenses. He has charge of all military signal duties and of books, papers, and devices connected therewith, including telegraph and telephone apparatus and the necessary meteorological instruments for target ranges and other military uses; of collecting and transmitting information for the army by telegraph or otherwise, and all other duties pertaining to military signaling.

The Signal Department furnishes all military posts and seacoast-defense stations with such instruments and materials as may be necessary for the electrical installation of range finders and the fire-control system for the purpose of intercommunication. This includes telephonic and telegraphic instruments, radio stations, electrical clocks, megaphones, field glasses, telescopes, and necessary meteorological instruments, i.e., barometers, thermometers, anemometers, etc.; also all such cable and land lines as may be required to connect contiguous military posts, or for connecting the posts with the commercial telegraph system.

Organization. In addition to its functions as an administrative and supply bureau of the War Department, the Signal Corps, with its existing personnel, provides the following tactical units for service in the field with the mobile army: (1) field companies, using the buzzer, the telephone and radio, with 4 officers, 96 enlisted men, 4 wire carts, each carrying 5 miles of field wire for use with the buzzer; 2 instrument wagons and 1 kit wagon; 2 field wagons, each carrying 10 miles of wire as a reserve; 85 saddle horses, 8 draft horses, and 20 draft mules. The field radio installation is carried by 8 pack mules. Field companies are designed primarily for combat purposes and for use in deployments. Equipped with both wire and wireless (radio) outfits, they were found of great practical use in maintaining communication along the Mexican border (1913–15). The radio pack set can be put in operation in two minutes, weighs 370 pounds, and under service conditions has a range of 25 miles. To the present field company is frequently added a wagon or motor radio set having a range of 200 miles. The peace organization in 1915 was 5 field companies. (2) Telegraph companies, having the duties of establishing semipermanent telegraph and telephone lines, installations in permanent camps or cantonments, and constructing and maintaining telephone systems for the mobile divisions. This company, established by War Department orders in September, 1913, supplements the field company and takes its place whenever permanent communications are to be maintained. The company consists of six sections—three equipped for camp telephone work, three for field telegraph work. It has a personnel of 4 officers, 139 enlisted men. It is equipped with enough wire to run about 125 miles of line and to establish 60 telephone and 10 telegraph stations. On account of lack of personnel only one of these companies was organized in 1916. Two field companies form a battalion, commanded by a major with necessary staff. In war one such battalion is attached to each division of the mobile army. In the same way two telegraph companies are combined to form a battalion which is assigned to duty in the zone of line of communications and in the service of the interior. (Consult *Tables of Organization, United States Army, 1914.*) (3) Aviation organization, 1916. A number of officers and enlisted men, detailed for aviation service, are assembled at advantageous points for instruction in the art of flying. The proposed organization under trial in 1916 was as follows: for each tactical division of the mobile army, an aërosquadron, commanded by a major, consisting of two aëro companies, each company organized with 9 officers, 39 enlisted men, and 4 aëroplanes, with necessary transportation. See ARMY ORGANIZATION; MILITARY AËRONAUTICS; SIGNALING AND TELEGRAPHING, MILITARY.

SIGNALING AND TELEGRAPHING, MILITARY. The term "military signaling" usually refers to the art of transmitting intelligence by visual signals. The employment of sound, electricity, and aëronautics for the transmission of signals, in their application by the army, is also included.

From the beginning of human existence signals (signs, sounds, gestures, and other indications) were used by individuals of tribes or communities for communication. Sounds came first, followed by representations of natural objects, hieroglyphics of the ancients, and other picture writings of savage peoples. The illustration shows a picture dispatch sent by North American Indians to the French during the war with England in Canada. It means that "they [the warriors] departed from Montreal," represented by a bird just taking wing from the top of a mountain. The moon and the buck show the time to have been on the first quarter of the buck moon (July).

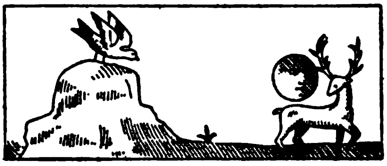


FIG. 1. PICTURE WRITING OF INDIANS.

While oral language was being developed, a means of communication beyond the limits of the voice was undertaken by pantomime signs; with the hands and body for short distances, by signal fires, smoke, prearranged display of shields, spears, flags, clothing, etc., for longer distances. The first record of a signal corps is given in the writings of Polybius about 260 B.C. The invention of the system then used is ascribed to Cleoxenes or Democritus, but the development of their ideas into a system was due to Polybius. He describes his system as follows:

"Take the alphabet; divide it into five parts with five letters in each. In the last part . . . a letter will be wanting, but this is of no importance. Then let those who are to give and receive the signals write upon five tablets the five portions of the letters in their proper order and concert together the following plan: that he, on one side, who is to make the signal, shall first raise two lighted torches and hold them erect until they are answered by torches from the other side. This . . . shows . . . both sides ready and prepared. That afterward he again who gives the signal shall raise first some torches upon the left hand, in order to make known to those upon the other side which of the tablets is to be inspected—if the first, e.g., a single torch; if the second, two; and so of the rest. That then he shall raise other torches also upon the right, to mark . . . to those who receive the signal which of the letters upon the tablet is to be observed and written. When they have thus regulated their plan and taken their respective posts it will be necessary, first, to have a dioptical instrument formed with two holes or tubes —one for discovering the right, and the other the left hand of the person who is to raise the torches on the opposite side. The tablets must be placed erect and in their proper order . . . and . . . there should be also a solid fence of about 10 feet in length and of the height of a man, that the torches, being raised along the top of those ramparts, may give a more certain light, and when . . . dropped again that they may also be concealed behind them."

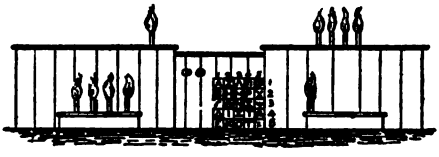


FIG. 2. SIGNAL SYSTEM OF POLYBIUS.

Signals are called transient when each element disappears on completion, permanent when the signal is a combination of arbitrary elementary indications—sounds, colors, forms, in accordance with rules familiar to sender and receiver. Primary signals are the elementary signs; those formed by uniting primary elements are called combination signals. These signals may consist of a single primary signal repeated, as 111, the number of repetitions conveying meaning; or by uniting primary signals, as 123, 113, etc. Three elements form signals of the third class, e.g., 131, 333; 12 or 21 are called second-class signals; a code is any number of prearranged signals, each having definite meaning to receiver and sender. If each letter is homographic, the class term is indicated by a certain (and always the same) number of symbols; chronosemic or time signals depend for meaning on time intervals between signals. The Myer system, long used in the United States army and navy, illustrates this class of signals, familiar examples being: a = 22, b = 2112, e = 12, i = 1, n = 11, o = 21, t = 2; can = c, not = n, yes = y, word

= w; I understand = 22 22 3, wait a moment = 1111 3; and many others similarly formed.

The Myer Code, in the army, was discontinued September 4, 1912, and replaced by the International Morse Code for all visual signaling, radiotelegraphy, and on cables using siphon recorders. The American Morse Code is still used on army telegraph lines, short cables, and on field telegraph lines. The International Morse Code, known as the General Service Code, is employed in all communications between the army and navy, whether by radio, visual, or sound signals. These two alphabets are given under Telegraph.

VISUAL SIGNALING

Modern military signaling of this nature is done according to United States army regulations by flag, torch, hand lantern, or beam of searchlight (without shutter). This involves the use of one position and three motions. The position (Fig. 3) is with the flag or other appliance held vertical, the signalman facing towards the distant station. The first motion, corresponding to the dot of the telegraph code, is to the right of the sender and embraces an arc of 90 degrees, starting from the vertical and returning to it, in a plane at right angles to the line connecting the two stations. The second motion, giving the dash, is a similar motion to the left (Fig. 4) of the sender; while the third motion (front) is downward directly in front of the sender, returning instantly upward to the first position. This motion indicates a pause or conclusion after a word or sentence. Though ordinarily used with the shutter, like the heliograph, the beam of the searchlight may be used for long-distance signaling when no shutter is available, in a manner similar to the flag or torch, the first position being a vertical one. A movement of the beam 90 degrees to the right of the sender corresponds to a dot; a similar movement to the left gives a dash; the beam is lowered vertically for front. With the torch or hand lantern a footlight is employed as a point of reference. The lantern is swung out upward to the right of the footlight for a dot, to the left for a dash, and raised vertically for front. In all kinds of signaling each word, abbreviation, or conventional signal is followed by front.

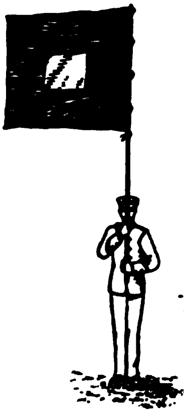


Fig. 3. Initial position.

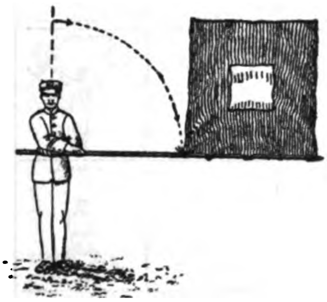


Fig. 4. The dash.

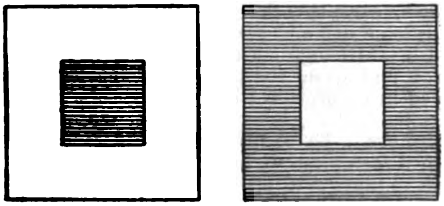


Fig. 5. Flags of United States army signal corps.

For long-distance signaling there are employed at night the heliograph, flash lantern, and a searchlight provided with shutter. The first position according to the United States army code is secured by turning a steady flash on the receiving station. Short and long flashes are used for signals, a short flash corresponding to a dot and a long steady flash to a dash. It is usual to make the elements of a letter slightly longer than in sound signals. In the United States navy, with flash or occult signals, the third movement, front, is used. It is made by displaying a long flash. This is not used in the United States army. In the daytime and in ordinary weather the shutter searchlight can be readily used for distances up to 10 miles at sea and is considered of exceptional value by the navy, being independent of background and capable of being used behind armor or other shelter.

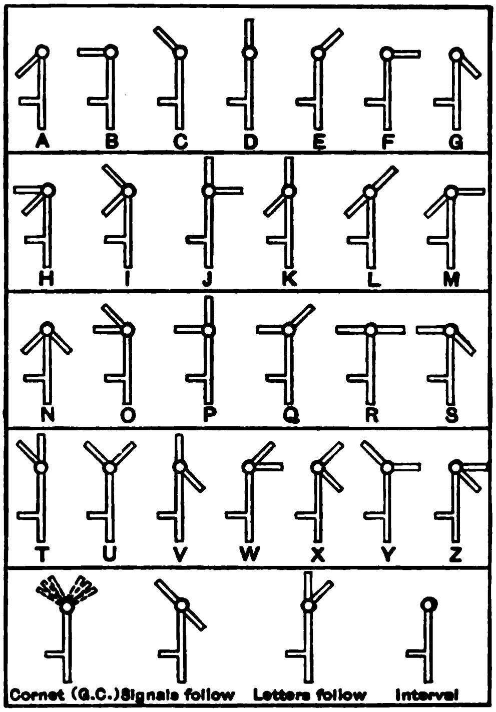


Fig. 6. Two-arm stationary semaphore.

The Ardois system of the United States army and navy consists of four lights, usually electric, suspended vertically from a staff, mast, or yard and operated from a keyboard. The red lamp indicates a dot and the white lamp a dash, the appropriate order giving the letter of the alphabet or other signal. For instance, red-white, or dot-dash, represents the letter A, and white-red-red-red, or dash-dot-dot-dot, represents the letter B. Coston lights, used also for marine or distress signals, are made of a slow-burning composition and are usually held in a socket and displayed by hand. Rockets, bombs, and the Very pistol (see SIGNALS, MARINE), not being adapted for general use with the dot and dash code, are used in connection with a conventional or a preconcerted code and for emergency signals.

The two-arm semaphore method is another way of transmitting signals, and a machine or stationary semaphore is authorized for the United States army and may be employed in the manner indicated in the diagram. In the machine a third arm or indicator is displayed on the right of the sender (at night a red light screened to the rear indicates the direction of the sending). The machine is so placed that it may be seen through the greatest arc of the horizon, and electric lights are installed on the vanes. The two-arm semaphore affords the most rapid method of transmitting held-out messages.

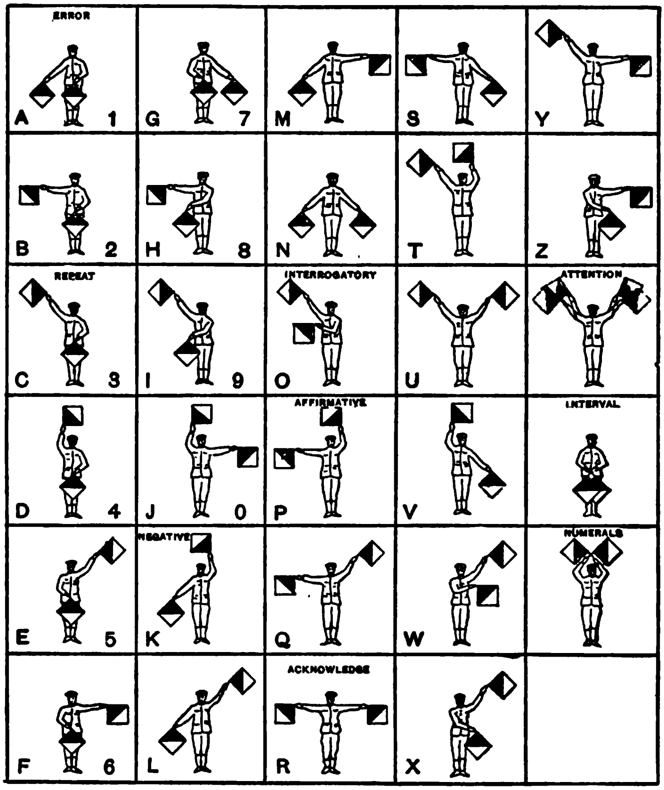


FIG. 7. TWO-ARM SEMAPHORE CODE WITH HAND FLAGS.

Hand flags are used both by the army and the navy. They are useful when rapid communication for short distances is needed, especially for interior signaling within batteries of the field artillery. The hand flags of the United States navy are of blue with a white square, or red and yellow diagonally, the colors to be used depending upon the background. The flags are from 12 to 15 inches square and are usually attached to light wooden staffs about 2 feet in length. In the United States army the hand flags are orange with a scarlet centre or scarlet with an orange centre; size, 18 inches square with a 9-inch centre. The hand flags are used in the same manner as the semaphore machine, except that in making the interval the flags are crossed downward in front of the body.

The International Code of Signals is used by the military forces when such use may appear desirable, as on army transports, at seacoast fortifications, and between the army and the navy. See SIGNALS, MARINE, and Colored Plate showing the signal flags.

Sound Signals can be made by the whistle, foghorn, bugle, trumpet, and drum for use in a fog, mist, falling snow, or at night, according to the dot and dash code. In applying the International Morse Code to sound signals one short blast indicates a dot and one long blast a dash, except with the drum, where one tap indicates a dot and two taps in rapid succession a dash. Although such signals can be used with a dot and dash code, they should be so employed in connection with a preconcerted or conventional code.

Ciphers. To secure secrecy it is necessary often to employ various means whereby messages or any writings can be transcribed in occult terms. Whatever their nature, all ciphers must employ some distinct method for transcription. This method, termed a key, is usually applied directly in enciphering and reversed in deciphering messages. A *cipher disk* (Fig. 8) often employed consists of two circles of cardboard, leather, or other material concentrically placed, with the upper disk revolving upon the lower. The alphabet, reading from left to right, is printed around the circumference of the lower disk. On the upper disk is the alphabet, reading from right to left. To put a message into cipher the key letter or the first letter of the key word or words is placed opposite "A." The cipher letters to be written are those opposite the text letter when the letter "a" on the upper disk is set opposite the selected key letter on the lower disk. For example, with J as a key letter, "Send powder" would be written "rfwg uvngfs."

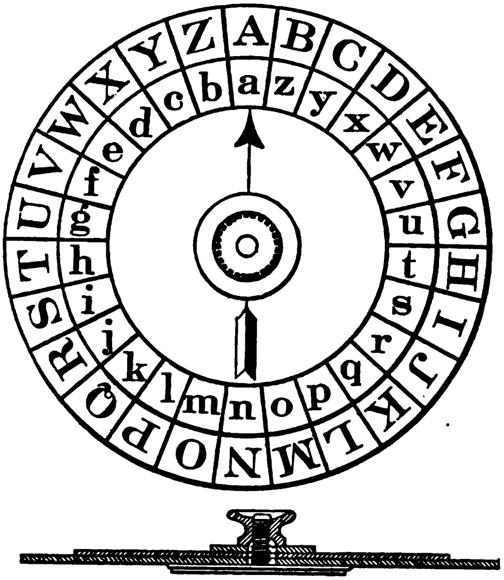

Z A B C D E F G H I J K L M N O P Q R S T U V W X Y
a z y x w v u t s r q p o n m l k j i h g f e d c b

FIG. 8. CIPHER DISK.

Infantry Company Signal Flags. The United States army infantry drill regulations prescribe signal flags to be carried by the company musicians in the field. In addition to their use in visual signaling, these flags also serve to mark the assembly point of the company when disorganized by combat, and to mark the location of the company in bivouac and elsewhere when such use is desirable. The number of the regiment is at the centre of the flag, while for militia and volunteers the State name abbreviated and the letters of the company appear. The regulations prescribe the following arrangement:

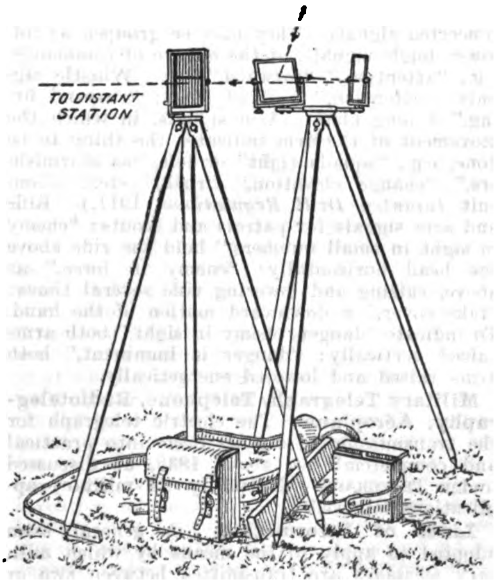
First battalion:	
Company A.	Red field, white square.
Company B.	Red field, blue square.
Company C.	Red field, white diagonals.
Company D.	Red field, blue diagonals.
Second battalion:	
Company E.	White field, red square.
Company F.	White field, blue square.
Company G.	White field, red diagonals.
Company H.	White field, blue diagonals.
Third battalion:	
Company I.	Blue field, red square.
Company K.	Blue field, white square.
Company L.	Blue field, red diagonals.
Company M.	Blue field, white diagonals.

A simple code of signals is provided, as given below, for communication between the firing line and the reserve or commander in rear. It is essential that in transmission the concealment of the flags from the enemy's view should be observed. In the absence of signal flags such a substitute as the headdress may be employed.

Heliograph. The heliograph (q.v.) for transmitting signals between distant stations by means of the sun's rays, was successfully used by the British army in India about 1878, and the Mance instrument was experimentally employed in the United States army as early as 1878. The early English heliograph had its movable mirror controlled by a key instead of a shutter, as in the case of modern instruments, and the difficulty of maintaining accurate adjustment during the transmission of signals constantly threw the flash out of alignment. On the American signal service heliograph a screen is provided which operates as a shutter and controls the flash reflected from an immobile mirror.

ALPHABET LETTER	If signaled from the rear to the firing line	If signaled from the firing line to the rear
a a a	Ammunition going forward	Ammunition required
c c c	Charge (mandatory at all times)	Am about to charge if no instructions to contrary
s s s	Support going forward	Support needed
f f f	Move forward	Preparing to move forward
h h h	Halt	
n n n	Negative	Negative
y y y	Affirmative	Affirmative

The heliograph possesses great portability, the ability to work over a great range, comparative rapidity of operation, and the great merit that the signals are invisible except to observers located approximately on a right line adjoining the two stations, but naturally it cannot be operated unless there is sunlight. Ordinarily the normal working range of the heliograph is about 30 miles, and its dependable speed of transmission is from 5 to 12 words per minute.

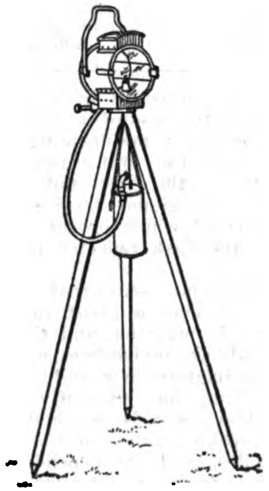


HELIOGRAPH ASSEMBLED.

Acetylene. The facility with which acetylene (q.v.) gas can be generated makes an acetylene signal lantern a useful instrument for the purpose of transmitting signals by means of intermittent flashes. It is the standard night visual equipment of the United States Army

Signal Corps and involves a specially constructed lantern where the height of flame is controlled by a key so as to show a small flame or a bright flash. This device possesses the great advantages of portability, speed of operation, and comparatively great range, but it is naturally affected by disturbances in the atmosphere caused by rain, fog, and moonlight. Nevertheless, as night conditions are usually more uniform than in the daytime, the acetylene lantern is thought to be the most reliable of the various visual signals adopted by the United States army.

Outside the visual signal above described there are a number of other visual and sound preconcerted signals. They may be grouped as follows: bugle signals, of the nature of commands, e.g., "attention," "forward," etc. Whistle signals: "attention," a short blast; "suspend firing," a long blast. Arm signals, in which the movement of the arm indicates the thing to be done, e.g., "squads right" or left, "as skirmishers," "change elevation," "rush," etc. (Consult *Infantry Drill Regulations*, 1911.) Rifle and arm signals for patrols and scouts: "enemy in sight in small numbers," hold the rifle above the head horizontally; "enemy in force," as above, raising and lowering rifle several times; "take cover," a downward motion of the hand. To indicate "danger, enemy in sight," both arms raised vertically; "danger is imminent," both arms raised and lowered energetically.



ACETYLENE SIGNAL LANTERN.

Military Telegraph, Telephone, Radiotelegraphy, Aëroplane. The electric telegraph for the transmission of signals came into practical and commercial use about 1835, as discussed under TELEGRAPH. Naturally its military applications followed.

Lines of Information. A general term adopted to apply to the means by which military messages are transmitted between two or more stations. As to construction, they are classified as permanent, semipermanent, and field lines. Permanent lines are similar to standard commercial lines. Semipermanent consist of light bare wires, usually No. 14 galvanized, supported on light poles, called lances. From 7 to 15 miles of such lines can be established daily. Either telegraph or telephone is used. Field lines are those laid on the ground hastily for temporary use and usually consist of insulated wire paid out from reels on carts or wagons or, in the smaller size wire, from hand reels. Sometimes bare wire is used on the ground, in which case only the buzzer will operate satisfactorily over them.

Classified according to use, lines of information are either strategical or tactical. The former are permanent or semipermanent; the latter are generally field lines, rapidly laid and taken up to follow the movements of the troops, and are sometimes called combat lines in that they transmit information and orders to the fighting units. Special vehicles and pack mules are required for transporting and laying wire and carrying the necessary instruments, including wireless sets, lances, etc. These include wire carts, instrument wagons, lance trucks, balloon train wagons, pack mules for radio sets, wagons for aëroplanes, etc. On field lines the buzzer in one of its forms is almost universally used. This instrument was introduced into the United States army in 1890 and first showed its efficiency in the Philippine and China campaigns. In its present form of field buzzer, and still more portable cavalry buzzer, it combines in a small leather case weighing a few pounds a complete telegraph and telephone station, including the necessary batteries. Its capacity for working over circuits impossible for any other telegraph instrument, such as bare-wire lines laid on the ground, through wire of wire fences, or railroad rails, or even through considerable breaks in the line when the ends lie on the ground, makes it the ideal instrument for field lines. To open a station when unreeling wire from horseback it is only necessary to fasten the ground of the buzzer to the horse by a small metal plate under the saddle blanket. By working the key an interrupter is operated giving a high singing note, which is broken up into the dots and dashes of the Morse alphabet. These correspond to vibratory electrical impulses, which go out on the line and are heard in the telephone receiver at the distant station. The efficiency of the buzzer under the difficult conditions stated is due to the marvelous sensitiveness of the telephone receiver to these rapidly pulsating currents. In practically the same circuit as the interrupter is a telephone transmitter, and when the button switch on this is depressed, the instrument becomes at once converted into a very efficient telephone set. The field telephone and field induction telegraph are specially designed for use under the severe conditions of field service. Portability and electrical efficiency are prime requisites.

The radio (wireless) apparatus of the United States Signal Corps included, in 1916, 10 stations in Alaska from 1 to 10 kilowatts, stations of 10 kilowatts in the Philippines, 1 to 2 kilowatts in the coast defenses, 1 to 5 kilowatts on army transports, and larger sets at important military stations in the interior of the United States. Two types of portable field sets are in use. The smaller set, carried on three pack mules, has a range of about 25 miles. The larger size, carried on a wagon, has a range, depending on weather conditions and terrain, which varies from 75 to 800 miles. Successful experiments at long distances, in America in 1915, with the wireless telephone suggests the future military use of this means of communication and as the best yet devised. The difficulties to be met in maintaining wire lines on the battlefield were fully appreciated in the Great War.

Aëronautics. In the United States army the Signal Corps (q.v.) is charged with the collection and transmission of military information. Under this general provision aëronautics in all its forms, including aëroplanes and gas bags, whether free, captive, or dirigible, pertains to that corps and has been developed by it since the first public flight of the Wrights in 1909 at Fort Myer, Virginia. Various systems of signals, from the aëroplane to earth, have been tried—flags, smoke signals, radiotelegraphy. The aëroplane was used in the Great War to assist in the adjustment of field-artillery fire by having the shorts and overs observed by the aviator signaled to the officer firing the battery. Consult: A. J. Myer, *A Manual of Signals* (Washington, 1879); United States Signal Corps, *Manual No. 3* (ib., 1910); *Signal Book, United States Army* (ib., 1913); United States Signal Corps, *Radiotelegraphy* (ib., 1914). See Army Organization; Military Aëronautics; Signals, Marine.

SIGNALS, Fog. See Fog Signals.

SIGNALS, International. See Signals, Marine, and accompanying Colored Plate.

SIGNALS, Marine. Marine signals now in current use may be divided into three classes: (*a*) day signals, (*b*) night signals, and (*c*) day and night signals. Day signals consist of set combinations of flags or shapes, moving combinations of arms or shapes, or the waving of shapes or flags. The use of flags of various shapes is widespread and of ancient origin; the Venetians used them, and there is good reason to believe that simple signals of this sort were used in early times. In 1856 the British government devised a system of signaling by flags which has been adopted by all maritime nations. It formerly consisted of 13 square flags, five triangular pennants, and a swallow-tailed flag. One of the pennants was the code pennant; the other pennants and flags were assigned to the consonants of the alphabet from b to w. On January, 1901, by international agreement, a new code went into effect. It consists of 19 square flags, two swallow-tailed flags, and five pennants besides the code or answering pennant. These are assigned (except the code pennant) to the different letters of the alphabet. The flags and pennants of the old code are retained with few changes, the new ones being added to cover the vowels and x and z. The flags and pennants are hoisted singly or in combinations of one, two, three, or four. One-flag signals are important in character and much used; two-flag signals are urgent and important; three-flag signals include all ordinary messages; four-flag signals signify geographical positions (seaports, islands, bays, etc.), alphabetical spelling tables, and vessels' distinguishing numbers. The signification of each combination of flags is the same in all languages, each combination standing for a complete message, a sentence, a phrase, or a single word. A vessel using a signal book printed in English can communicate with a vessel using a book printed in Italian as easily as with one using an English book.

The spelling table may be used between vessels having books printed in languages using Roman characters. The American edition of the international signal code is published by the Hydrographic Office of the Navy Department and is divided into three parts. The first contains urgent and important signals, signals for tables of money, weights, etc., for geographic positions (arranged geographically), and a table of phrases formed with auxiliary verbs. The second part (more than half the book) is an index. It consists of a general vocabulary and a geographical index, each alphabetical. The third part gives lists of the United States storm-warning, life-saving, and time-signal stations, and of Lloyd's signal stations throughout the world, and contains semaphore and distant signal codes and the United States army and navy wigwag codes. As the international code flags have to be carried by every man-of-war, to avoid multiplicity of flags, the naval signal books of nearly all nations have been adapted to their use.

The use of shapes is common for distant signals, as colors and patterns of flags cannot be determined with certainty beyond 2 or 3 miles. These shapes are cones, balls, and drums, supplemented with a square flag and a pennant. The placing of movable arms in certain positions is termed semaphore signaling. Devices for semaphore signaling have been in use for some centuries at least; they were called telegraphs and were placed in sight of each other to form long chains of communication across country. The modern semaphore has two or three arms, and its use is chiefly at signal stations on the coast or on board ship. In most navies a simple semaphore code is arranged for two small flags, one to be held in each hand of the signalmen. In the United States and British navies there are seven positions, in the French navy eight. These positions of the first named are: right arm inclined downward at angle of 45°; same, horizontal; same, inclined upward at angle of 45°; three of the remaining positions are for the left hand at 45° downward, 45° upward, and horizontal; the remaining position is either arm held vertically. In the French code the right arm held vertically is one position, and the left arm held vertically is another. In both codes the combination of any two positions is used in addition to the simple positions. In the United States army and navy the signal-flag wigwag code is used as described under Signaling and Telegraphing, Military.

Night Signals are made with lights, rockets, torches, etc. By waving a lamp or torch or changing the direction of the beam of a searchlight from side to side the wigwag code may be used. In Very's night signals, visible at a distance of 10 miles or more under favorable circumstances, red and green stars like those in Roman candles are fired from pistols in different combinations, four in each and each combination or group of four corresponding to a figure. Coston's signals, consisting of different-colored flaming lights, were formerly used. Rockets and blue lights (q.v.) are used to attract attention and for special purposes. The night signals most in use in the navies of the world are the Ardois, the invention of a French officer of that name, brought into general use in 1885–90. They consist of double electric lamps—one-half white and one-half red—arranged on a cable extending up and down one of the masts. In many foreign navies these lamps consist of five pairs, but in the United States navy there are but four, and the significations of the telegraph code are used. The lights are read downward from the masthead, the red and white lights corresponding to dot and dash of the telegraphic or to 1 and 2 of the wigwag code. The space or interval has a special combination to denote it. These lights are worked by a keyboard, and the signaling is quite rapid. In the United States and other navies one or two white lights are flashed, using the continental telegraphic code with short and long (or double) flashes to indicate dots and dashes.

The day and night signals are sound signals and wireless telegraph signals. The former are composed of long and short blasts of a whistle or double and single strokes of a bell. With wireless telegraph systems the continental telegraphic code is employed.

Some simple signals are used in Rules of the Road at Sea. (See Rules of the Road.) Signals of distress are of various kinds, such as hoisting the colors, i.e., the national flag, upside down, firing guns, rockets, blue lights, wireless calls, etc. Consult *Instructions for Signaling, United States Navy* (Washington, 1898), and United States Hydrographic Office, *International Code of Signals* (Amer. ed., ib., 1914). See Signaling and Telegraphing, Military.

SIGNALS, Railway. See Block Signal System; Railways.

SIGNATURE (ML. *signatura*, from Lat. *signare*, to sign, from *signum*, sign, mark, token). In its broadest legal sense, the name of a person, written or printed, or a sign or mark to represent a name, either executed or affixed by the person himself or adopted by him as his own. It became common to sign legal instruments after the Statute of Frauds, 29 Car. II, c. 3. Previous to that time a person intending to bind himself by a written instrument usually affixed his seal. In most jurisdictions a printed name may be adopted by a person as his signature. Where a person wishing to execute a written instrument is unable to write, it is customary to have some one write his name and to have him make a cross mark between Christian name and surname. One writing the name usually puts above the mark the word "his" and, below, "mark" and becomes a witness to identify it. If the illiterate person be awkward, the one writing the name may also make the mark, while the former touches the pen, but there have been decisions that this is not necessary. In some jurisdictions a person's name written by another may be adopted by the former as his signature without affixing a mark. A signature is usually at the end of an instrument, but (in the absence of statute) it may be elsewhere if clearly intended as such. The mere recital of a person's name in the body of an instrument will not constitute a signature. In contracts some sign or act is necessary which will indicate an intention on the part of the contracting parties to be bound by the terms of the instrument. Where the Statute of Frauds requires a contract or conveyance to be in writing and signed by the person to be charged or by his agent, a physical mark is necessary; and where a statute requires an instrument to be subscribed, as a will, the signature must be at the end, or the instrument will be a nullity. See Seal.

SIGNATURE, in Music. See Key; Musical Notation, *Time Signatures;* Time.

SIGNET, Writers to the. See Writers to the Signet.

SIGNET RING. See Jewelry.

SIGN LANGUAGE. A system of intertribal gesture communication among American Indians used by the Plains tribes in default of a common language, practically the same from Canada to the Mexican border. In many respects it forms the manual counterpart of the Indian pictograph system as displayed in buckskin paintings or birch-bark records. The signs are based upon natural ideas or the things of everyday Indian life, so as to be readily interpreted by a member of any of the tribes. Thus, *cold* is indicated by a shivering motion of the hands in front of the body. By an extension of the idea the same sign indicates the cold season, i.e., *winter*, and as the Indians count by winters it may mean also *a year*. A slow turning of the hand upon the wrist indicates vacillation, doubt, *maybe*. A modification of this, with quicker movement, is the question sign. *Fatigue* is indicated by a downward sweep of the hands, with index extended, giving the idea of collapse. *Strong, strength*, are indicated by the motion of breaking a stout stick; *bad*, by a motion of contemptuously throwing away; *foolish*, by a circling movement of the fingers in front of the forehead, i.e., *rattle-brained; song, singing*, by the same motion next the side of the head, to indicate the shaking of the rattle which usually accompanies the song. As the song and rattle are almost invariable accompaniments of religious ceremonials and medical conjurations, the same sign may also mean *sacred, religion, doctor, medicine*, according to the context. *White man* is indicated by drawing the fingers across the forehead, typifying the wearing of a hat, and there is a special sign for *Indian* and for each tribe as well as for particular rivers, mountains, etc. Two fingers extended at the side of the head indicate a *wolf*, as representing the erect ears; the same two extended fingers drawn across in front of the body indicate the *dog*, as the former carrier of the Indian travois; the same fingers brought down crossed over the extended index finger of the other hand indicate the *horse*, as the riding animal.

The signs follow the regular order of the words in the Indian sentence. The general system is so elaborated that there is a sign or combination for every idea in the Indian category and universally understood. There is also a system of long-distance signaling by means of smoke, riding in a circle, waving a blanket, etc., in certain ways, for particular occasions.

A similarly elaborate system of manual signs occurs in parts of Australia. Consult: Mallery, *Collection of Gesture-Signs and Signals of the North American Indians, with Some Comparisons* (Washington, 1880); Clark, *Indian Sign Language* (Philadelphia, 1884); W. E. Roth, *Ethnological Studies among the North-West-Central Queensland Aborigines* (London, 1897). See Gesture Language.

SIGNORELLI, sē̆′nyō̇-rĕl′lē̇, Luca (1441–1523). An Italian painter of the Renaissance, usually classed with the Umbrian school, but his training and affinities are rather Florentine. He was born at Cortona, studying first under Piero della Francesca at Arezzo, and at an early period he came under the influence of Pollaiuolo at Florence. His life was chiefly spent in peregrinations among the hill towns of Tuscany and Umbria, where most of his work was done. His first recorded activity (1470) is in his native town, but at an early period he worked independently at Florence, executing while there the "Pan" (c.1475), now in the Berlin Museum, for Lorenzo de' Medici—a fine example of his treatment of the nude—and a Madonna, now in the Uffizi. Among other works in Florence are the fine portrait of a man, in the Torregiani Palace,

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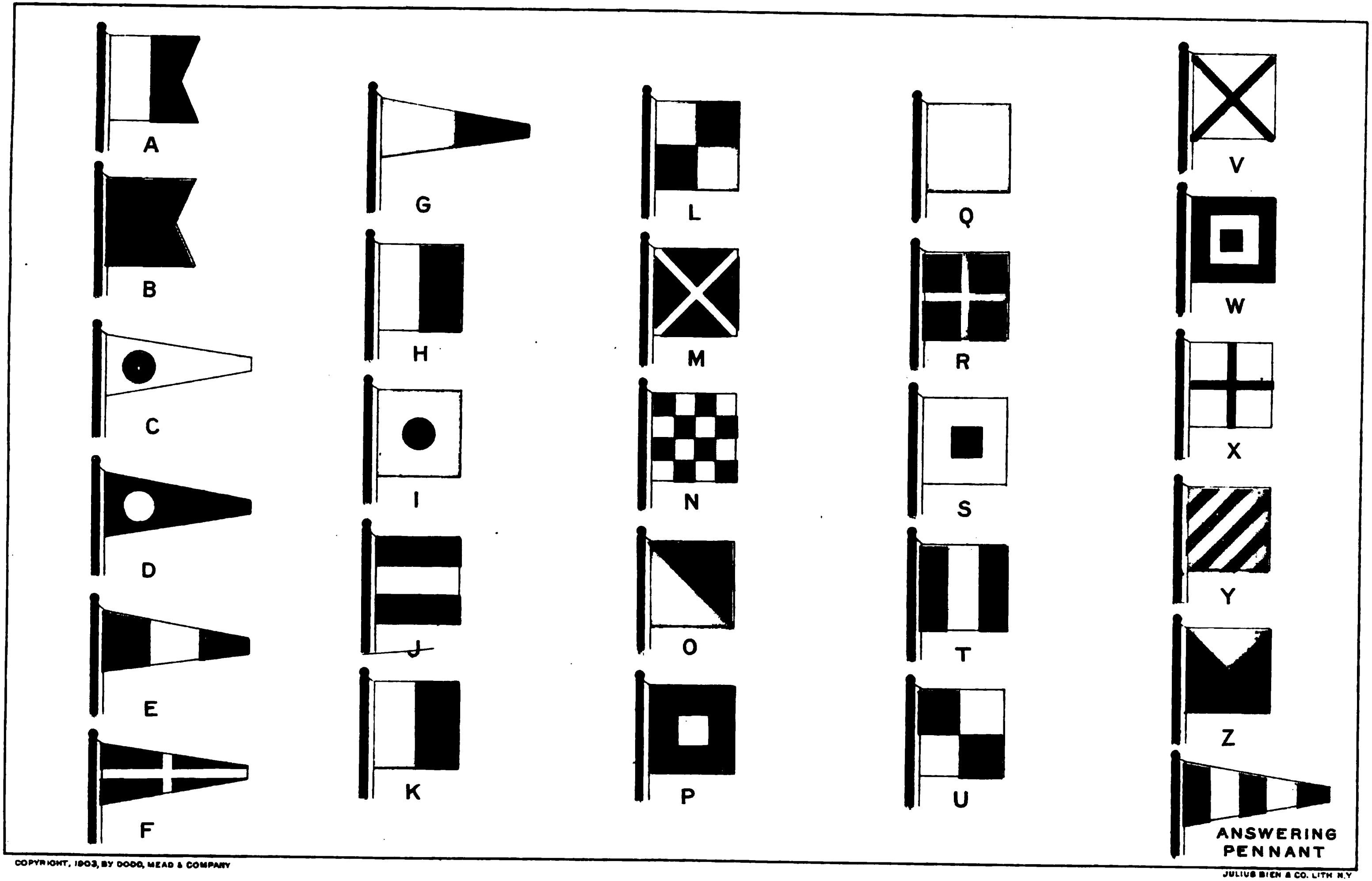

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and the "Crucifixion with the Magdalen." Other well-known altarpieces are a grand "Madonna with Saints," in the cathedral of Perugia (1484), and the Bicci altarpiece in San Agostino and Siena (1498). Many of the small towns of Perugia and Tuscany possess fine examples of his work.

But Luca's principal works are his frescoes, which far transcend his panel paintings. He was one of the painters selected to decorate the Sistine Chapel with subjects from the "Life of Moses" (1482). In 1484 he received a commission for the decoration of the sacristy of the church of Loreto with subjects from the New Testament, including the masterly "Conversion of St. Paul." At Siena he also painted in fresco a series of antique subjects in the Petrucci Palace and in the neighboring convent of Monte Oliveto (1497) eight large subjects from the "Life of St. Benedict," treated in an interesting decorative manner. His success in these commissions led to what is considered his masterpiece, the frescoes in Orvieto Cathedral (1499–1503). The subject represented is the "End of the World"; in eight panels of the ceiling are Christ and the heavenly hierarchy, while eight frescoes of the wall culminate in the "Last Judgment." They are remarkable examples of restless and intricate movement.

Under the pontificate of Julius II and again in 1513 he visited Rome, but was unable to make headway against the rising genius of Michelangelo and Raphael. He retired to Cortona, where he was held in the highest honor, and continued at his craft, his work in no wise deteriorating, until his death, June 14, 1523. His last works are principally in Cortona and the vicinity, like the fine "Pietà" (1502) and the "Last Supper" (1512), in the cathedral; an excellent example is the fine "Madonna" with the Trinity, two archangels, and saints, in the Uffizi, Florence.

Signorelli's great importance in Italian art is that he was the first to use the nude as the chief means of pictorial expression. Like the Greeks, he expresses emotion by means of muscular movement and construction, the faces being only typical of general emotion. He also introduced the use of the human body as a purely decorative motive, foreshadowing Michelangelo, whom he undoubtedly influenced. In his work the drawing, composition, and action are all excellent, combining impressive breadth of execution with great strength of conception; but the effect is sometimes marred by an inharmonious use of color. Consult: Vischer, *Luca Signorelli und die italienische Renaissance* (Leipzig, 1879); id., in Dohme, *Kunst und Künstler* (Eng. trans., London, 1880); Giorgio Vasari, *Lives of the Most Eminent Painters, Sculptors, and Architects*, vol. ii (Eng. trans. by Blashfield and Hopkins, New York, 1896); Maude Crutwell, *Luca Signorelli* (London, 1899); *Masters in Art*, vol. viii (Boston, 1907).

SIGOURNEY, sĭg′ẽr-nĭ, Lydia [Huntley] (1791–1865). An American poet and philanthropist, born in Norwich, Conn. She was one of the first women in America to plan for higher female education. In 1809 she established at Norwich a girls' school and in 1814 one at Hartford. This latter she directed until her marriage, in 1819, to Charles Sigourney, a Hartford merchant. The first of her 50-odd books was *Moral Pieces in Prose and Verse* (1815). Her autobiographical *Letters of Life* appeared posthumously (1866). Mrs. Sigourney edited numerous juvenile and religious publications and contributed widely to periodicals.

SIGRA, sē′grȧ. A suburb of Benares (q.v.).

SIGS′BEE, Charles Dwight (1845–). An American naval officer, born at Albany, N. Y. He graduated at the Naval Academy in 1863, was assigned to the Gulf squadron, and took part in the battle of Mobile Bay. In 1865 he was transferred to the North Atlantic squadron and participated in the bombardment and capture of Fort Fisher. From 1874 to 1878 he was employed in exploring the bottom of the Gulf of Mexico, and because of improvements introduced in this work he received the Order of the Red Eagle of Prussia and a gold medal. He was promoted to commander in 1882 and to captain in 1897. In the latter year he was assigned to the battleship *Maine*, which, while still under his command, was destroyed in the harbor of Havana, Cuba, on Feb. 15, 1898. On this occasion he displayed great courage and coolness and was commended for his self-restraint in asking a suspension of judgment until an investigation should show where the responsibility lay. During the war he commanded the auxiliary cruiser *St. Paul*. From 1898 to 1900 he commanded the *Texas* and was then appointed chief officer of naval intelligence, a member of the Naval Construction Board and of the Naval General Board. In 1903 he was made a rear admiral and in 1907 was retired. He wrote *Deep Sea Sounding and Dredging, United States Coast Survey* (1880), and *The Maine: An Account of her Destruction in Havana Harbor* (1899).

SIGURD, sē′gṳrd. An opera by Reyer (q.v.), first produced in Brussels, Jan. 6, 1884; in the United States, Dec. 24, 1891 (New Orleans).

SIGURD. The hero of the Norse Eddas, corresponding to the German Siegfried of the *Nibelungenlied* (q.v.).

SIGURDSSON, sē′gṳrds-sôn, Jón (1811–79). An Icelandic scholar and statesman, born at Rafnseyri, northwest Iceland. For several years he was archivist, and in 1851 was made president, of the Icelandic Archæological Society. In 1845, when the Danish government granted the reëstablishment of the Althing, the Icelandic national assembly, he was made its Speaker, and it was mainly due to his exertions that Iceland obtained practical home rule in 1874. His publications include *Diplomatarium Islandicum, 874–1264*, and *Lovsamling, 1096–1859*, a collection of laws (17 vols., 1853–77). Consult K. Maurer, *Jón Sigurdsson, the Icelandic Patriot* (Reykjavik, 1887).

SIGWART, zēκ′värt, Christoph von (1830–1904). A German philosophical writer, born at Tübingen. Educated in theology and philosophy, he was professor in the seminary at Blaubeuren from 1859 to 1863 and in 1865 was made professor of philosophy at Tübingen. His publications include: *Ulrich Zwingli: der Charakter seiner Theologie, mit besonderer Rücksicht auf Picus von Mirandola dargestellt* (1855); *Spinozas neuentdeckter Traktat von Gott, dem Menschen und dessen Glückseligkeit* (1866); the particularly well-known Logik (1873–78; 3d ed., 1904; Eng. trans., 1894); *Vorfragen der Ethik* (1886); *Die Impersonalien* (1888).

SIKA, sē′kȧ. The small deer (*Cervus sika*) of Japan and north China, having a spotted coat in summer which becomes uniformly brown in winter. The antlers usually have only four points, as the bez-tine is lacking. These deer are natives of forested hills, and many specimens have been naturalized in European parks. The Manchurian deer is probably only a larger variety, but two or three other valid species belong to the sika group, of which the best known is that common in the mountains of Formosa (*Cervus taĭva-nus*). Consult Richard Lydekker, *Deer of All Lands* (London, 1898).

SIKA ANTLERS.

SIKES, Bill. A brutal, hardened burglar in Dickens's *Oliver Twist*.

SIKESTON, sīks'-tŭn. A city in Scott Co., Mo., 166 miles south by east of St. Louis, on the St. Louis and San Francisco and the St. Louis, Iron Mountain, and Southern railroads (Map: Missouri, G 5). There are large flouring mills which ship their product abroad, hoop and heading factories, and a box factory. Pop., 1900, 1077; 1910, 3327.

SIK'HIM. A native state of India. See Sikkim.

SIKHISM. See Sikhs.

SIKHS, sēks (Hindi, disciple, probably associated with *sikhna*, to learn, Skt. *śisya*, disciple). The term applied to a religious community of which the Punjab, in northwestern India, is the principal seat.

From the time of the tenth pontificate the sect called itself the Khalsa, "the pure." At first the Sikhs were merely a religious sect affected by Mohammedan influences. Their religion was a deism tinctured with superstition. From the energy which they developed under oppression, and their proselytizing enthusiasm, the Sikhs became by degrees a formidable nationality. Their founder, Nanek, was born in 1469 near Lahore and died in 1539. To him succeeded, in turn, nine pontiffs, each of whom, like himself, is popularly denominated guru, or teacher. These were Angad (1539–52), Amardas (1552–74), Ramdas (1574–81), Arjun (1581–1606), Hargovind (1606–45), Harray (1645–61), Harkrishna (1661–64), Teg Bahadar (1664–75), and finally Govind (1675–1708).

The aim of Nanak was religious and humanitarian and designed to combine Hindus and Mohammedans into one brotherhood. His three immediate successors held themselves aloof from political complications. Arjun, however, not content with signalizing himself as the compiler of the *Adi Granth* (q.v.) and as the founder of Amritsar (q.v.), the holy city of the Sikhs, rendered himself conspicuous as a partisan of the rebellious Prince Khusru, son of Jahangir. Hargovind, who succeeded Arjun, called the Sikhs to arms, led them to battle, and became an active, though sometimes refractory, adherent of the Great Mogul, against whom his predecessor had plotted. Harray subsequently espoused the part of Dara Shikoh, son of Shah Jehan (q.v.), when contending with his brothers for the throne of India. Harkrishna, son of Harray, died a child and was only nominally a guru. Teg Bahadar was executed by Aurungzebe (q.v.) in 1675 for having refused to embrace Mohammedanism. The chief motive that instigated his son Govind, the tenth of the teachers, was, probably, a desire to avenge the death of his father. He resolved to combat both the Mohammedan power and the Mohammedan religion and for that reason instituted the worship of steel and book (sword and bible). In what measure he was a man of thought is evinced by his legacy to his coreligionists, the second volume of the Sikh scriptures, which teaches that a Sikh should worship one God, observe morality, and practice the use of arms. Govind's successor Banda, after three cruel massacres of his Mogul opponents, was himself slain in 1716. After his death the government of the Khalsa passed into the hand of the Akalis, military zealots who in 1764 began to rule the Punjab. In the early part of the nineteenth century Ranjit Singh (q.v.) built up a powerful Sikh monarchy, which became a formidable neighbor to the British. After his death (1839) the British engaged in the First Sikh War (1845–46), in which their forces were led to victory by Sir Hugh Gough (q.v.) and which secured to the East India Company the possession of a great portion of the Sikh territory. The Second Sikh War (1848–49), in which Sir Hugh Gough again figured, terminated in the submission of the Sikhs and was followed by the annexation of the Punjab to British India. The Khalsa ceased to exist. The Sikhs are now divided into two classes, Sahijdari, or those who live at ease, and Kesadhari, or those who wear long hair.

According to the census of 1911 there were then 3,014,466 Sikhs in India. Consult: E. W. Hopkins, *Religions of India* (Boston, 1895); M. A. Macauliffe, *The Sikh Religion: Its Gurus, Sacred Writings and Authors* (6 vols., Oxford, 1909); Dorothy Field, *Religion of the Sikhs* (London, 1914). For an account of the Sikh wars, consult: Gough and Innes, *The Sikhs and the Sikh Wars* (ib., 1897); Rait, *Life and Campaigns of Viscount Gough* (ib., 1903); J. D. Cunningham, *History of the Sikhs* (ib., 1903).

SI-KIANG, sē'kyăng', or West River. The most important river of southwest China. It rises in the Province of Yunnan near Nanning Hien (or Kuchingfu), flows through a generally mountainous country in a tortuous course through Yunnan, Kwangsi, and Kwangtung for 1650 miles to the South Sea (Map: China, J, K 7). It receives many tributaries, chiefly from the right, the most important being the Yü-kiang or Melancholy River. Near Samshui (q.v.) the stream divides, the smaller portion flowing east and, after receiving the waters of the Pe-kiang or North River, being known as the Chu-kiang or Pearl River, on which the city of Canton is situated. The main body of the waters of the Si-kiang continues its course west of the Chu-kiang delta, breaking up into several channels. The estuary is 75 miles wide. The upper courses are obstructed by many rapids. From Samshui to Wuchow it is navigable for vessels drawing not more than 8 feet, while lower down the largest vessels may float.

SIKKIM, or **SIKHIM**, sĭk'ĭm. A native state in the northeast of India, feudatory to Bengal (Map: India, F 3). Area, 2818 square miles. Pop., 1911, 87,920. It is on the south slope of the Himalaya Range, Kunchinjinga in the north having an altitude of 28,000 feet. It is drained into the Brahmaputra by the Tista. There are valuable forests of oak, walnut, chestnut, and other trees. Copper is mined, rice, maize, millet, cotton, tea, oranges, and other fruits are cultivated, and there is an increasing trade importing cotton-piece goods and tobacco and exporting grain and general agricultural produce. The natives are of Mongolian origin; their language is a Tibetan dialect and their religion Lamaism; they call themselves Rong-pa, but are known to the Gurkhas as Lepchas. The majority of the inhabitants, however, are Hindus in religion. Sikkim was conquered by the Gurkhas in 1789, but after the Nepal War in 1814 the independence of the Raja of Sikkim was guaranteed for his coöperation with the British. He ceded Darjeeling to the British in 1836 and opened his territory to their trade in 1861. His successor, opposing the Indian government, was kept under surveillance in India, but was reinstated in 1895, with a British officer as Resident and adviser. In 1889 the Chinese by treaty recognized the British protectorate over Sikkim. Capital, Tumlung. Consult J. Claude White, *Sikhim and Bhutan* (London, 1909).

SIKSIKA, sĭk′sĭ-kȧ. See Blackfoot.

SI′LAGE (from *silo*, Sp. *silo*, silo, from Lat. *sirus*, from Gk. *σιρός*, *siros*, *σειρός*, *seiros*, pit for corn), or Ensilage. A general name applied to green crops packed and preserved under pressure in specially constructed structures (silos) or in stacks (stack silos), in each of which they undergo fermentation. The preservation of green crops in silos possibly commenced about the year 1800 and in the United States about 1875. Since then the use of silage has greatly extended.

COMPOSITION OF DIFFERENT KINDS OF SILAGE

KIND OF SILAGE	Water	Fat	Protein	Crude fibre	Nitrogen-free extract	Ash
	Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
Corn silage, crop well matured	73.7	0.8	2.1	6.3	15.4	1.7
Corn silage, crop immature	79.0	0.6	1.8	6.0	11.2	1.4
Sweet-sorghum silage	77.0	0.9	1.5	7.0	12.0	1.6
Red-clover silage	72.2	1.2	3.8	9.0	11.3	2.5
Soy-bean silage	73.0	1.5	4.0	8.2	9.8	3.5
Corn and soy-bean silage	75.3	1.2	2.5	6.7	12.3	2.0
Cowpea silage	78.0	0.9	3.2	6.3	9.4	2.2
Apple-pomace silage	79.4	1.3	1.6	4.5	12.2	1.0

The plants most available for silage in the United States are Indian corn, red clover, rye, oats, wheat, sorghum, the millets, alfalfa, soy beans, and cowpeas. Corn is considered most satisfactory. The entire plant should be ensiled, the best time to cut this and other crops being at maturity before the leaves turn brown or the water content begins to diminish. Corn fodder should be cut into pieces ½ to 1 inch long when the silo is filled, otherwise the material does not pack closely and is not convenient to handle. Silage should be well distributed and well packed along the sides and in the corners. If cut in a very dry season and not very juicy, considerable water should be poured on the silage as it goes into the silo. The silage may be fed at once, or a layer of about a foot of cut straw will prevent decay.

When green materials are ensiled, a portion of the carbohydrates, and to a less extent the albuminoids, of the plant is broken down, and acids and other simple bodies are formed. At the same time oxygen is absorbed and carbon dioxide produced. These changes result in a loss of material which ranges from 4 to 40 per cent of the original amount. The chemical changes are accompanied by the production of heat, the temperature sometimes rising as high as 66° C.

As shown by analysis, the cured silage does not differ materially in composition from the green crop. It is therefore essentially coarse fodder. Silage from legumes is naturally richer in protein than that from corn or other cereals. As regards digestibility silage compares favorably with the green crop from which it is made or the corresponding dry fodder.

Silage has become a very important accessory to dairy farming and has been used with success in fattening beef cattle, sheep, and horses. Originally intended for winter use, silage is now frequently put up for summer feeding when pastures are short. Animals usually eat sound silage with a relish and reject it only when decay is present. Dairy cattle should be fed relatively small amounts of silage until they become accustomed to it. In changing from grass or dry feed to silage, if a regular ration is given, the silage will perhaps slightly affect the taste of the milk for a few milkings, and if the change is from dry feed, it may cause too great activity of the bowels. Its use as a food for swine has not been found successful at the agricultural experiment stations.

A cubic foot of silage under average conditions will weigh 35 to 40 pounds. Ordinarily this amount with other food is enough for one cow's daily ration, and at this rate one cow will consume about 4 tons in 200 days. Allowing for waste and emergency conditions, 50 tons is considered necessary for a herd of 10 cows for 200 days.

Approximately 8 per cent of the corn acreage in the United States in 1914 was cut for silage. This is equivalent to over 8,000,000 acres of corn. Generally speaking, three tons of silage are equal in feeding value to one ton of hay. On this basis a much larger amount of digestible food can be secured from an acre of silage corn than from an acre of hay. The food equivalent to four tons of hay can easily be produced on an acre of land planted to corn. Crops may be more compactly and economically stored as silage than as hay. See Silo.

Bibliography. J. M. Bailey, *Book of Ensilage* (New York, 1880); Woods, *Ensilage: Its Origin, History, and Practice* (Norwich, England, 1883); Thurbir, *Silos and Ensilage* (New York, 1886); H. W. Collingwood, *Conserved Cattle Food* (ib., 1892); M. Niles, *Silos, Ensilage, and Silage* (ib., 1895); Ohio State Agricultural Experiment Station, *Modern Silage Methods* (Salem, 1913); M. L. King, *Silos: Construction and Service* (St. Paul, 1913); United States Department of Agriculture, *Bulletin No. 578* (Washington, 1914); Henry and

Morrison, *Feeds and Feeding* (Madison, Wis., 1915); also *Experiment Station Record* (Washington) and publications of the various State experiment stations.

SILA'NION (*Σιλανίων*). A Greek sculptor of the fourth century B.C., famed for his portrait statues. The place of his birth is unknown, but he seems to have worked at Athens. He made ideal portraits of mythical or historical characters, such as Achilles, Theseus, Sappho, and Corinna. Among his portraits of contemporaries were those of Plato and the sculptor Apollodorus. His work was marked by an effort to express individual character. Consult E. A. Gardner, *A Handbook of Greek Sculpture* (2d ed., London, 1915). See GREEK ART, II (*c*) *Age of Praxiteles and Scopas*.

SILAO, sê-lä'ō. A town in the State of Guanajuato, Mexico, 14 miles by rail from the city of that name (Map: Mexico, H 7). It manufactures cotton and woolen goods and is the centre of a rich maize and wheat district. Pop., 1910, 14,059.

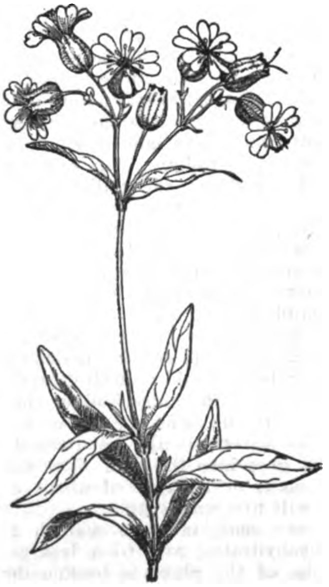
SI'LAS, or **SILVA'NUS**. A prominent leader of the primitive Church. The name Silas is probably Semitic, Silvanus being the Latin form. Silas is first mentioned in Acts xv. 22 ff. as one of the "chief men" in the Jerusalem church and as a "prophet." (Verse 32.) With a certain Judas he was chosen to carry and explain the decision of the apostolic council to the church at Antioch. Here he probably remained, while Judas returned to Jerusalem (so Acts xv. 34 as read in some manuscripts). Shortly after this Paul chose Silas to be his companion on his second missionary journey. (Acts xv. 36–40.) He continued with Paul at least until after the work in Corinth was well under way (Acts xvi. 19 ff., xvii. 4–15, xviii. 5; cf. 1 Thess. i. 1; 2 Thess. i. 1; 2 Cor. i. 19), possibly until the return to Antioch. (Acts xviii. 22.) Acts xvi. 37 implies that Silas possessed the Roman citizenship. Apparently he did not accompany Paul on his third missionary journey or rejoin him later. 1 Pet. v. 12, if the Silvanus here is the Silas of Acts, indicates that he subsequently attached himself to Peter as companion or assistant (his amanuensis if necessary). This might explain some of the Pauline characteristics of 1 Peter. Consult A. C. McGiffert, *The Apostolic Age* (New York, 1897); Theodor Zahn, *Introduction to the New Testament*, vol. i (Edinburgh, 1909).

SILAS MARNER, THE WEAVER OF RAVELOE. A story of humble life by George Eliot (1861), considered by many her finest work.

SILAY, sê-lī'. A town of Negros Occidental, Philippines, situated on the northwest coast, 9 miles north of Bacólod (Map: Philippine Islands, D 5). Pop., 1903, 15,649.

SILCHER, zĭlk'ẽr, FRIEDRICH (1789–1860). A German song composer, born at Schnaith, Württemberg. He studied with his father and Auberlen, an organist at Fellbach. He taught music while residing at Stuttgart and in 1817 received the appointment of musical director at the University of Tübingen, which position he held until within a few months of his death. His *Sammlung deutscher Volkslieder* contains many of his songs, which have become real folk songs. Among these are: "Aennchen von Tharau," "Morgen muss ich fort von hier," "Ich weiss nicht was soll es bedeuten," "Zu Strassburg auf der Schanz." Among his other works are three books of hymns, *Tübinger Liedertafel*, and *Harmonie- und Compositionslehre*. He died at Tübingen.

SIL'CHESTER. A village in northern Hampshire, England, between Reading and Basingstoke. Near by is the site of the old Roman town Calleva Atrebatum. The site is inclosed by the remains of the old wall and broad ditch, but no other ruins of the city are above ground, and the place has long been under cultivation. The first systematic excavations were attempted in 1864 by Joyce. In 1890–1909 the Society of Antiquaries took up the work, and now the greater part of the ancient site has been explored. The museum at Reading has been chosen as the depository of such objects as can be transported. The wall of the ancient town forms an irregular heptagon about 1½ miles in circuit. Six gates have been found. In the centre lay the forum, an open space surrounded on three sides by colonnades with shops behind them, while on the fourth was the basilica, 270 by 58 feet. The streets divided the town into a series of blocks (*insulæ*); the houses were not closely joined, but seem to have stood in their own gardens. They consist of rooms opening from a long corridor, or else of three such corridors about a square courtyard. One house of large size, with baths, is supposed to have been an inn. Three temples have been found and apparently an early Christian church (a small building with a nave, two aisles, and an apse, as well as side rooms). The place was thoroughly Romanized, as is proved by the inscriptions and the art. The earlier excavations are reported in *Archæologia*, vols. xl, xlvi, published by the London Society of Antiquaries (London, 1866–87). Beginning with vol. lii (1890) full annual reports have been published, well illustrated by plates and plans. Consult F. Haverfield, *The Romanization of Roman Britain* (3d ed., Oxford, 1915).



BLADDER CAMPION.

SILENE, sī-lē'nē (Neo-Lat., from Lat. *Silenus*, Gk. *Σειληνός*, *Seilēnos*, name of a satyr). A large genus of annual or perennial plants of the family Caryophyllaceæ, mostly natives of the northern temperate zone. Bladder campion (*Silene cucubalus*, or *Silene latifolia*), a European perennial, grows in grain fields and dry pastures, has a branched stem a foot high, bluish-green leaves, panicles of white flowers, and an inflated calyx. It is rather common from Quebec to Iowa, having been introduced from Europe. The young shoots are sometimes used like asparagus and have a peculiar flavor, somewhat resembling peas. They are best blanched. The plant has not obtained a place among garden plants. *Silene stellata*, the starry campion of the United States, quite similar to the moss campion (*Silene acaulis*), a little plant with beautiful purple flowers, grows in patches so as to form a kind of turf. It occurs in the mountains of Europe and also in America. Many species are called catchfly from their viscidity.

SILENI. See Silenus.

SILENT WOMAN, The. See Epicœne.

SILE'NUS (Lat., from Gk. *Σειληνός*, *Seilēnos*). In Greek mythology, one of the Sileni, spirits of the springs, streams, and marshy meadows, companions of Dionysus (q.v.). They seem to belong to the Asiatic worship of the wine god; it is in Asia Minor that we find a Silenus in various legends, which, while showing the drunken, lascivious nature, also exhibit a nobler side, in which Silenus is the possessor of supernatural wisdom. Thus, after his capture through his love of wine, Silenus reveals to King Midas (q.v.) much hidden wisdom. So, also, Marsyas (q.v.) appears as a Silenus. Silenus is in the later legend a king of Nysa and the foster father of Dionysus, whom he accompanied in his journeys, borne upon an ass, whose bray struck terror to the giants and other foes. Art represented him as an old man, bald, huge of paunch, wrinkled, and in a state of jovial intoxication. He usually has beside him a wine skin and, if he walks, needs the support of friendly satyrs or is held by them upon his steed. The Sileni are usually identified with those attendants of Dionysus who have horses' ears, tails, and hoofs, or even legs, and are common on the earlier Attic and Ionic vases. Consult Otto Gruppe, *Griechische Mythologie und Religionsgeschichte* (2 vols., Munich, 1906). See Satyr.

SILESIA, sĭ-lē'shĭ-ȧ *or* -shȧ (Ger. *Schlesien*). The largest of the provinces of Prussia, occupying the southeastern end of the Kingdom (Map: Germany, G 3). Area, 15,569 square miles. The southern part is traversed by chains of the Sudetic Mountains, the Reisengebirge, and other ranges, culminating in the Schneekoppe (5260 feet) and the Grosser Schneeberg (4665 feet). An extensive coal field lies in the extreme southeast and another in the Hochwald, southwest of Breslau, at a height of nearly 2790 feet. Silesia is drained chiefly by the Oder and its numerous tributaries. The Vistula takes in a small part of the east and the Oder the west. There are many mineral springs.

The climate is moderate and healthful in the lower parts, but harsh in the mountainous regions. Silesia is still preëminently an agricultural country. About 55 per cent of the total area is arable land, of which about two-thirds is divided into small holdings, while the remainder is made up of large estates. The fertile land is found chiefly between the Oder and the southwestern mountain chains; most of the land east of the river is unfit for agriculture. Silesia stands next to Saxony among the grain-producing provinces of Prussia. The chief cereals are rye, oats, wheat, and barley. Potatoes, different kinds of forage plants, beets, and hay are also raised extensively. The forests are very extensive, and cattle raising and sheep grazing are important.

Silesia contains the richest coal deposits of Germany, and its coal mines gave occupation to over 93,000 persons in 1900. The output of coal for the year 1910 was 39,993,239 metric tons, or nearly 28 per cent of the total output of Prussia. The zinc deposits of Silesia, found in the plateau of Farnowitz, are among the richest in the world and yielded an output of over 591,154 metric tons in 1910. Iron and lead are important mineral products. The District of Oppeln is the centre of the iron industry, now highly developed. The other manufacturing industries not connected with mining are also extensive, and the industrial progress is shown by the fact that the population engaged in industrial pursuits outside of agriculture increased from 1,409,698 in 1882 to 1,742,187 in 1895, while the agricultural population for the same period shows a decrease from 1,790,934 to 1,628,105. In 1913 there were under rye 600,600 hectares; wheat, 213,000; barley, 149,000; potatoes, 339,400; oats, 389,500; hay, 347,200. The textile industry ranks next in importance to mining and allied industries, employing nearly 100,000 people. In weaving and flax spinning Silesia ranks first among the Prussian provinces. Extensive cloth, woolen, and yarn manufactures are centred at Breslau and Liegnitz. Other important products are china, earthen and stone wares, glassware, beet sugar, spirits, woodenware, apparel, etc. The chief centre of industrial and commercial activity is Breslau, the capital.

Silesia is divided into the three government districts of Breslau, Liegnitz, and Oppeln. To the Lower House of the Prussian Landtag Silesia sends 65 deputies. To the Reichstag the province returns 35 members. Pop., 1816, 1,942,000; 1864, 3,511,000; 1900, 4,668,857; 1910, 5,225,962. About one-fifth of the people are Polish. In 1910 Evangelicals numbered 2,199,114 (42.08 per cent); Roman Catholics, 2,962,783 (56.69); Jews, 44,985 (0.86). The larger cities and towns include: Breslau (pop., 1910), 514,979; Görlitz, 85,806; Königshütte, 72,641; Beuthen, 67,784; Liegnitz, 67,396; Gleiwitz, 66,981; Kattowitz, 43,173; Oppeln, 33,907.

History. Silesia was inhabited in ancient times by Germanic or Celtic tribes, who were succeeded by Slavic. At the end of the tenth century it came under Polish rule and was soon Christianized. From 1163 the greater part of Silesia was ruled by dukes of the Polish line of Piast. (See Poland.) These dukes, to repeople the country, then devastated by the numerous civil wars, encouraged the settlement of German colonies, especially in Lower Silesia. Division and subdivision of territory prevailed so extensively in Silesia that in the fourteenth century it had no fewer than 18 independent dukes. Famous among the Silesian dukes was Henry II of Lower Silesia, who fell in battle against the Mongols on the field of the Wahlstatt (Liegnitz) in 1241. In the course of the fourteenth century these petty rulers, who were constantly at war with each other, placed themselves under the overlordship of the King of

Bohemia, and Silesia was thenceforth part of the Holy Roman Empire. In 1537 the Duke of Liegnitz, one of the numerous Silesian princes, entered into an agreement of mutual succession (*Erbverbrüderung*) with the Elector of Brandenburg on the extinction of either reigning line. The other ducal lines becoming gradually extinct, their possessions fell to Liegnitz or to Bohemia or lapsed to the Emperor. In 1675, when the last ducal family, that of Liegnitz, failed, the duchies of Liegnitz, Brieg, and Wohlau would have fallen to Prussia, but the Emperor Leopold I refused to recognize the validity of the agreement of 1537 and took possession of the Liegnitz dominions as a lapsed fief of Bohemia. The remainder of Silesia was thus incorporated in the Austrian dominions. In 1740 Frederick II of Prussia, taking advantage of the helpless condition of Maria Theresa of Austria, laid claim, on the strength of the agreement of 1537, to certain portions of Silesia. Without declaring war he marched into and took possession of the province, maintaining his hold despite the utmost efforts of Austria in the struggles of 1740–42 and 1744–45, called the first and second Silesian wars. At the close of the Seven Years' War (q.v.) in 1763 the bulk of Silesia was definitively ceded to Prussia. Parts of Silesia (Austrian) were overrun by the Russians in the Great War which began in 1914. See War in Europe.

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SILESIA. A duchy and crownland of the Austrian Empire (Map: Austria, E 1). Area, 1987 square miles. The Sudetic chain enters Silesia from the west, and the Carpathians send off several spurs into the interior from the east, giving the surface an extremely mountainous character. The chief rivers are the Oder and the Vistula, both rising in the crownland. The climate is raw, but on the whole healthful. About one-half of the total area is arable land, which produces good crops of cereals and industrial plants. The census of Dec. 31, 1910, returned 31,769 horses, 196,526 cattle, 5748 sheep, 37,072 goats, and 144,209 swine. Silesia produces more coal than any other crownland of Austria; its output in 1913 was 7,594,865 metric tons, as compared with 16,459,889 tons for the Empire. Favored by its abundance of fuel, Silesia has a number of well-developed manufacturing industries. Ironware, textiles, beer, and spirits are the chief products. Silesia has a Diet of 31 members and is represented in the Lower House of the Austrian Reichsrat by 15 members. Pop., 1890, 605,649; 1900, 680,422; 1910, 756,949. Roman Catholics in 1910 numbered 639,053 (84.4 per cent); Evangelicals (Augsburg), 102,072 (13.5); Jews, 13,442 (1.8). German in 1910 was the vernacular of 325,523 persons (43.9 per cent); Polish, 235,224 (31.7); Bohemian-Moravian-Slovak, 180,348 (24.3). Troppau, the capital, had, in 1910, 30,762 inhabitants; Polnisch Ostrau, 22,892; Teschen, 22,489; Bielitz, 18,568; Jägerndorf, 16,121; Karwin, 15,761. For history, see preceding article.

SI'LEX (Lat., flint). A generic name formerly used by mineralogists to designate those minerals of which silica is the principal ingredient.

SILHOUETTE, sĭl'ụ-ĕt'. A profile drawing of a portrait, the outlines of which are filled in in black, showing a profile as if cast by the shadow of a candle. The name is derived from Etienne de Silhouette, a French minister of finance, whose measures of rigid economy in 1759 were very unpopular. The frivolous Parisians applied his name to anything parsimonious, incomplete, or imperfect, and therefore to this kind of likeness, then the mode in Paris. The black is sometimes varied by lighter lines or less shadow. Consult: Emily Jackson, *History of Silhouettes* (London, 1911); Desmond Coke, *The Art of Silhouette* (ib., 1913); E. S. Bolton, *Wax Portraits and Silhouettes* (Boston, 1914).

SIL'ICA, or Silicic Acid. See Quartz; Silicon.

SIL'ICIDE OF CARBON, or Carbide of Silicon. See Carbides.

SILICEOUS (sĭ-lĭsh'ŭs) **ROCKS.** A group of sedimentary rocks characterized by quartz as the principal constituent. Sandstone, quartz conglomerate, arkose, novaculite, and chert are the chief varieties of siliceous rocks.

SIL'ICON (Neo-Lat., from Lat. *silex*, flint), or Silicium. A nonmetallic element discovered by Berzelius in 1823. Among the ancients minerals rich in silica were used in glassmaking. In the seventeenth century it was found that such minerals did not change when heated by themselves, and formed a fusible glass only when brought in contact with other bodies. In 1660 Tachenius showed that silica possessed acid rather than alkaline properties, as it combined with alkalies, but its true nature remained unknown until Davy demonstrated it early in the nineteenth century. Silicon is the most abundant of all elements in the earth's crust, excepting oxygen. It is never found isolated, but occurs in combination with oxygen as silicon dioxide or silica (quartz, flint, sand, etc.) and in various minerals in the form of metallic silicates. It also occurs in mineral springs and sea water. It was originally prepared by Berzelius by decomposing potassium silicofluoride by means of potassium in an iron tube at a red heat. When allowed to cool, the mass was treated with water, which dissolved the potassium fluoride, leaving silicon in the form of an amorphous brown powder. In 1856 Wöhler showed that sodium or aluminium may be substituted for potassium in preparing crystalline silicon by the Berzelius method. More recently silicon has been obtained by heating silica with aluminium, and since 1908 a roughly 95 per cent silicon has been manufactured at Niagara Falls by heating silica (sand) with coke in the electric furnace. Small amounts of silicon have been used in the manufacture of steel, but a very large demand for the element arose in the year 1915 in connection with the European War.

A graphitoidal modification of silicon is recognized by some and may be produced by heating amorphous silicon in a platinum crucible, while a third modification, known as crystalline or adamantine silicon, is formed by heating in an earthenware crucible a mixture of three parts of potassium fluosilicate, one part of sodium in small pieces, and four parts of granulated zinc.

Silicon (symbol, Si; atomic weight, 28.3), when in an amorphous condition, is a lustrous brown powder which does not conduct electricity and is fusible in a nonoxidizing atmosphere at a temperature between the melting points of steel and cast iron. The graphitoidal modification consists of shining metallic scales, while crystalline silicon is obtained in the form of grayish-black metal-like leaflets or needles, with a specific gravity of from 2 to 2.5 and a melting point between 1100° C. and 1300° C. (between 2012° F. and 2372° F.). Silicon combines directly with a number of the elements, forming silicides. With oxygen silicon combines to form only one oxide, the dioxide, or silica (SiO_2), which is an important constituent of the solid crust of the earth and may be artificially prepared by burning silicon in air or oxygen. As flint and as sand it has many applications in the arts, as in the manufacture of glass, pottery, etc. Silicon unites with the halogens. Thus, with fluorine it forms a silicon tetrafluoride, which is a colorless gas that combines with water, forming hydrofluosilicic acid, which in turn unites with bases to form salts known as silicofluorides.

SILISTRIA, sĭ-lĭs'trĭ-ȧ. A town of Rumania, on the right bank of the Danube, 75 miles below the important Bulgarian city of Rustchuk (Map: Balkan Peninsula, F 2). In the vicinity are vineyards and tobacco plantations, and the town produces flour and leather on a considerable scale. Pop., 1900, 12,133. Silistria was called by the Romans Durostorum and was an important city of Mœsia Inferior. It was a strong fortress under the Turkish rule and repeatedly baffled the attacks of the Russians. It belonged to Bulgaria from 1878 to 1913, when, in the course of the Second Balkan War (q.v.), it was seized by Rumania and confirmed to that Power by the Treaty of Bucharest (Aug. 10, 1913).

SIL'IUS ITAL'ICUS, TIBERIUS CATIUS (25–101). A Latin poet, whose name appears frequently in Martial and Pliny. In 69 he was consul and soon afterward proconsul in Asia. He was rich and luxurious, a dilettante in literature, art, and philosophy, a Stoic, and a friend of Epictetus. He starved himself rather than linger with an incurable disease. A *Homerus Latinus*, or *Pindarus Thebanus*, bears his name in acrostic at beginning and end. It is an epitome of the *Iliad*. He is better known by the *Punica*, an artificial heavy epic in 17 books, edited by Ruperti (1795–98) and by Bauer (1890–92). Consult H. E. Butler, *Post-Augustan Poetry* (Oxford, 1909), and Martin Schanz, *Geschichte der römischen Litteratur*, vol. ii, part ii (3d ed., Munich, 1913).

SILK (AS. *seolc*, *sioloc*, *sioluc*, OHG. *silecho*, silken robe, probably from OChurch Slav. *šelkŭ*, silk, from Lat. *sericum*, silk, neut. sing. of *Sericus*, from *Seres*, Gk. Σῆρες, Chinese). The fibre derived from the cocoon of the silkworm (*Bombyx mori*), or from some other form of caterpillar or spider, and woven into many useful and ornamental fabrics.

Historical Sketch. Silk appears not to have been well known to the ancients; though mentioned in the translations of the Bible, authorities deny that it is in the original or was known to the Hebrews. Among the Greeks, Aristotle is the first who speaks of it. From all the evidence which has been collected it would appear that the natives of Cos (mentioned in Aristotle) received it indirectly through the Phœnicians and Persians from China. The silken webs of Cos found their way to Rome, but it was long before it was obtainable except by the wealthy. The cultivation in Europe of the worm itself did not take place until 530 A.D., when, according to Procopius, the eggs were brought from India (China) to the Emperor Justinian by some monks. In China the cultivation of silk is of the highest antiquity, and, according to Chinese authorities, it was first begun by Si-ling, the wife of the Emperor Hoang-ti (2609 B.C.), and the mulberry was cultivated for feeding silkworms only 40 years later.

Since its introduction into Europe silk culture has always formed a great branch of industry in Italy, Turkey, and Greece, and it has been carried on to some extent in France, Spain, and Portugal.

In early times the American colonists devoted much labor to the growth of the mulberry and culture of silkworms. In 1732 the Colonial government of Georgia allotted a piece of ground for a nursery plantation for white mulberry trees. Lands were granted to settlers on condition that they planted 100 of these trees on every 10 acres when cleared, 10 years being allowed for their cultivation. In 1749 the British Parliament passed an Act exempting from duty all raw silk certified to be the product of Georgia or Carolina. In the same year an Italian expert was sent to Georgia to conduct a filature—for reeling, etc.—and in 1759 receipts of cocoons at the filature exceeded 10,000 pounds, the quality of the raw silk being so good that it sold in London at three shillings a pound more than that from any other part of the world. After 1759, however, the production of silk in Georgia fell off greatly. Mansfield, Conn., became, in the latter part of the eighteenth century, an important silk-raising section, and this continued to be a fixed industry in that locality. Pennsylvania engaged in the culture about 1767, and a filature was established in Philadelphia in 1769 or 1770, and, in 1771, 2300 pounds of cocoons were brought there to reel. This State maintained the industry up to Revolutionary times. From the close of the Revolution to about 1825 silk manufacture in the United States was domestic, families making small quantities—hardly ever reaching 100 pounds per annum in a single family. Importation of silk goods in the meantime had increased, so that in 1821 it amounted to $4,486,924. It was felt that this costly importation should be stayed, and congressional committees investigated the subject, and voluminous reports were made. This brought about the enthusiastic culture of the *Morus multicaulis*, which grew into a mania, during which a great many speculators and private buyers were ruined.

The result of this speculative incident, the financial depression of 1837, and the fact that in 1844 a blight affected all the mulberry trees in the country were disastrous to silk culture in the United States. In California, in 1860–75, the business was largely prosecuted, but did not succeed. In 1884 Congress began making appropriations for the encouragement of silk culture in the United States, and these, expended under the Department of Agriculture, were continued until 1890, when they lapsed until 1901. In the meantime considerable silk was grown in Utah under State bounties, and private individuals have raised cocoons and reeled the silk on hand reels for home weaving in many other States. The climate and soil of many parts of the United States seem admirably adapted to silk culture, but as yet there are no commercial reeling establishments. The first silk mill on the Western Continent was set up at Mansfield, Conn., in 1810. The manufacture was introduced into Philadelphia about 1815, and as early as 1824 the Jacquard loom began to be used there. Power looms were next introduced, and power-loom weaving begun about 1838. From 1831 to 1839 many factories were started at Windsor Locks (Conn.), Poughkeepsie (N. Y.), Philadelphia, and elsewhere, most of which failed. Burlington, N. J., became an important silk-producing locality about 1838. The industry included the culture of the mulberry tree and the raising of silkworms, as well as the manufacture of silk. Hartford, South Manchester (Conn.), Holyoke, Northampton, and Haydenville (Mass.) are among the New England towns in which silk has been manufactured extensively. But the most important centre of this industry in America is Paterson, N. J. (q.v.), where the water power of the Passaic River, facilities for transportation, etc., offer good conditions for its prosecution. The first silk mill in Paterson was set up about 1838 in the fourth floor of Samuel Colt's pistol factory and was followed by other factories, until in the years succeeding the Civil War Paterson became, and has since remained, the chief seat of silk manufacture in the United States.

Processes of Manufacture. Although raw silk, unlike other textile fibres, is a continuous thread and requires no spinning, yet its preparation for the loom includes many distinct operations. After the cocoons reserved for breeding purposes are set aside, those to be used for silk are submitted to treatment that will kill the chrysalis without injury to the cocoon, just at the time when the insect has finished spinning and is ready to force its way through its covering. Several methods have been adopted for this. The chrysalis may be destroyed in an oven heated to 60° C. or 70° C. (140°-160° F.), or by placing it in the hot sun for several days under glass, or by a steam bath. The last method was invented by Professor Castrogiovanni of Turin. The cocoons are placed under an iron receiver, where steam is applied at a uniform temperature of 212° F. One objection to this process is that the pupa sometimes bursts, soiling the silk. It is said the Chinese reel off the silks from the cocoon while the silkworm is still alive.

Reeling. In order to be able to remove the silk from the cocoon the latter is soaked in warm water, which loosens the gummy substance binding the filaments. As a single fibre has not sufficient tenacity, from 4 to 18 filaments, according to the size of the thread desired, are taken, and two threads formed by passing them through perforated metal or porcelain guides. The threads are crossed or twisted together at a given point, and again separated and passed through a second pair of guides, the temporary twisting or crossing causing the agglutination of the individual fibres of each thread. The thread is then passed through a pair of distributing guides on to the reel. Great care and skill are required in reeling silk from cocoons to keep the thread of uniform thickness. The threads of different cocoons are not the same length, and that from the inner part of the cocoon is finer than the outside, so the filament from another cocoon must now and then be added to keep the thread even. The common reeling machine is a simple device consisting of a reel 60 to 90 inches in diameter, adjusted in a frame which contains the guides, the water basin, and means for keeping the water warm. Steam filatures are in general use, in which the heat of the water can be regulated. Reeled silk is the raw material of the silk manufacturer, called raw silk. It is shipped by silk growers in hanks of various sizes, packed in bundles or bales.

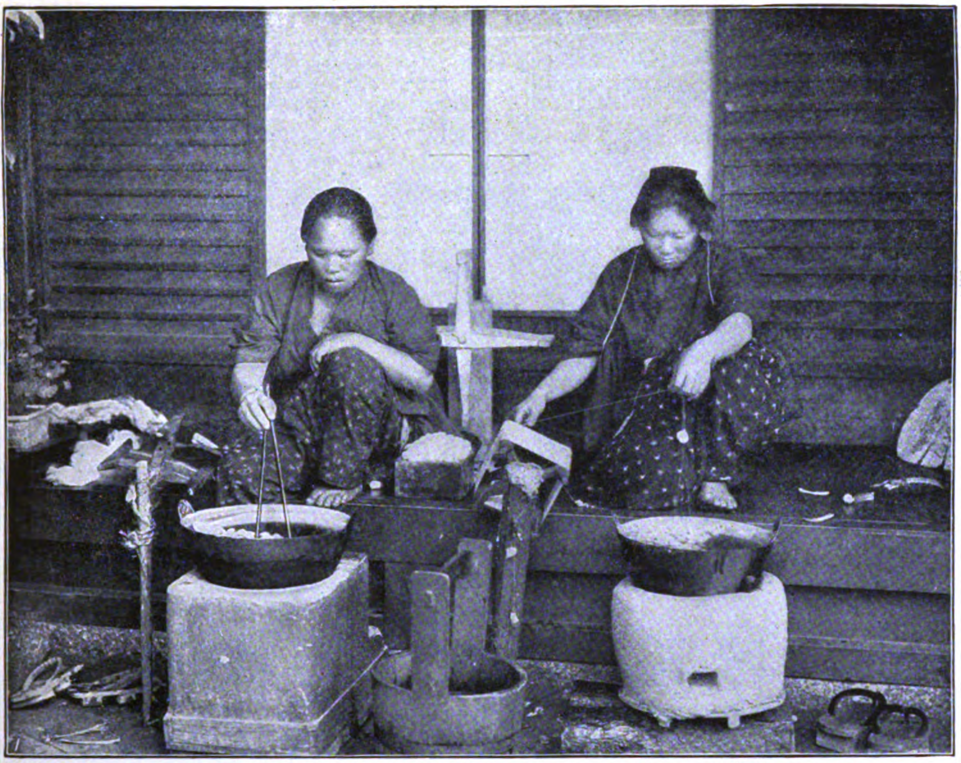
Silk Conditioning. One of the most striking physical characteristics of raw silk is its avidity for moisture; it will readily absorb 30 per cent of its weight in moisture without the fact being perceptible. In order, therefore, to determine the amount of normal silk in a given bulk, the raw silk is tested in an apparatus called a desiccator. This is done by first weighing a sample, then drying it to constant weight at 105°-110° C. (220° F.), and noting the loss of weight. To the thoroughly dried silk an allowance of 11 per cent is added and the result taken as normal weight. In the great centres of silk manufacture the testing is required by buyers and is done by special houses called silk-conditioning establishments.

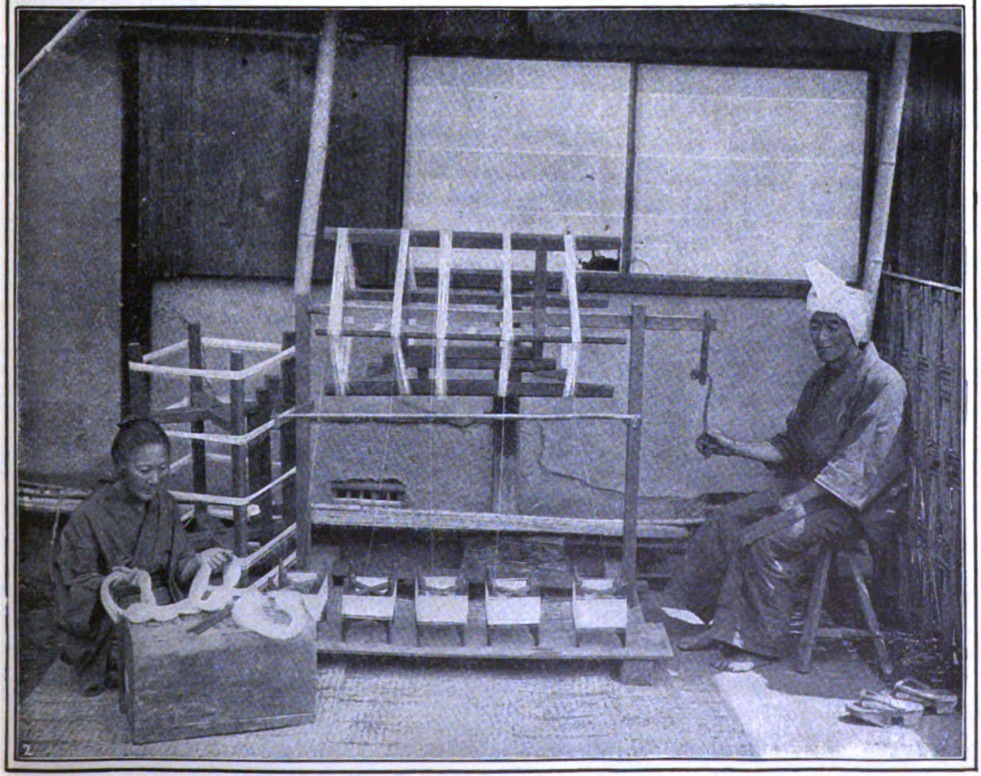
Throwing. The process of preparing the reeled silk for the loom is technically called throwing. The first step is to transfer the silk from the skeins to bobbins. The skeins, inclosed in a light cotton bag, are soaked for several hours in soapy water at 110° F. They are then dried in a hydro-extractor and stretched upon swifts—skeleton reels so adjusted that they will hold the skeins tightly. Thence they are wound on bobbins. The silk is next cleaned by passing it from one bobbin to another through the cleaner, which consists of two parallel plates so adjusted that there is just room for the thread to pass through. Adhering dirt or an imperfection in the thread at once holds the thread and arrests the motion of the spindle until the operator removes the cause. The best Italian silk does not require this process, but for Chinese silk it is always necessary.

Doubling and Twisting is the next process performed, and the manner in which it is done gives the name to the three different silk threads. 1. Single silk is doubled or twisted little if at all, being usually woven direct from the cleaning process. Cloth produced in this way possesses a softness and brilliancy not obtainable in that made from twisted silk. Pongee is a familiar fabric made from singles. 2. Tram silk is made by twisting two or more single threads, which are then doubled and slightly twisted. It is used for the woof thread in weaving. 3. Organzine silk is made by the union of two or more single threads, twisted separately in the same direction, which are doubled and then retwisted in the opposite direction. It is used chiefly for warp threads.

Boiling-off is the process applied to thrown silk to remove more or less of the glue adhering to the silk thread, so it will have a greater lustre and may be able to take a better color in dyeing. According to the amount of gum removed in scouring, silk is known as boiled, in which from 24 to 30 per cent is removed; souple,

SILK





1. UNWINDING THE COCOONS

2. REELING

in which only from 5 to 12 per cent is removed; écru, in which not more than 5 per cent is removed. The boiling-off is performed in soapsuds. The silk is now ready to be dyed, although for white or pale shades it must first be bleached in sulphur fumes.

Shaking, Glossing, and **Lustring** are supplementary processes for which special machinery has been devised, designed to develop the lustre of the silk.

Loading or **Weighting of Silk** was, in the beginning, an attempt on the part of silk dyers to make up for the loss of weight, often amounting to one-fourth, incurred during the process of boiling-off, by the use of certain chemicals which, combining with the silk, took up the dye. For a time weavers were satisfied if the dyeing process was so conducted that there was no loss of weight. But the art of imparting factitious weight to silk was soon developed to a ruinous extent. Sugar and glucose were at first the favorite agents of sophistication, but were soon abandoned for more effective materials. In black silks the extreme weighting was first practiced, a pound of silk being treated so as to weigh 100 ounces. The discovery of the use of salts of tin, however, has made it possible to weight the white and colored silks as heavily as black. By this process the durability of the silken fabric, once its most prominent characteristic, is entirely lost.

Spun Silk. Before winding the cocoons a flossy portion has to be removed. (See FLOSS SILK.) After the filament has been wound off another remains like a compact bag. These, together with the silk from perforated and double cocoons and the fragments of broken thread which accumulate during the process of throwing, are sold under the name of waste silk. This waste is thoroughly cleaned by washing, boiling, and drying and is then carded and spun like cotton, the yarn thus produced being known as spun silk or fleuret silk. This greatly economizes the use of silk, as the quantity of silk waste always greatly exceeds the amount of good silk reeled off. The processes employed in the production of silk yarn or floss silk, from the waste, differ little from those for spinning other materials. Four million pounds of floss silk are annually consumed in France alone. The United States imports about 6,000,000 pounds of silk waste annually.

Wild Silk. Many silk-producing moths exist besides the *Bombyx mori*, or cultivated moth, from which the ordinary commercial silk is derived. The one at present attracting the most attention is that from which Tussah silk is manufactured, much used in connection with ordinary silk and in the manufacture of plush. Tussah silk is the product of the moth *Antheræa mylitta*, found in India. Other wild silks are the eria silk of India, the fagara silk of China, and the yamamai silk of Japan. See SILKWORM.

Other Silk. A certain amount of silk is spun by many insects. The bombycid and Saturnian moths spin the largest quantity. There is a butterfly (*Eucheira socialis*), however, whose caterpillars live in an enormous silken nest. Insects of other orders, also, have smaller silk glands and secrete some silk. In the Arachnida a number of groups produce silk, the greatest amount being spun by the spiders, and many experiments have been made to place the production of spider silk upon a commercial basis.

Silk Fabrics. The process of weaving silk does not differ from that of weaving other fabrics, except that in Europe for the finer grades the hand loom is still largely employed. (See WEAVING.) The four principal silk-woven textures are sarcenet, taffeta, satin, and velvet.

RAW SILK PRODUCTION OF THE WORLD

FROM UNITED STATES CONSULAR REPORTS, JUNE 9, 1915

	Production in pounds	
	1913	1914
Western Europe:		
France	771,618	892,872
Italy	7,804,363	8,994,859
Spain	180,779	154,324
Austria-Hungary	601,862	272,410
Total	9,358,622	10,714,465
Levant and Central Asia:		
Asiatic Turkey:		
Anatolia	1,025,149	793,664
Syria and Cyprus	1,080,265	925,941
Other provinces	297,624	242,509
European Turkey:		
Adrianople	187,393	132,277
Balkans: Bulgaria, Servia, and Rumania	297,624	231,485
Greece, Saloniki, and Crete	407,885	330,693
Caucasus	848,780	771,618
Turkestan and Central Asia (exports)	496,040	....
Persia (exports)	462,971	....
Total	5,103,701	3,428,187
Extreme Orient:		
China:		
Exports from Shanghai	12,709,648	8,201,195
Exports from Canton	6,062,711	4,287,990
Japan:		
Exports from Yokohama	26,720,022	21,495,068
East Indies:		
Exports from Bengal and Kashmir	249,122	66,139
Indo-China (exports)	26,456	22,046
Total	45,767,959	34,072,438
Grand total	60,230,282	48,215,090

The apparent falling off in 1914 as contrasted with 1913 was due to the state of war, which almost completely suppressed the arrivals of raw silk from Turkestan, Persia, and the extreme Orient.

SILK AND MANUFACTURES OF SILK IMPORTED INTO THE UNITED STATES

For the fiscal year ending June 30, 1915

UNMANUFACTURED

Coooons	free	pounds	51,495
		dollars	35,114
Raw, or as reeled from the cocoons	free	pounds	26,030,925
		dollars	80,531,785
Waste	free	pounds	4,970,254
		dollars	2,563,658
Total unmanufactured		dollars	83,130,557

MANUFACTURES OF

Clothing, ready-made, and other wearing apparel	dut.	dollars	2,629,550
Dress and piece goods	dut.	dollars	9,135,804
Laces and embroideries	dut.	dollars	3,034,804
Ribbons not over 12 inches wide	dut.	dollars	1,862,078
Spun silk, or schappe silk yarn	dut.	pounds	2,147,975
		dollars	4,038,778
Velvets, plushes, and other pile fabrics	dut.	pounds	596,509
		dollars	2,231,923
Bandings, beltings, bindings, etc. not over 12 inches wide	dut.	dollars	304,326
Bolting cloths	free	dollars	256,041
All other	dut.	dollars	1,549,366
Total manufactures		dollars	25,042,670

Statistics. According to the United States Census of 1910 there were in the country at the close of 1909 852 silk factories, with a combined capital of $152,158,002 and a product valued at $133,288,072. The rapid growth of the industry during the last half of the nineteenth century and the first decade of the twentieth is shown by the fact that in 1850 there were only 67 silk factories, having a capital of $678,300 and a product of $1,809,476.

In 1909 there was a total of 75,406 silk looms in the United States, of which 28,915 were in New Jersey, 26,249 in Pennsylvania, 7575 in New York, 5006 in Connecticut, and 2717 in Massachusetts. During the year 1914, 51 silk mills were built, and nearly one-half of the silk product of the world was consumed in the United States. Returns for the year 1909 for the State of New Jersey gave the total number of silk establishments in that State as 348; average number of men and women employed therein, 30,285; gross value of product, $65,429,550.

Consult: E. A. Posselt, *Structure of Fibres, Yarns, and Fabrics* (Philadelphia, 1890); Coles, *Ornament in European Silks* (London, 1899); S. P. Sadtler, *Handbook of Industrial Organic Chemistry* (Philadelphia, 1912); J. M. Matthews, *Textile Fibres: Their Physical, Microscopical, and Chemical Properties* (3d ed., New York, 1913). See also Silkworm; Spinning; Textile Manufacturing; Weaving; and bibliographies there given.

SILK, Artificial. Artificial silk has been the aim of experimenters for many years. The first attempts to produce it on a commercial scale were made by Joseph Wilson Swan of Bromley, England. The Comte de Chardonnet, at the Paris Exposition of 1889, exhibited a most ingenious process of producing from cellulose an artificial fibre resembling in its characteristics and uses the true silk of *Bombyx mori*. The cellulose experimented with was principally of cotton and the pulp of soft woods. In making artificial silk from cotton by the Chardonnet method the lint is first carded into wadding, which is immersed in a mixture of 15 parts of nitric acid of 1.5 specific gravity and 85 parts of commercial sulphuric acid. This process transforms the cotton into a nitrated cellulose and continues until its color, when examined with the microscope and polarized light, is a clear blue. The next stage in the process is to press the nitrated cotton, which is then washed to remove all traces of the acid. It is then dissolved in a mixture of 40 parts alcohol and 60 parts ether, forming collodion, which requires aging in order to secure the best results. This collodion is placed in steel cylinders, and the liquid is expelled by pressure through capillary tubes into nitric acid diluted one-half with water. The fibres thus produced are wound directly upon reels and are ready for subsequent treatment. This involves the drying of the fibre by warm air and its denitration in a bath of alkaline sulphide. It then goes through additional washing and drying processes, after which it may be spun and dyed like natural silk. Many other inventors, notably Lehner and Du Vivier, followed Chardonnet, modifying his method.

A second type of artificial silk is known as the cuprammonium or Glanzstoff silk. It is made by dissolving cellulose in ammoniacal copper oxide or carbonate and forcing the solution through capillary tubes into a coagulating bath. The threads are wound on bobbins, spun, washed, soaped, and dried.

The artificial silk principally produced in the United States is commercially known as viscose. It was first prepared in 1892 by Cross, Bevan, and Beadle, of London. As manufactured in the United States, cellulose in some form, usually wood pulp, is treated with caustic soda to form a sodium cellulose and then dissolved in carbon disulphide. The product, alkali-cellulose-xanthate, is a viscous solution popularly called viscose. It is filtered, allowed to ripen by standing, and finally forced through fine apertures into a setting bath which solidifies the threads.

Artificial silk is chiefly remarkable for its brilliancy. Nitro and viscose silks are more lustrous than natural silk, but have a somewhat harsher feel. Some of the early shortcomings of the artificial product—lack of strength and elasticity and a tendency to disintegrate when wet—have been considerably lessened, and these silks are now used in fabrics for both warp and filling threads, for hosiery, dress trimmings, upholsteries, and rugs. They also take the place of real silk for insulating electric-light wires and make durable mantles for incandescent lights.

The production of artificial silk is rapidly increasing. In 1912 the world's output amounted to over 8000 tons, valued at about $30,000,000. Consult: S. P. Sadtler, *Handbook of Industrial Organic Chemistry* (Philadelphia, 1912); Sir T. E. Thorpe, *Dictionary of Applied Chemistry* (rev. ed., London, 1913); J. M. Matthews, *Textile Fibres: Their Physical, Microscopical, and Chemical Properties* (3d ed., New York, 1913); and articles in *Textile American* (August to October, 1914).

SILK, Vegetable. A term usually applied to a soft silky fibre surrounding the seeds of the pods of certain plants of the milkweed family. It has been mixed with silk and with wool in the manufacture of certain fabrics. See Silk.

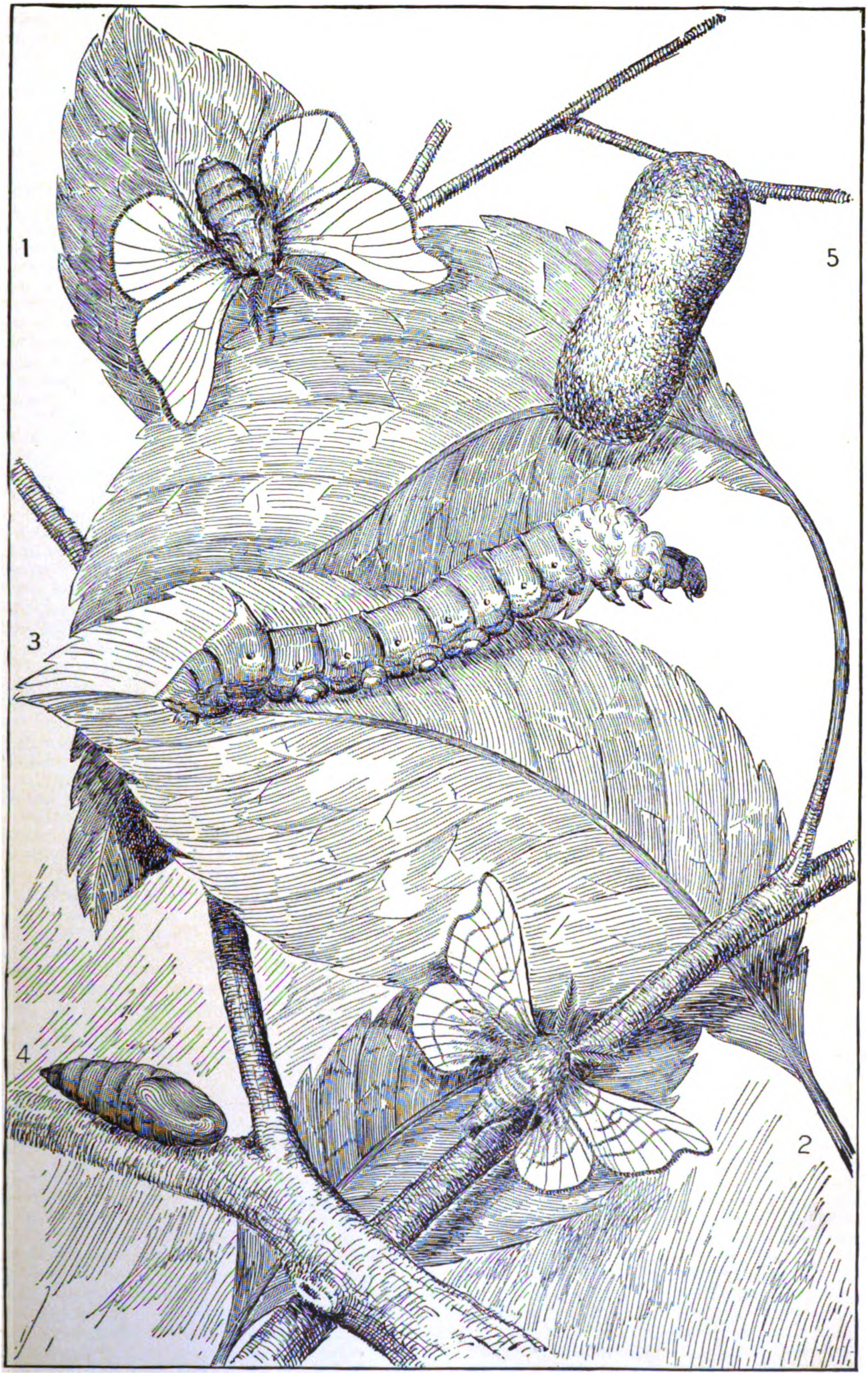
SILK BARK. A name given in South Africa to *Gymnosporia populifolia*, a small evergreen tree, 10 to 50 feet high, becoming a shrub in arid situations. It is of interest on account of its yielding caoutchouc, the presence of which can be readily shown by breaking even the dry twigs.

SILK BLEACHING. See Bleaching.

SILK-COTTON TREES. See Eriodendron.

SILK OAK. See Grevillea.

SILKWORM. The silkworm of commerce is the caterpillar of *Bombyx mori*, a moth of the family Bombycidæ, a group commonly known as the family of silkworm moths. The caterpillars of all the species of this group have the silk glands largely developed, and many produce large quantities of silk in making cocoons. The Bombycidæ have a short and rudimentary proboscis, live only a brief period in their perfect state, and take little or no food; the body is thick and hairy, the wings large and broad, the antennæ pectinated. The caterpillars feed on the leaves and other tender parts of trees or other plants; the chrysalids are inclosed in a cocoon of silk. The common silkworm is a native of either the northern provinces of China or of Bengal. The perfect insect is about an inch in length, the female rather larger than the male, the color whitish, with a broad pale-brown bar across the upper wings. The females generally die very soon after they have laid their eggs, and the males do not survive long. The eggs are numerous, bluish in



SILKWORM (Bombyx mori).

1. Female Moth.
2. Male Moth.
3. Caterpillar (Silkworm) on Mulberry Leaf.
4. Chrysalis.
5. Cocoon.

color, about the size of a pin's head, not attached together, but fastened to the surface, on which they are laid by a gummy substance which, when dry, becomes silky. They are laid about the end of June and are hatched about the middle of the following April or at the time when the leaves of the mulberry unfold.

The caterpillar is at first small—a quarter of an inch in length—but rapidly increases in size till, full grown, it is nearly 3 inches long. It is usually yellowish gray in color, but some varieties are much darker. The skin is changed four times during the growth of the caterpillar. Before each change of skin it becomes lethargic and ceases to eat, whereas at other times it is very voracious. When the skin is ready to be cast off, it bursts at the forepart, and the caterpillar then, by continual writhing, without moving from the spot, thrusts it backward. Silkworms frequently die during this change. A rapid increase of size takes place while the new skin is still soft. The natural food of the silkworm is the leaf of the white mulberry, but it will also feed on the leaves of some other plants, as black mulberry and lettuce, and in the United States it is frequently fed on the Osage orange. When so fed, however, it produces inferior silk. The silk-producing organs are two large glands (sericteria) containing a viscid substance, which extend along a great part of the body and terminate in two spinnerets in the mouth. These glands become very large when the change to the chrysalis or pupa state is about to take place.

When about to spin a cocoon, the silkworm ceases to eat and first produces the rough fibre which forms the outer part of the cocoon, and then the more closely disposed and valuable fibre of its interior. In this process the position of the hinder part of the body is little changed, but the head is moved from one point to another, and the cocoon when finished is much shorter than the body. Each fibre of silk, when examined by a microscope, is seen to be double, being equally derived from the two silk-producing organs of the caterpillar. A single fibre ranges from 800 to 1000 yards in length. The time of the silkworm's life in the caterpillar state is about four weeks. About three days are occupied in the spinning of the cocoon, after which about two or three weeks elapse in the chrysalis stage before the perfect insect comes forth.

Diseases. The silkworm is liable to various diseases, particularly to muscardine, pébrine, flacherie, gattine, and grasserie. Muscardine (q.v.), commonly known as silkworm rot, is due to a fungous growth within the caterpillar. A worm so affected becomes dull white, sluggish, and soon dies. A few days after death it becomes hard, red, and floury. The cause of the disease was discovered by an Italian, Bassi, and the fungus is called *Botrytis bassiana*. Pébrine, unquestionably bacterial, is an hereditary disease and probably contagious and infectious. It is the most fatal of silkworm diseases. By 1847 its ravages in France compelled the French to get their silkworm eggs from Italy. The disease spread to Italy, and then the eggs were procured from the Danube, then from China, and in 1865 healthy eggs could be obtained only from Japan. Pasteur showed that selection and isolation of healthy moths is the only remedy. With the methods of isolation and care against contamination such as are at present practiced, France now supplies her own market and exports 300,000 ounces of silkworm eggs annually. In worms affected with flacherie the food ferments in the alimentary tract and sustains vibrios and certain fungi. This disease is probably induced by improper care of the eggs. Gattine is probably only a modification of flacherie. The cause of grasserie (q.v.) is unknown. It is the least fatal of silkworm diseases. To keep silkworms healthy they must be reared in a suitable and constant temperature. Humidity, ventilation, and cleanliness must be strictly and constantly attended to. Lime is used for whitewashing the walls and buildings in which worms are reared, and sulphur fumes for sterilizing trays.

Culture of Silkworms. The leaf of the white mulberry (*Morus alba*) is apparently the natural food of the domestic silkworm. There are many horticultural varieties of this plant, some much better adapted than others to commercial silk culture, and some better suited to certain localities. The *Morus moretti*, the *Morus multicaulis*, and the black mulberry (*Morus nigra*) are also used. The red mulberry (*Morus rubra*) does not make good food, and the paper mulberry (*Broussonetia papyrifera*) is also valueless. The best varieties of mulberries are propagated by means of seeds and by cuttings. The trees should be planted well apart and should be pruned so as to form a short trunk and a close low head. Silkworm eggs are kept through winter at a low temperature, the embryo beginning to take form when the temperature rises above 50° F. The receptacle in which they are stored should be ventilated, the air should not be moist, and great care should be taken to keep them out of the reach of mice and insects. The eggs are hatched in an artificial incubator or by natural heat. When an incubator is used the temperature should be gradually increased until 73° F. is reached. The whitening of the eggs denotes the nearness of hatching. The eggs should then be covered with sheets of tulle or finely perforated paper, sprinkled with finely cut white mulberry leaves. The young caterpillars will at once mount to the leaves and should be fed eight to ten times during 24 hours. After each feeding the lower sheet of paper or tulle should be removed with the frass. About the sixth day they will begin to molt and pass into the second stage. As the worms increase in size, paper in which the perforations are larger should be used, and the same general directions followed for each stage until the fifth has been reached.

The worms have now grown to nearly full size, are very voracious, and it is difficult to satisfy their appetite. After five days in the fifth stage they are ready to spin. In making preparations for spinning, dry brush, bundles of straw or shavings or finely split-up wood may be used. The brush or straw should be placed upright between the feeding shelves, in rows about 16 inches apart, the tops spread to form arches and allow the worms plenty of room to spin. The temperature during spinning should be 75° F., and the humidity throughout the rearing about 65°. The rearing room should be well ventilated, and before introducing the worms should be disinfected with chloride of lime or sulphur. One ounce of eggs contains approximately 40,000, and the space required may be estimated by allowing 1 square yard for this amount at birth, on the fourth day

2 square yards, for the second stage 4 square yards, three days later 8 square yards, for the third stage 16 square yards, and for the fourth stage 32 square yards, and for the fifth stage 60 square yards. Plenty of space is desirable, since when crowded the worms will not be so robust. A mean temperature of about 74° F. is the best. There are many commercial varieties of the silkworm graded according to the size, color, and quality of the cocoon. When the cocoons are completed, which is known by the absence of any sound within, they are carefully sorted and a certain number kept for laying. The sexes are readily known by difference of shape as well as of size, the female being plumper; the male, much smaller, having a central depression and sharper extremities. The French growers sort them into nine varieties, those which are less compact or in which the worm has died—a fact known by external indications—being separated from the good ones. When the sorting is finished the cocoons are placed in an oven with a gentle heat, which kills the inclosed chrysalis, otherwise they would all become perforated by the insect eating through. The cocoons are then ready for the first stage in the manufacturing process, which consists in the removal and winding of the fibrous covering as described under SILK.

Other Silkworms. It is supposed by some entomologists that the original wild silkworm from which descended the silkworm of commerce is a species known as *Theophila huttoni*, which occurs in Japan, the northwest Himalaya, and Assam. The moth is of the same size as that of *Bombyx mori*, light brown, with the characteristic markings on the wings. The larva almost precisely resembles the domestic silkworm, but has a pair of small black thorns on the back of each segment of the abdomen. It seems very unlikely, however, that this species could have been the ancestor of *Bombyx mori*, since it lacks palpi, which are present in the *Bombyx*.

Oriental people have utilized the cocoons of a number of species of bombycid moths in the manufacture of silk goods. The so-called tussah, tusseh, or tusser silkworm is *Antheræa mylitta*. a species occurring in China, India, and Ceylon. In Upper India this silk is extensively produced, and the cocoons are collected in the jungle districts by the Sahars and other half-wild castes who live in such places. Other silkworms which are said to be used in the manufacture of tussah silk are *Antheræa pernyi*, from China; *Antheræa assama* (*Saturnia perottetti* and *Antheræa mezankooria* are synonyms of this species), a native of Assam and there called moonga or moogha; *Antheræa roylei*, from India; *Antheræa helferi*, from Sikkim; *Antheræa jana*, from Java; *Antheræa frithii*, from Sikkim, Bhutan, and Darjeeling; and *Antheræa larissa*, from Java. The very large and beautiful *Attacus atlas*, from India, Ceylon, Burma, and Java, is said to produce cocoons used for tussah silk.

The wild silkworms which have received the most attention in Europe, however, are *Antheræa yamamai*, from Japan, commonly known as the yamamai silkworm; *Antheræa pernyi*, from China; and *Philosamia cynthia*, from Japan, China, the Himalaya, Assam, and Java, which has been introduced into Europe and which has been acclimatized in the eastern United States. Its larva is commonly known as the ailanthus silkworm, while the yamamai and pernyi silkworms are commonly known as oak silkworms.

The yamamai silkworm is commonly raised in Japan, and its cocoon is large, heavy, handsome, and of a yellowish-green color. It is readily reeled, and its silk ranks commercially next to that of the domestic silkworm. The silk is strong and valuable. It bleaches well and may then be dyed. Fewer threads are required to make a strand than with *Bombyx mori*, and the cocoons unwind with perfect ease by the ordinary process. The life of the worm lasts from 50 to 80 days, and it feeds on all kinds of oak, but prefers those of the white-oak group. The pernyi silkworm has been cultivated in Europe with better success than the yamamai. It develops more rapidly, is double-brooded, and passes the winter in the chrysalis state. The cocoon is not so valuable, though ranking probably third best among the different silkworm cocoons. The ailanthus silkworm is utilized extensively in north China. It has been known in Europe since the middle of the last century and has been cultivated there as well as in the United States with perfect success. The cocoons, however, cannot be reeled successfully, and their silk is utilized principally by carding processes.

In the United States several species of silkworm moths occur, and their caterpillars spin an abundance of silk of a strong and durable quality. The American silkworm (*Telea polyphemus*) is a large moth of a buff color, whose caterpillar feeds upon the leaves of many trees, including oak, willow, hickory, maple, apple, sycamore, and many others. The cocoon is formed of strong silk, which when unwound has a glossy fibre. It is oval and closed at both ends, dense, and generally fastened to a leaf or leaves, with which it sometimes falls to the ground. The fibres are intermixed and cemented with a gummy substance which when dry gives the cocoon a chalky appearance. The principal difficulty in reeling the cocoon is in the hard matter which binds the threads. This, however, may be softened, and no doubt the cocoon could be improved by a process of continued selection. The insect has one generation each year in the Northern States, two in the Southern States, and passes the winter in the chrysalis state.

The large luna moth (*Tropæa luna*) is a beautiful species of a delicate green color, with long tails to the hind wings, whose larva feeds on several forest trees and whose cocoon is less dense than that of the polyphemus moth. The cocoons of these two species have the same general characteristics as those of the yamamai silkworm. Another native North American silkworm (*Callosamia promethia*) resembles in many respects the ailanthus worm. Its cocoon, like that species, is open and is in the same way difficult to reel. It feeds on ash, sassafras, wild cherry, maple, lilac, birch, and other trees. The largest of the American silkworms is the larva of *Samia cecropia*, a beautiful moth of a grayish-brown color marked with reddish and yellow spots and bands. The large green larva, which bears six coral-red tubercles on its thorax and smaller blue tubercles on its abdomen, feeds upon the apple and other rosaceous plants, as well as upon hazel, hickory, maple, willow, and honey locust. The cocoon is peculiar in being apparently double. There is a thick, wrinkled outer layer which resembles strong brown paper and which covers an inner oval cocoon composed of the same kind of silk, but closely woven like that of the mulberry silkworm. Nearly related to this species are *Samia gloveri*, of the Rocky Mountain region; *Samia columba*, of the North Atlantic States; and *Samia rubra*, from the Pacific States. In Mexico there are several large silkworm moths of the Saturnian group which produce quantities of silk, but it has not been commercially utilized or experimented with. There is another group of moths belonging to the family Psychidæ, in which the larva makes a large bag of silk which it carries about with it to protect its soft body from the attacks of birds. A common American example is the bagworm (q.v.) or basket worm. This silk has not been utilized except in China.

Bibliography. C. V. Riley, in *Fourth Annual Report State Entomologist of Missouri* (Jefferson City, 1872); id., "The Mulberry Silkworm," in *Division of Entomology, United States Department of Agriculture, Bulletin No. 9* (Washington, 1886); H. A. Kelly, "The Culture of the Mulberry Silkworm," in *Bulletin No. 39* (ib., 1903); A. M. Villon, *La soie* (Paris, 1890); Verson and Quajat, *Il filugello e l'arte sericola* (Padua, 1896); G. W. Oliver, *Mulberry and Other Silkworm Food Plants* (Washington, 1907). See SILK.

SILKWORM GUT. A material used to form the hook end of a fishline. Its advantages are its extreme tenacity and transparency or invisibility in water. It is prepared from the viscid secretion found in the silkworm (q.v.) just before the worm begins to spin. The grub is immersed in strong vinegar for several hours, and the substance which, if it had lived, would have formed the cocoon is forcibly drawn from the dead worm. This thread is first soaked in cold water and then in a caustic solution. This loosens the outer covering, which is next removed. The silk is then dried in a shady place. If simply dried it will be of a yellowish hue; the pure white thread is produced by bleaching in sulphur fumes. The manufacture of gut strings is carried on in Italy and Greece and other silk-growing countries, but particularly in Spain, the principal market being Valencia. It takes from 20,000 to 30,000 threads to make a pound.

SILKWORM ROT. See MUSCARDINE.

SILL, EDWARD ROWLAND (1841–87). An American poet and essayist, born at Windsor, Conn. He graduated at Yale in 1861, resided till 1866 on the Pacific coast, studied theology at Harvard, and after several years of teaching and literary work in Ohio, was appointed in 1874 professor of English in the University of California. Sill returned to Ohio in 1882, residing at Cuyahoga Falls until his death. He wrote: *Hermione, and Other Poems; The Hermitage, and Later Poems* (1867); *The Venus of Milo, and Other Poems* (1882). After his death a collection of essays and letters appeared (1890) as *Prose*. In 1906 his collected *Poetical Works* were published by W. B. Parker, who in 1915 wrote *Edward Rowland Sill: His Life and Work* (Boston). The small poetic production of Sill, who was a man of rare temperament and insight, is notable for carefulness of diction, delicacy of feeling, and a dominating strain of spiritual optimism.

SIL'LIMAN, BENJAMIN (1779–1864). An American scientist, born Aug. 8, 1779, at North Stratford (now Trumbull), Conn., the son of Gold Selleck Silliman, a general in the army of the Revolution. After graduating at Yale in 1796, he studied law, became a tutor in Yale, was soon chosen to be a professor of natural science, and went abroad to fit himself for the chair in which he became a teacher of chemistry, mineralogy, geology, and pharmacy. He held his professorship in Yale from 1802 to 1864—from 1853 onward as professor emeritus. He was honored and beloved as a teacher and acquired even greater distinction as a lecturer, especially on geology. These courses began at New Haven in 1831 and were so much appreciated that Silliman was selected to give 24 lectures before the Lowell Institute of Boston in its first session (1839–40). In 1818 he established the *American Journal of Science* (often quoted as "Silliman's Journal"), the editorship of which long remained in his family. With Dr. Robert Hare he constructed the compound blowpipe. He published after his return from England a narrative of his journey, and 50 years later, at the end of a second journey, he published a similar memoir. His *Tour to Quebec* (1819) was likewise widely read. His contributions to science were not numerous, one of those most famous at the time being an account (with J. L. Kingsley) of a remarkable meteor which fell at Weston in 1807. During his long career Silliman was an active participant in all the affairs of Yale College—the organization of the Medical School, the formation of a cabinet of minerals, the acquisition of Colonel Trumbull's paintings, and the purchase of the Clark telescope. He died Nov. 24, 1864. Consult the *Life* written by G. P. Fisher (2 vols., New York, 1866), largely from material left by Silliman and containing many entertaining reminiscences, and D. C. Gilman, in *Leading American Men of Science* (ed. by D. S. Jordan, New York, 1910).

SILLIMAN, BENJAMIN (1816–85). An American chemist and toxicologist, son of Benjamin Silliman. He was born in New Haven, Conn., and, after graduating at Yale College in 1837, became an assistant to his father. In 1842 he fitted up in one of the college buildings a chemical laboratory, out of which grew the foundation in 1847 of the Yale (now Sheffield) Scientific School. He was professor of medical chemistry and toxicology in the University of Louisville, Ky., from 1849 to 1854. In 1854 he succeeded to his father's chair at Yale. This he resigned in 1870, continuing, however, to lecture in the medical department until his death. He gave popular lectures on scientific topics throughout the country, examined mines, prepared reports on processes in chemical manufacture, conducted researches, and was one of the editors of the *American Journal of Science*. He was the author of *First Principles of Chemistry* (1846; 2d ed., 1856); *First Principles of Physics* (1858; rev. ed., 1868); *American Contributions to Chemistry* (1875). Consult A. W. Wright, in the *National Academy of Sciences, Biographical Memoirs*, vol. vii (Washington, 1911).

SIL'LIMANITE (named in honor of Benjamin Silliman). A silicate of aluminium chiefly occurring in long slender crystals, in parallel groups, and in fibrous masses, brown or gray in color and extremely tough in tenacity. It occurs in gneiss, mica schist, and other crystalline rocks. The fibrous varieties are commonly called fibrolite (q.v.), while the name "sillimanite" is given to those varieties that are found in the form of long slender crystals.

SI′LO. An air-tight storage room, either above ground or below, in which green crops usually cut small are tightly packed for future use; also a stack in which the feed is preserved under pressure. The first silos made in the United States were of brick or stone, lined with a smooth coating of cement. Wooden silos were later found to be satisfactory and much less expensive. These are circular in form, built of staves held together by iron hoops, and rest upon a concrete foundation. A continuous opening down the side, closed by sections removable as needed, enables the silage to be taken out conveniently. The concrete form is more durable although more expensive than the wooden silo. Silos are commonly roofed over at the top. Where the climate is dry, pit silos have been used successfully. Consult: Rabild, Risser, and Parks, "Homemade Silos," in *United States Department of Agriculture, Farmers' Bulletin 589* (Washington, 1914); *Concrete Silos*, published by Universal Portland Cement Company (Chicago, 1914); and files of *Experiment Station Record*. See SILAGE.

SILO′AM (Heb. *Shiloaḥ*, *Shelaḥ*, Gk. Σιλωάμ, modern *Birket Silwan*). A pool situated at the southern end of the eastern hill of Jerusalem, mentioned in Neh. iii. 15 and John ix. 7. Isaiah (viii. 6) speaks of the "waters of Shiloah that go softly." The water in this pool is supplied by the Virgin's Spring and is brought to the pool at the entrance to the Tyropœon valley by a tunnel over 1700 feet in length. The tunnel is rather winding and about 19 feet from the Siloam end an important inscription was found in the wall in 1880. As translated by Driver, it reads: "(Behold) the piercing through— And this was the manner of the piercing through. Whilst yet (the miners were lifting up) the pick, each towards his fellow, and whilst yet there were three cubits to be cut (through, there was heard) the voice of each calling to his fellow, for there was a fissure in the rock on the right hand. . . . And on the day of the piercing through the miners smote each so as to meet his fellow, pick against pick; and there flowed the water from the source to the pool, 1200 cubits; and 100 cubits was the height of the rock over the head of the miners." Hence the cutting was evidently done simultaneously from both ends. In default of any date there has been much controversy as to the age of the inscription. It has generally been assigned to the time of Hezekiah, who is said to have "made the pool and the conduit, and brought water into the city" (2 Kings xx. 20). But it cannot be denied that the form of the letters resembles those of a later age more than those of our earliest inscriptions. Pilcher assigns the inscription, on paleographical grounds, to the time of Herod, Stanley A. Cooke to c.200 B.C. Their arguments are not conclusive, however, and Driver leaves the question open. The aim in conducting the waters through the tunnel into a pool of the Tyropœon valley was to make it more accessible to the inhabitants of the lower part of Jerusalem. Consult: Tobler, *Die Siloahquelle und der Oelberg* (Saint-Gall, 1852); A. Socin, *Die Siloahinschrift* (Freiburg, 1899); *Proceedings of the Society of Biblical Archæology* (London, 1897, 1909); S. R. Driver, *Notes on the Hebrew Text and Topography of the Books of Samuel* (2d ed., Oxford, 1913).

SILOTI, sē̆′lō̂-tē̆, ALEXANDER (1863–). A famous Russian pianist, born near Kharkov, South Russia. He studied at the Moscow Conservatory under Tschaikowsky, Zveriev, and Nicholas Rubenstein (qq.v.), making his début at Moscow in 1880. After a successful appearance at Leipzig (1883), his fame as a virtuoso became world-wide. Nevertheless, at various times till 1886, he studied with Liszt. He taught piano at the Moscow Conservatory from 1880 to 1890, after which he went abroad. His concert tours included one in the United States (1898). Returning to Russia, he became actively interested in orchestral and chamber music, conducting concerts in Moscow, St. Petersburg, and other cities.

SIL′PHIUM (Lat., from Gk. *σίλφιον*, a sort of umbelliferous plant, the juice of which was used in food and medicine). A genus of about a dozen tall, coarse, American perennial plants of the family Compositæ. They have a copious resinous juice and large corymbose-panicled yellow flowering heads. *Silphium laciniatum*, called rosinweed, is rough and bristly, grows from 3 to 6 and sometimes 10 feet high, and has pinnately parted leaves. It grows on the prairies of Michigan, Wisconsin, and southward and westward, and blossoms in July. It is called compass plant (q.v.), from the turning of its lower leaves so that their edges point north and south. Another species, *Silphium terebinthinaceum*, the prairie burdock, grows from 4 to 10 feet high and has many small heads in a panicle at the top.

SILU′RIAN SYSTEM (from Lat. *Silures*, a people of ancient Britain). A division of the Paleozoic group of rocks established by Murchison (q.v.) to include the strata between the Archean and Devonian systems. It was subsequently restricted to the two groups now known as the Ordovician or Lower Silurian and Upper Silurian or Silurian proper. These two extend from the upper limits of the Cambrian to the base of the Devonian. Silurian rocks, using the term in the narrower sense to embrace the upper of the two groups, are extensively developed in both the United States and Europe. The rocks, as illustrated by the classic New York section, are divided as follows:

Silurian system	Cayugan	Manlius limestone Rondout waterlime Cobleskill limestone Salina beds
	Niagaran	Guelph dolomite Lockport dolomite Clinton beds
	Oswegan	Medina sandstone Oswego sandstone

The rocks are largely limestones, but with beds of shales and some sandstones interstratified. While there was some disturbance at the end of the Ordovician era, it was not sufficiently extensive in America to change materially or increase the extent of the land surface existing in Ordovician times. Silurian rocks are present in great thickness in the Eastern States, especially along the Appalachian region. West of this region they appear in Ohio, Kentucky, Tennessee, Missouri, Illinois, and Wisconsin, though on the whole not so well developed. In the Rocky Mountain area they have limited distribution.

The lowest or Oswego stage is made up mostly of gray thin-bedded sandstone. The next member is the Medina sandstone, which occupies a belt along the southern shore of Lake Ontario and attains a thickness of 1200 feet in western New York. It is characteristically a hard fine-grained sandstone, formed in shallow water. It shows many ripple marks. Overlying this is the Clinton shale, well known from New York down into Georgia and westward into Wisconsin, in which region it changes into limestone, indicating that the Silurian seas were deeper in that area than farther east. A subsequent deepening of the water over a still greater area is indicated by the formation of the limestones or dolomites, which are well developed in the gorge of Niagara River and whose resistance to erosion causes the abrupt descent of the Niagara River at the Falls. The Niagaran limestones range over a very large territory westward to Wisconsin and then southward through Illinois into Missouri and west Tennessee. Small areas are also found in Iowa, the Black Hills, and Nevada. Following this great limestone deposit comes a series of shallow-water deposits of salt, gypsum, and shale of the Salina stage, which are well developed in New York and Ohio, but thin out in Pennsylvania. In some localities an argillaceous limestone was deposited during the same period, to which has been given the name of water lime for its value in the manufacture of cement. On top of these beds lie great beds of limestones due to the deepening of the water in which the Silurian sediments were being deposited. The limestones of the Cayugan series are also known as the Lower Helderberg formations. It is probable the depression made at this time submerged some areas which had been dry land since Ordovician times, as in some cases we find the Cayugan rocks resting directly on Ordovician strata. The Lower Helderberg limestones are abundant in New York, where they form the bold escarpment of the Helderberg Mountains near Albany, but are also known to extend southward through Pennsylvania to Virginia, while additional deposits are known in west Tennessee and Maryland.

Silurian beds are well developed in Europe, China, northern Africa, South America, and Australia, as well as in North America. At the termination of the Silurian there was a gradual transition into the Devonian, so that it is often difficult to determine the boundary line between the rocks of the two systems.

The plant life of the Silurian, as revealed by the fossil remains, was scanty. Seaweeds were abundant, but land plants are rarely found. Among the animals there was a great development of invertebrates. Sponges, corals, crinoids and starfishes abounded in the seas, and trilobites also flourished, although not so numerous as in Ordovician time. Some insects have also been found, such as scorpions, proving that there must have been land vegetation. The brachiopods continued in countless numbers, and the genera were quite different on the whole from those of the Ordovician. The bivalve mollusks were similar to those of the Ordovician, but other orders showed more or less change. The only vertebrates known to have existed were fishes such as ostracoderms and sharks, but their remains are rather fragmentary.

The economic minerals of the Silurian are fairly diversified. In the rocks of the Clinton age we find a very persistent bed of the hematite iron ore of oölitic or fossiliferous character. Wherever the Clinton rocks are found this ore is liable to occur and forms the basis of the iron industry at Birmingham, Ala., where a deposit several miles long and from 12 to 20 feet thick is worked. In the rocks of the Salina stage we find the deposits of gypsum and rock salt, the latter material being of great economic value in the State of New York. The limestones of the Cayugan series are quarried for building stone and cement manufacture and the Medina sandstone is used extensively as a structural material.

Bibliography. Murchison, *Siluria* (London, 1859); Dana, *Manual of Geology* (4th ed., New York, 1895); Sir Archibald Geikie, *Text-Book of Geology* (4th ed., ib., 1903); W. B. Scott, *Introduction to the Study of Geology* (2d ed., ib., 1907). Also: C. S. Prosser, "The Thickness of the Devonian and Silurian Rocks of Central New York," in *Geological Society of America, Bulletin*, vol. iv (ib., 1893); Stuart Weller, "The Silurian Fauna Interpreted on the Epicontinental Basis," in *Journal of Geology*, vol. vi (Chicago, 1898); J. M. Clarke, "Note on the Siluro-Devonic Boundary," in *Science*, vol. xii (n. s., New York, 1900); Ulrich, "Revision of the Paleozoic Systems," in *Geological Society of America, Bulletin*, vol. xxii, no. 3 (Washington, 1911). See Clinton Stage; Salina Stage; etc.

SILU′RIDÆ. A very large family of soft-rayed fishes. See Catfish.

SILVA, sēl′vȧ, Antonio José da (1705–39). A Portuguese playwright who became a victim of religious fanaticism and was burnt at the stake by the Obscurantists, Oct. 18, 1739. Silva was the son of a converted Jew. His *Operas* are often coarse and rough, but full of wit and humor of a popular kind. Consult: Ernest David, *Les opéras du Juif Antonio José da Silva* (Paris, 1880); "Portugiesische Litteratur," in Gröber, *Grundriss der romanischen Philologie* (Strassburg, 1897); G. A. Kohut, *Bibliography of Works Relative to Antonio José da Silva* and *Bibliography of Don Antonio's Compositions*, in *American Jewish Historical Society, Publications, No. 4* (Baltimore, 1896).

SILVA, João Manoel Pereira da. See Pereira da Silva, João.

SILVA LEITÃO, João Baptista da. See Almeida-Garrett.

SILVA′NUS. In Latin mythology, a divinity of the fields and forests, the protector of fields and of cattle. He is by later writers identified with Pan, Faunus, and other divinities and is represented by the poets and in art as an old man in love with Pomona. He is especially associated with the cypress and the pine. Sacrifices to him consisted of grapes, grain, meat, milk, wine, and pigs.

SILVANUS. A leader of the primitive Christian Church in Jerusalem. See Silas.

SILVELA, sēl-vā′lȧ, Francisco (1843–1905). A Spanish statesman, orator, and Academician, born at Madrid. He studied law and in 1869 was elected to the Cortes as a Conservative. In 1879 he became Minister of the Interior (under Martínez Campos), and from 1883 to 1884 he was Minister of Justice. After the death of Cánovas, Silvela, as the head of the reorganized Conservative party, became Prime Minister in February, 1899. He resigned in October, 1900, but after the fall of Sagasta resumed office, in December, 1902. In 1903 he retired from politics. He was a member of the Royal Spanish Academy of the Language and of the Royal Academies of History, Moral and Political Sciences, and Fine Arts.

SILVER (AS. *seolfor*, *seolubr*, Goth. *silubr*, OHG. *silabar*, *silbar*, Ger. *Silber*, silver). A metallic element, known to the ancients and when first mentioned referred to as a medium of exchange. It is described in early Hebrew writings under the name *Késeph*, the root of which signifies "to be pale," while among the Greeks it was known as *ἄργυρος*, *argyros*, signifying "shining." The alchemists called it *luna* or *Diana* and referred to it in their writings by the crescent symbol. It occurs native, and specimens weighing several hundred pounds have been found, although it usually occurs in combination, as given below in the table of ores. It also occurs in lead and copper ores, the former being an important source of its production. It is found in sea water, and small quantities in the form of chloride have been detected in volcanic dust. It has never been commercially extracted from these sources. The metal may be readily prepared by heating silver sulphide with litharge or lead sulphate, the lead being separated from the resulting alloy by cupellation. Metallic silver may be obtained by reducing silver chloride with zinc or by fusion with carbon and sodium carbonate.

Silver (symbol Ag.; atomic weight, 107.88) is a white lustrous metal, very malleable, with a specific gravity of 10.57 and a melting point of 961° C. (about 1761° F.). Of all metals it is the best conductor of electricity; it is also an excellent conductor of heat. It is ductile and capable of taking a high polish. It crystallizes in regular forms, such as the cube and octahedron. A thin film of silver transmits blue light. When in the molten state it possesses the power of absorbing 22 times its volume of oxygen from the air, giving this up on solidification. When a mass of the molten metal is rapidly cooled, the silver solidifies before the oxygen has escaped from the interior, and this gas then bursts through the crusts, driving out part of the fused silver in globular masses and excrescences—a phenomenon known as spitting. Silver finds extensive use in coinage and for tableware and decorative articles; for silver plating, silvering mirrors, and to a slight extent for laboratory purposes. A large amount finds use in photography. Silver forms alloys (q.v.) with many metals, and that consisting of 9 parts of silver to 1 part of copper is the standard alloy used for the United States coins, while 835 parts silver to 165 parts copper, called "standard" silver, is the standard employed in the countries included in the Latin Union.

With oxygen silver forms three oxides, an argentous oxide or suboxide, a protoxide or normal oxide, and a peroxide or dioxide. Of these the protoxide is the most important. It is obtained as a brown, pulverulent precipitate when silver nitrate is treated with potassium or sodium hydroxide. This compound is used to give a yellow color to glass and finds some employment in medicine as a substitute for silver nitrate. Silver nitrate, or lunar caustic, is prepared by dissolving silver in nitric acid and evaporating to crystallization. The crystals are large, colorless, and transparent and blacken upon exposure to light or in contact with organic matter. Silver nitrate may be fused and is often cast into sticks, the usual form in which the compound is used as a caustic in medicine, etc. The nitrate is also the basis of many indelible inks, is a constituent of some black hair dyes, and is the form in which some of the silver is used in photography. The haloid salts of silver include the chloride, iodide, and bromide. They occur in nature but rarely and are not usual in ores. They may be prepared by the action of soluble iodides, chlorides, or bromides upon a solution of silver nitrate. The haloid salts are sensitive to light action and for this reason are much used in photography. Silver sulphide is formed by the action of sulphur or sulphurous gases upon silver or its compounds. It is the black tarnish formed upon domestic silverware upon continued exposure and is the basis of the so-called "oxidized" finish upon articles of art. The tarnish may be removed by a weak solution of potassium cyanide.

Silver Ores. The following table gives the composition of the principal silver ores, grouped approximately in the order of their importance:

NAME	Combining element	Formula
Native silver		Ag. Often in alloys
Argentite	Sulphur	Ag_2S Ag = 87.1%
Proustite (Light ruby silver)	Arsenic and sulphur	Ag_3AsS_3 Ag = 65.4%
Pyrargyrite (Dark ruby silver)	Antimony and sulphur	Ag_3SbS_3 Ag = 59.9%
Stephanite (Brittle silver)	Antimony and sulphur	Ag_5SbS_4 Ag = 68.5%
Cerargyrite (Horn silver)	Chlorine	AgCl Ag = 75.3%
Hessite	Tellurium	Ag_2Te or $(AgAu)_2Te$
Tetrahedrite (Fahl ore)	Complex mixture of antimony or arsenic sulphides with silver sulphides and base metals	Very Complex
Dyscrasite	Antimony	Ag_3Sb or Ag_6Sb

Occurrence. Most of these silver minerals occur in combinations and mixtures in natural deposits, and ores received at metallurgical works almost invariably consist of several different minerals. When found at all, native silver and the haloid compounds usually occur in the upper portions of the deposits, while the sulphides, arsenides, antimonides, and other complex minerals are found in the lower portions, usually below ground-water level. This is subject to some variation, since it is well known that native silver occurs with some of the most highly complex minerals near the surface in the Cobalt silver district of Canada. Dyscrasite, one of the usually uncommon minerals, is commonly found in the Cobalt ores. Tetrahedrite occurs in most cases alone. The minerals containing silver as a more or less accidental ingredient are galena, sphalerite, chalcopyrite, pyrrhotite, pyrite, bournonite, chalcocite, bornite, native arsenic, arsenopyrite and certain nickel, cobalt, and bismuth ores. Galena often contains silver up to 1 per cent, or 291 ounces to the ton, so that at times the value of the silver in ore is greater than that of the lead. The Cœur d'Alene district of Idaho is the principal locality in the United States where the silver output is a by-product of lead and zinc. These deposits were primarily largely valued for their silver values, which formed a great portion of the surface ores, but are now principally worked for their lead and zinc content, although the silver is an additional asset that helps materially towards the total values recovered. In Europe the greater portion of the silver production is derived from galena ores, and in the United States a large percentage of the lead is obtained from argentiferous ores. Copper ores frequently contain considerable silver, notably in the Butte district of Montana. In one of the mines of this district, the Butte & Superior, silver occurs with a zinc mineral. The famous copper-bearing schist of Mansfeld, Germany, also carries silver.

Silver ores occur in the rocks of various geological ages—in gneiss and allied rocks, in porphyry, trap, sandstone, limestone, and shales. The veins often intersect eruptive rocks, as trachyte or porphyry, or the sedimentary formations in the vicinity of such rocks, and have often owed their existence to the dynamic processes and vapors from below attending eruptions. The usual gangues are calcite or quartz and frequently dolomite or barite.

Production. For many years the silver mines of Mexico have been by far the richest on record, and, in spite of the former imperfect methods of mining and transportation, Mexico has produced more than one-third of the total output of the world's silver, one-half of the production of the Republic having been derived from the central mining districts of Guanajuato, Zacatecas, and San Luis Potosí. Until 1860 Bolivia and Peru, followed by Chile, were next to Mexico in importance of silver production. From 1895 to 1915 the remarkable development of silver mining in the western part of the United States has increased the output so that it now ranks second to that of Mexico, and at present these two countries supply nearly three-quarters of the world's total annual production of this metal. The Comstock lode in Nevada is the greatest silver-producing locality in the history of the United States, although its present output is insignificant. The principal silver camp in 1916 was Tonopah, Nev., possibly the most important of the Western mineral districts. There are other smaller but important camps in Nevada, while there are several in Colorado, Idaho, and other of the Western States. In Europe Spain has been the most productive country. The richest mines are in the Province of Guadalajara. They were extensively operated as late as 1846, but recently the quality of production has decreased. Austria-Hungary, Saxony, and Harz Mountain district in Germany have contributed largely to the total output of Europe. The silver mines of Norway, at Kongsberg, have long been famous, although their present output is not important. The mines of Laurion in Attica, famous in antiquity for their large production of silver, are now worked mainly for lead.

The annual silver production of the United States has increased steadily from an average of about 600 kilograms in 1834 to more than 4,000,000 kilograms in 1913. The total reported production during this period is approximately 120,000,000 kilograms. Of this total the famous Comstock lode in Nevada produced approximately 5,000,000 kilograms during the period from 1859, the year of its discovery, until 1891. The value of the gold produced with the silver from these mines amounted to more than $140,000,000. The production of silver in the United States, classified, is shown in the first table. The second table shows the world's production of silver for 1911, 1912, and 1913.

SILVER PRODUCTION IN THE UNITED STATES*

IN FINE OUNCES

STATE	1912	1913	1914
Alabama	200	100	100
Alaska	539,700	366,700	398,500
Arizona	3,445,500	3,912,000	4,306,600
California	1,384,800	1,421,500	1,744,500
Colorado	7,933,100	8,989,700	8,612,900
Georgia	200	100	100
Idaho	7,862,900	9,477,100	12,689,500
Illinois	1,800	2,300	1,800
Maryland	700	....	....
Michigan	543,500	333,700	404,500
Missouri	30,000	38,900	60,000
Montana	12,524,000	12,540,300	10,746,000
Nevada	13,851,400	15,657,400	14,814,200
New Mexico	1,460,800	1,666,900	1,682,100
North Carolina	2,300	1,700	1,300
Oklahoma	....	800	....
Oregon	54,000	172,200	126,700
South Carolina	....	....	100
South Dakota	205,800	172,600	180,500
Tennessee	112,000	109,000	95,400
Texas	379,800	429,800	601,000
Utah	13,076,700	11,282,300	11,397,500
Virginia	700	200	1,000
Washington	350,800	218,700	54,100
Wyoming	300	1,200	100
Continental U. S.	63,761,000	66,796,200	67,918,500
Philippines	5,800	5,300	9,700
Porto Rico	....	....	1,500
Total	63,766,800	66,801,500	67,929,700

* Engineering and Mining Journal, Jan. 9, 1915.

It is not possible to forecast the silver production of the world with any degree of accuracy. The large production from such great silver districts as Tonopah, Nev., and the Cobalt camp in Canada were once regarded with apprehension by many Western operators, who

WORLD'S PRODUCTION OF SILVER *

SMELTERS' PRODUCTION — IN METRIC TONS

(From statistical report of the Metallgesellschaft, Frankfurt-am-Main)

	1911	1912	1913
Great Britain	536.1	499.3	395.1
Germany	420.0	476.0	537.9
Belgium	264.7	252.7	280.0
Spain and Portugal	134.9	117.6	†130.0
France	53.0	47.0	†47.0
Austria-Hungary	63.1	61.2	58.9
Italy	14.2	12.1	14.4
Norway	7.2	7.6	†8.0
Russia	4.9	5.0	†5.0
Turkey†	1.5	1.5	1.5
Sweden	.....	1.2	0.9
Total Europe	1499.6	1481.2	1478.7
United States	3891.9	4073.0	4059.1
Mexico	1055.6	‡1063.2	‡1159.2
Central and South America†	200.0	200.0	200.0
Canada	509.2	593.4	546.5
Total America	5656.7	5929.6	5974.8
Asia (Japan)	141.6	138.1	148.9
Australia	129.1	136.4	143.0
Total production	7427.0	7685.3	7745.4

* Engineering and Mining Journal, Jan. 9, 1915.
† Estimated. ‡ Fiscal years 1910–1911 and 1911–1912.

feared a depressing effect upon silver quotations, but, as a matter of fact, the increase in total production has had little or no effect upon its price. It is true that for several periods the price of silver has gone below 50 cents per ounce, a point that has been considered about the profitable limit for many mines, but on the other hand there have been long periods through which the price has remained consistently above that point. For the production of silver and its use as money, see MONEY; PRECIOUS METALS.

Metallurgy. The variety of processes for the extraction of silver from its ores is so great that only a general review of the most important is possible here. In all cases the silver is at last obtained in union with lead, zinc, copper, or mercury, or in solution, from which it can be precipitated as metal or sulphide or chloride, or else it is separated by electrolysis from its combinations. The methods of extraction thus fall into three main groups—designated as dry processes, combined dry and wet processes, and electrolytic processes. As a matter of fact, however, the latter division is not a true one, since electrolysis is only a step, or auxiliary, in one of the other processes. Essentially the metallurgy of silver may be broadly classed under the two heads of fire metallurgy and wet metallurgy.

Dry Process, or **Fire Metallurgy.** The extraction of silver under this method is effected by converting the metal into a silver-lead alloy which is cupeled in a furnace, or by forming a silver-copper alloy in copper smelting, from which the silver is finally extracted by dissolution and electrolytic deposition. The production of the silver-lead alloy depends upon the power which molten lead possesses of dissolving silver from its ores or compounds. The lead readily alloys with the silver, and the process is carried out either by simple melting or by a combination of roasting and melting. The silver-lead alloy is called work lead. When the silver in the lead is not in great enough quantity to make direct cupellation profitable, an intermediate process of concentration is carried out. Different processes are required to produce work lead from ores and from matte, speiss, alloys, and other intermediate products.

The variations of the fire process are all modifications of two general systems—one in which the ore is introduced into a bath of molten lead in a reverberatory furnace, and the other the reduction of the ore, or other product, with materials rich in lead in a blast furnace. The processes are known as reverberatory and blast-furnace processes. The former is used to some extent abroad, but in the United States the blast-furnace system is almost universally followed. If the silver content of the work lead is less than about 0.12 per cent, the lead is preferably treated either by the Pattinson process or by zinc desilverization. In the Pattinson process the work lead, by slow cooling from the molten state, is separated into crystals poor in silver and a molten portion rich in silver. If the richer portion is separated it can again be divided into a poorer solid part and a richer liquid alloy. This operation can be repeated until the enriched lead contains 2.5 per cent of silver. The Pattinson process is conducted in pots of cast steel or cast iron. The crystals are separated from the mother liquor either by ladling them out of the pot or else by tapping off the mother liquor and leaving the crystals behind. The formation and separation of the crystals are effected either by stirring the cooling mass or by blowing steam through it.

In zinc desilverization the silver is separated from the work lead in the form of a zinc-silver-lead alloy, the lead poor in silver remaining behind. The process is based upon the fact that, if argentiferous lead be melted, pieces of zinc forming altogether from 1½ to 2 per cent of the weight of the lead thrown upon the surface, the temperature of the bath raised to the melting point of the zinc, and the whole thoroughly stirred by mechanical devices or by the passage of dry steam and allowed to cool, a crust or scum forms upon the surface as the temperature is lowered, and this scum is a mixture of solidified lead alloys, zinc, and silver. The scum is lighter than the molten lead and, containing all the silver originally present in the lead, it can easily be separated from the rest of the metal forming the bath. After separation the excess of lead present is removed by liquation (see LIQUATION), a process based upon the fact that the alloy has a higher melting point than the lead itself. The scum is placed in pots or reverberatory furnaces and heated until the excess of lead melts and separates from the solid alloy. The latter, or rich scum, is next heated for the separation of zinc by the process of distillation, or oxidation, or treatment with fluxes, so that only the silver and lead remain. The cupeling process consists of an oxidizing melting of the lead in a reverberatory or cupel furnace. It may be performed in stages or continuously. The work lead is charged into the furnace with a quantity of litharge, and the mass is slowly melted by increasing heat. Successive scums are formed on the molten surface; these scums containing litharge mixed with other oxides of lead, together with impurities, are scraped off from time to time. The remaining product is silver containing about 10 per cent of impurities. This is then again refined, more litharge being added and the melting and skimming process repeated.

The dry or fire process is responsible for the greater part of the silver produced, but the wet processes are important in metallurgy, since they account for a production of the metal from ores too poor to be treated by the fire process. Wet metallurgy of silver is cheaper and simpler than the fire process and is among the most highly developed of metallurgical systems.

Argentiferous copper ores (see COPPER, METALLURGY) are treated in such manner that silver and gold, if the latter is present, follow the copper into the matte and crude metal. The usual practice in the United States is to separate the precious metal from copper by electrolytic refining. Crude copper is partially refined in reverberatory furnaces, thus removing the greater part of the base metal and impurities. From this furnace molten metal is cast into the form of anode plates, and these are suspended in multiple with cathode sheets of thin pure copper in a tank containing an electrolyte of copper sulphate and sulphuric acid. On passing a current of electricity, the copper is dissolved from the anode and deposited on the cathode in a pure state, leaving the base metal impurities and the precious metals in the form of a sludge, or mud, which is subsequently treated by fire and reduced to metal bars. A further separation may be made if gold is present. The gold-silver separation is made before melting the sludge into bars.

Wet Processes. The amalgamation of silver, one of the earliest of the wet processes, is performed by grinding the ore and mixing it with mercury, either in the presence of chemical reagents or without them. The grinding is done in water, and during the process the silver unites with the mercury, forming an amalgam that is afterward distilled, the mercury being driven off as a vapor and the silver left behind in a spongy form, which is afterward melted into bars. Amalgamation with mercury alone is comparatively rare in the metallurgy of silver and can be applied only to those ores in which the silver occurs in a free metallic state. It is said to have been formerly used extensively in Peru, Chile, and Mexico and may yet be used to some extent in countries where ores of the requisite kind are to be found.

Amalgamation with the use of chemical reagents is employed where silver exists in the combined form, either with sulphur, arsenic, antimony, or combinations of two or more of them. Within the scope of this classification come the processes known as the Cazo, Kröhnke, Patio, and Washoe processes. Of these the first two have never become popular nor widely used, but both the Patio and Washoe processes, almost identical in chemistry but differing in mechanical application, have had an extremely wide application. The Patio process is of great antiquity and is said to have been first applied by one of the Spanish operators at Pachuca, Mexico, in the early part of the sixteenth century. Its name is derived from the Spanish word for a paved court, or floor, which is known as a patio. The process was extensively used in Mexico and the Central and South American countries. In its application the ore is first ground in edge runners, or Chilean mills. (See GRINDING, CRUSHING, AND PULVERIZING MACHINERY.) Then fine grinding is done in an arrastra. This machine consists of a circular depression in the ground having its sides and bottom lined with hard stone. In the centre of the pit floor is a pyramidal stone with a hole in the top, on which pivots a vertical post, supported at its upper end by a horizontal beam. This post carries two or four horizontal arms, to each of which is fixed, through chains or thongs, one or more blocks of hard rock. The blocks are so arranged that when grinding the front end is slightly lifted from the floor, the rear end dragging. By revolving the vertical shaft these blocks are dragged around in the pit, grinding the ore, which is deposited on the floor. The movement of the machine was originally provided by animals, but later applications used steam or water power. The ore is ground with sufficient water so that when it is removed from the arrastra it is in the form of a thin mud. This mud is then placed upon the amalgamation floor, or patio, in small heaps, or tortas. The patio is simply a spacious yard paved with flagstones or cement, preference given to material as impervious as possible to mercury. When first formed the tortas are about the consistency of thick mud. They are given a sprinkled layer of salt and turned with a shovel, after which a troop of horses or mules is driven around in the torta for a number of hours each day. Turning by shovels follows the treading process, and then another period of treading follows. After a sufficient number of repetitions of these alternate processes sulphate of copper in one form or another is sprinkled over the torta and mixed by a similar procedure of shoveling and treading. Mercury is then added in a finely divided state and is in turn mixed in by turning and treading. Altogether this treatment of the torta lasts from three to six weeks and is considered complete when 75 per cent of the silver content has been amalgamated. The amalgam is separated from the other materials by agitating the torta slowly in tanks with water. The heavy amalgam settles to the bottom, while the water is agitated enough to carry off the lighter ore. The amalgam is collected and pressed into bags, molds, or bottles and is then ready for distillation. The Patio process is now seldom or never used, having been superseded in the last 10 years first by the Washoe process and then by cyaniding.

The Washoe process of amalgamation is the one developed and most frequently used in the United States to take the place of the Patio process. It was widely used before being replaced by still more economical forms of metallurgy. Its chemistry is identical with that of the Patio process. The ore is crushed in breakers, stamp mills and regrinding machines forming a finely ground pulp, just as in the Patio process. The pulp is then passed to pans with either wood or iron sides, but having cast-iron bottoms. They are from 2 to 2½ feet deep and from 4 to 5½ feet in diameter. A central revolving apparatus, equipped with grinding shoes, bears down upon the cast-iron bottom and performs a grinding service. When the ore, together with mercury and the necessary chemicals, is introduced into the pan, a period of grinding and amalgamation follows. This is analogous to the shoveling and treading of the tortas in the Patio process. By means of mechanical energy and steam heat, however, the time required for the fruition of the process is much reduced. When amalgamation has been completed the contents of the pan are emptied into a settler, in which the pulp is diluted with water and gentle agitation provided, allowing the amalgam to settle to the bottom while the ore pulp is washed away. This is the same as the washing process used in the Patio system. A later development of the Washoe process is known as the Boss process, or continuous system, identical theoretically with the systems described, but performed through a series of pans operated continuously, thus avoiding the necessity for stopping and emptying each pan. It is simply a mechanical improvement upon the Washoe process.

When the ore is so complicated as to require roasting, that process is applied for the purpose of removing volatile interfering elements such as sulphur, arsenic, antimony, etc. After being roasted the ore may be treated either by the Patio or Washoe process.

Distillation is the final operation through which the silver-mercury alloy, or amalgam, is separated. Cast-iron retorts are usually employed, the mercury vapor being cooled in a condenser.

Another class of wet processes is that in which the silver is dissolved in aqueous solutions and later recovered from them by precipitation. The silver is first converted into a compound soluble in water or certain aqueous solutions, and suitable reagents used to precipitate it. The soluble silver compound may be the chloride, the sulphate, or the cyanide, i.e., the double cyanide of silver and an alkaline element. There are several processes by which silver is obtained as chloride. The Augustin process uses brine as a solvent and metallic copper as a precipitant. The Patera process uses sodium thiosulphate, and the Kiss process calcium thiosulphate as solvent. In the Russell process the silver as metal or metal sulphide is brought into solution by sodium-copper thiosulphate, and in the Ziervogel process the silver is converted into sulphate and dissolved in hot water. In the cyanide process the ore is treated with a solution of an alkaline cyanide, forming a double cyanide of the silver and alkaline metal. Precipitation from the solution is by means of zinc, aluminium, or electrolysis. The Augustin, Patera, Ziervogel, and Kiss processes are rarely practiced now. In the Russell process the silver present as metal or sulphide is dissolved by a solution of sodium-copper thiosulphate and precipitated by sodium sulphide. The Ziervogel process is used in treating copper ores containing silver. By careful roasting the silver in such ores is converted into sulphate, and this is dissolved by treating the roasted ore with hot water. The silver is precipitated by metallic copper. The Russell process is still in use in some cases, especially in treating accumulated tailings contaminated with organic matter and thus not amenable to cyanidation.

Electrolytic Processes. The electrolytic process has been used to separate the silver from the lead-silver produced at smelting works from argentiferous lead ores. The silver alloy is remelted and cast into plates as anodes, with plates of pure lead as cathodes. The electrolyte is a solution of lead fluosilicate. The separation of silver from the gold-silver alloy obtained in cupeling rich silver lead is successfully accomplished by electrolysis. The alloy is cast into anode bars and suspended with cathodes of pure silver in an acid electrolyte of silver nitrate, where the silver is deposited upon the cathode, leaving the gold in the form of a residual sludge. The cathode silver is melted in a small cupel furnace and refined until the quantity of impurities present has been reduced to 0.001 or 0.002 per cent.

Cyanide Process. From 1906 to 1916 the application of the cyanide process in silver recovery was so complete that it practically replaced all other wet systems. This process depends upon the solubility of the silver double cyanide in aqueous solutions. The cyanide systems now in use may be divided into three general classes. The first of these makes use only of percolation, in the practice of which the ore is ground so as to make a minimum of very fine or colloidal matter, as much as possible of the ore being put into finely granular form. This is put into a tank equipped with a filter bottom, and the cyanide solution allowed to percolate through it. In its passage the silver is dissolved.

Under the second system part of the ore is treated by percolation and part by agitation. The latter is applied to only the very finely divided ore that can be kept in suspension by economical mechanical means. The finely divided portion, known technically as slime, is separated by a classifying machine from the sand and is put into agitating tanks. The reason for agitation is that slimes consist largely of colloidal matter which cannot be percolated, since it will not permit the passage of solutions through its impervious bed. Should this material be discarded, as was done in the early days of the process, it would entail a large loss, since the slime usually carries much silver. In the third method all of the ore is treated as slime by first grinding it to a state of extreme subdivision. This is usually referred to as the total-slime method. After the dissolution of the silver has been carried to the desired point the solutions are separated from the slimes by filtration or by settling and decantation.

The solutions from both sand and slime are carried to the precipitation department, where they are run through boxes containing zinc shavings, the result being the precipitation of silver and gold upon the zinc. The latter is consumed during the operation, the precious sludge settling to the bottom of the box, whence it is gathered, dried, fluxed, and melted in a crucible, usually of graphite. The resulting bars are usually shipped to a refinery for the final treatment. It has been found in some cases that aluminium becomes a more satisfactory precipitating agent than zinc, since it forms no cyanide compounds and results in less consumption of that material. Electrolysis has also been largely used for precipitation, iron anodes and sheet-lead cathodes being used. The silver is deposited upon the lead as a plating, the recovery being by cupellation. A modification of the electrolytic process is one in which the current density is so increased that the silver is deposited as a sludge instead of a plating, the sludge settling and being recovered as with zinc. Both zinc and aluminium are used principally at the present time in the form of dust or fume, since the finely divided form offers more surface to the action of solutions and performs more efficient work than the metal in coarser form.

The flotation process is simply a modification of concentration, in which oiled sulphides are floated by attaching to them bubbles of air, a froth being formed on the surface of the mixture containing the valuable sulphides. A skimming process recovers the froth and sulphides, which are afterward filtered and treated either by fire or by one of the wet metallurgical methods, often by cyaniding.

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SILVER, FREE COINAGE OF. See BIMETALLISM.

SILVER, GERMAN. See GERMAN SILVER.

SILVER, MEDICAL USES OF. Metallic silver is not used as a therapeutic agent, but is employed in surgery in the form of wire for suturing wounds and uniting bone fragments. The silver salts of the materia medica are the nitrate, the oxide, and the iodide. Silver nitrate has already been partly considered under the title LUNAR CAUSTIC. Externally the silver preparations are astringent, stimulating, and hemostatic; in concentrated solution, caustic. Of late years a number of compounds of silver and albumen or nuclein have been made, with the object of eliminating the irritant properties of silver nitrate while preserving its alterative and tonic qualities. Argyrol and protargol are representatives of this class and are largely replacing the nitrate. These are useful in catarrhal conditions or specific inflammations of the mucous membrane of the eye, nose, throat, middle ear, urethra, and vagina and are employed as topical applications in conjunctivitis, chronic pharyngitis, or laryngitis, in gleet (chronic urethritis), and inflammation of the vagina or cervix uteri. Internally silver salts, principally the nitrate, are useful in gastric ulcer, in combination with hyoscyamus, as a pill. Silver nitrate is a remedy of value in idiopathic or nonsyphilitic spinal sclerosis, but it is often ineffectual. When the silver salts are given for any length of time, they are deposited in the tissues, giving rise to a peculiar pale slate-blue color of the skin. Argyria, as this condition is called, is not very amenable to treatment, but potassium iodide may help to eliminate the substance from the tissues.

SILVER AGE. See Golden Age; Latin Literature.

SILVER-BELL TREE. See Snowdrop Tree.

SILVER CITY. A city and the county seat of Grant Co., N. Mex., 175 miles northwest of El Paso, on the Atchison, Topeka, and Santa Fe Railroad (Map: New Mexico, A 6). It is the trade centre for a large mining and stock region. Gold, silver, copper, zinc, and lead are mined, and there are highly productive turquoise mines. The New Mexico Normal School is situated here. Silver City is known chiefly as a health resort for tuberculosis patients, there being here three large sanatoriums, besides the Fort Bayard government sanatorium for soldiers and sailors, 9 miles to the northwest. In the neighborhood are the interesting cliff dwellings of the Gila River. Pop., 1900, 2735; 1910, 3217.

SILVER CREEK. A town in Chautauqua Co., N. Y., on Lake Erie, at the mouth of Silver Creek, 9 miles east-northeast of Dunkirk, and on the Lake Shore and Michigan Southern and the New York, Chicago, and St. Louis railroads (Map: New York, A 5). It has extensive grain-cleansing-machinery plants, and manufactories of chairs, canning and other mill machinery, furniture, grape products, etc. Pop., 1900, 1944; 1910, 2512.

SILVER EYE. See White Eye.

SIL′VERFIN′. A minnow (*Notropis whipplei*), common in clear streams of the northern interior of the United States. It is 4 inches long and leaden silvery in color. See Plate of Dace and Minnows.

SIL′VERFISH′, or Fish Moth. See Bristletail; Cutlass Fish.

SILVER FULMINATE. See Explosives, *Fulminates and Amides.*

SILVER GLANCE. See Argentite.

SILVER GRAYS. In United States political history the conservative wing of the Whig party. It is said to have derived its name from the long gray hair of Francis Granger (q.v.). See Party Names.

SILVER LACE. See Gold Lace.

SIL′VERMAN, Joseph (1860-). An American rabbi, born at Cincinnati, Ohio. He graduated from the University of Cincinnati in 1883, studied at the Hebrew Union College, and was ordained rabbi in 1884. After 1888 he was minister of Temple Emanu-El, New York. In 1900–03 he served as president of the Central Conference of American Rabbis. He was a member of Mohonk Peace Conferences in 1911–13 and vice president of the International Peace Forum and associate editor of the *Peace Forum Magazine* in 1913. Besides pamphlets on various subjects, Dr. Silverman published *Catechism on Judaism* (1886).

SILVER PARTY. See Party Names.

SILVER PHEASANT, Chinese. See Kaleege.

SIL′VERSIDE′, or Sand Smelt. A slender fish of the family Atherinidæ, which seldom exceeds 6 inches in length. The silversides go in large schools in the tropical and temperate shore waters. A few are found in fresh waters. All have a silver band along the side, whence their name. When large enough they are esteemed as food. See Plate of Mullets and Allies.

SIL′VERSPOT′. See Fritillary.

SILVER SPRING. The most noted spring in Florida and one of the largest in the world. It is in Marion County, at the eastern edge of the lime-sink region, about 6 miles east-northeast of Ocala. It fills an approximately circular basin about 200 feet wide and 30 feet deep. It contains about 275 parts per million of dissolved minerals, chiefly calcium carbonate, and its temperature is about 72° F. The water, which is extremely transparent, issues from several irregular orifices in the bottom of the basin at a rate varying from about 400 to 800 cubic feet a second at different seasons, or several hundred million gallons a day. The stream issuing from it, Silver Spring Run, 9 miles long, is a tributary of the Oklawaha River (q.v.) and is navigated right up to the spring by passenger steamers from Palatka. It has a railroad station right on its edge as well as several boathouses. Consult: John LeConte, in *American Journal of Science*, vol. lxxxi (New Haven, 1861); C. L. Norton, *Handbook of Florida* (3d ed., New York, 1892); United States Geological Survey, *Water Supply and Irrigation Papers, Nos. 102, 242, 319* (Washington, 1904–14); Florida Geological Survey, *7th Annual Report* (Tallahassee, 1915).

SIL′VERTIPS′. See Bear, *Grizzly Bear.*

SILVER WEDDING. See Wedding Anniversaries.

SILVER WEED. See Potentilla.

SILVES, sĕl′vĕsh. A southern seaport of Portugal, on the Silves River (Map: Portugal, A 4). Cork cutting and the exporting of fruits and vegetables form its main industries. In the eleventh century Silves was the capital of the Moorish Kingdom of Algarve and was captured by the Christians two centuries later. Pop., 1900, 9688.

SILVESTRE, sĕl′vĕs′tr′, Paul-Armand (1837–1901). A French novelist, poet, playwright, and critic, born in Paris. He studied at the École Polytechnique, entered the government service, and was finally employed in the Bureau of Libraries and Archives. His first verses, *Rimes neuves et vieilles*, appeared in 1866 with a preface by George Sand. Other books of his poetry are: *Renaissances* (1870); *Gloire du souvenir* (1872); *Chanson des heures* (1878); *Ailes d'or* (1880); *Chemin des étoiles* (1885); *Roses d'octobre* (1889); *L'Or des couchants* (1899). Silvestre composed many Rabelaisian tales for the journal *Gil Blas*. His prose consists mainly of the short stories which he turned out with facility, finished in style, but nearly always sensual in tone and subject. He also wrote *La Russie, impressions, portraits, paysages* (1891), and several dramas, comedies, and libretti.

SILVESTRE DE SACY, BARON. See SACY, A. I., BARON SILVESTRE DE.

SIL'VICUL'TURE. See FORESTRY.

SILVIUS. See SYLVIUS.

SIMANCAS, sê-män'kȧs (Lat. *Septimanca*). A town of the Province of Valladolid, in Old Castile, Spain, 8 miles southwest of Valladolid, on the right bank of the Pisuerga River. The town is situated in the midst of a plain devoted to culture of cereals, fruits, and the vine. Here an old Roman bridge spans the river and remains of ancient fortifications exist. In Simancas are collected the richest archives of Spain. The Moorish alcazar was selected as the repository by Charles V and this received the support of Philip II. These historical treasures are largely unexplored. Pop., 1900, 1129; 1910, 1112. In 934 Simancas was the scene of a bloody battle between the Christians and the Moors.

SIMBIRSK, sêm-bêrsk'. A government of east Russia (Map: Russia, G 4). Area, about 19,110 square miles. It rises to an elevation of over 1000 feet above the sea in the range which covers the eastern part along the Volga. The western part is low and intersected by rivers. Simbirsk belongs to the basin of the Volga, that river forming its eastern boundary. The climate is continental and severe; a large part of the surface is covered with forests. Agriculture, the leading occupation, is favored by a fertile soil, and extensive crops of rye and oats are exported. Linseed and hemp are also grown, and stock raising is important, the government being noted for its breed of horses. The forests furnish the material for house industries, whose chief products are wagons, sledges, and wooden vessels. Felt hats and boots, bags, and small metal wares are also produced in the villages. The annual output of the manufacturing industries (principally military cloth, flour, and spirits) exceeds $5,000,000. Pop., 1912, 1,997,400.

SIMBIRSK. The capital of the Government of Simbirsk in Russia, on the right bank of the Volga, about 580 miles east-southeast of Moscow (Map: Russia, G 4). It has a pleasant appearance on account of its numerous gardens and elevated positions above the river. The principal products are spirits; a considerable trade in horses is carried on. The annual fair is still of some importance. The town was founded in 1648. Pop., 1911, 64,072.

SIMCOE, sĭm'kô. A town and the county seat of Norfolk County, Ontario, Canada, on the Grand Trunk and the Wabash railways (Map: Ontario, E 8). It has a Carnegie library and owns its water works. Pop., 1901, 2627; 1911, 3227.

SIMCOE, JOHN GRAVES (1752–1806). An English soldier, the first Governor of Upper Canada. He was born at Cotterstock, Northamptonshire. After education at Eton and at Merton College, Oxford, he entered the army in 1771 and went to New England during the Revolutionary War, raising and commanding the Queen's Rangers, as lieutenant colonel. He was wounded at Brandywine and at Monmouth and surrendered with Cornwallis at Yorktown in 1781. He was Governor of Upper Canada (1791–94), Governor of Santo Domingo (1796–97), became lieutenant general in 1798, and in 1806 received the appointment of commander in chief in India, but was taken ill, and, returning, died in England. He founded London (q.v.), Ontario; and Lake Simcoe, a county, and a town in Ontario were named in his honor. Consult D. C. Scott, *John Graves Simcoe* (Toronto, 1905).

SIMCOE, sĭm'kô, LAKE. A lake of Ontario, Canada, 30 miles long and 18 miles wide, with an area of 160 square miles (Map: Ontario, F 5). It is about 130 feet above Lake Huron, into which it discharges through the Severn, Lake Couchiching, and Georgian Bay. In the winter its frozen surface forms a serviceable highway. Barrie and Orillia (qq.v.) are its chief towns. There are also numerous pleasant summer resorts, with good boating and fishing. The vicinity was the scene of the great war between the Iroquois and Hurons, in which the latter were almost exterminated.

SIM'EON (Heb. *Shim'ôn;* of uncertain derivation). A very common Hebrew name (also Nabatæan), appearing generally in English as Simon (also Symeon); also the name of a Hebrew tribe and of its traditional ancestor, the second son of Jacob. Of the patriarch little is told; he took part with Levi in the raid upon Shechem (Gen. xxxiv), was hostage for his brothers to Joseph (chap. xliii), and is cursed along with Levi by the father in Jacob's blessing (chap. xlix). These traditions doubtless represent tribal conditions in early Hebrew history. Upon the conquest of Canaan Simeon appears as accompanying Judah in the conquest of southern Canaan (Judges xi). This seems to indicate that Simeon, whose territory appears to have been north of Levi's, with its centre at Kadesh Barnea (q.v.), was crowded out by Judah. From this time Simeon almost disappears from history, except for a probably reliable record by the Chronicler (1 Chron. iv. 24 et seq.) of an expansion of the tribe in King Hezekiah's time, even as far as the land of Seir. It does not figure at the division of the Kingdom, nor is there any reference to Simeon upon the return. (An old tradition reads Simeon for Shimei in Zech. xii. 13.) With this disappearance of the tribe goes the testimony of its nonmention in Moses' blessing (Deut. xxxiii). The legends of patriarchal times therefore stand for the historic fact that Simeon, a border tribe, early lost its identity, partly through war, partly through amalgamation with Judah or with desert tribes, with which history may be compared the fate of Dan. Consult: Graf, *Der Stamm Simeon* (Meissen, 1866); Steuernagel, *Einwanderung der israelitischen Stämme* (Berlin, 1901); Eduard Meyer, *Die Israeliten* (Halle, 1906).

SIMEON, or **SYMEON** (?–c.927). A Bulgarian ruler, son of the Boris who introduced Christianity, which was established firmly by Simeon. The latter created a Bulgarian archbishop independent of Constantinople. He was the first Prince of Bulgaria to take the style of Czar or Emperor of all the Greeks and Bulgarians, upon coming to the throne in 890. His greatest fame was as a warrior. He thrice laid siege to Constantinople and in 893 concluded a treaty by which the city became tributary to him, as Servia also was during most of his reign.

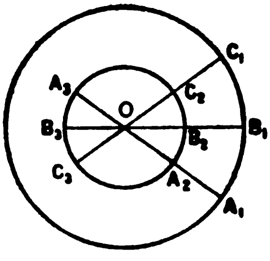
SIMEON, CHARLES (1759–1836). An eminent evangelical preacher of the English church. He was born at Reading in Berkshire, educated at Eton and at King's College, Cambridge, and was ordained a priest in 1783. He was appointed vicar of Trinity Church, Cambridge, in the year of his ordination and held this office to the close of his life. As a preacher Simeon was distinguished for an impassioned evangelicalism that at first roused against him a bitter and protracted opposition. His earnestness, however, brought friends and followers, and in course of time Simeon became a centre of evangelical influence that spread itself over the whole church. He was one of the founders of the Church Missionary Society, and his influence was large in the growth of the Low Church movement. His entire works, including a homiletical commentary on the Bible, have been published (21 vols., London, 1840); also selections (2 vols., 1854). Consult: W. Carus, *Memoirs of the Life of Charles Simeon* (London, 1847); A. W. Brown, *Recollections of Simeon's Conversation Parties* (ib., 1862); H. C. G. Moule, *Charles Simeon* (ib., 1895).

SIMEON (STYLITES), sĭm'ē-ŭn stī-lī'tēz. See Pillar Saint.

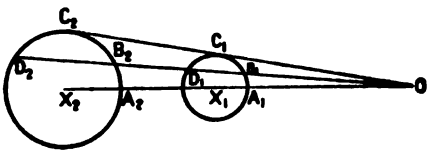
SIMFEROPOL, sēm'fĕ-rŏ'pōl-y'. The capital of the Government of Taurida, South Russia, in the southwestern part of the Crimean peninsula, about 200 miles southeast of Odessa (Map: Russia, D 5). It has a separate quarter for the Tatar inhabitants and a number of mosques. Fruit preserving is the chief industry. There are some manufactures of flour and tobacco and an export trade in fruits and wine. Pop., 1911, 69,666, including 7000 Tatars. Simferopol occupies the site of the Tatar settlement of Ak Metchet (white mosque).

SIMI'IDÆ. The family of simian or anthropoid apes. See Ape.

SIM'ILAR'ITY (from *similar*, from Lat. *similis*, similar, like; connected with *simul*, together, Gk. *ἅμα*, *hama*, together, Skt. *sama*, like, equal, same, and ultimately with Eng. *same*). In geometry, the theory of similar systems and similar figures. Two systems of points, $A_1, B_1, C_1, \dots A_2, B_2, C_2, \dots$ are said to be similar when they can be so placed that all lines, A_1A_2, B_1B_2, C_1C_2, . . . joining corresponding points form a pencil whose vertex, O, divides each line into segments having a constant ratio r. In the figures $OA_1 : OA_2 = OB_1 : OB_2 = \dots = r$. Two figures are said to be similar when their systems of points are similar. The symbol ∽, for similarity, is due to Leibnitz and is derived from the letter *S*.

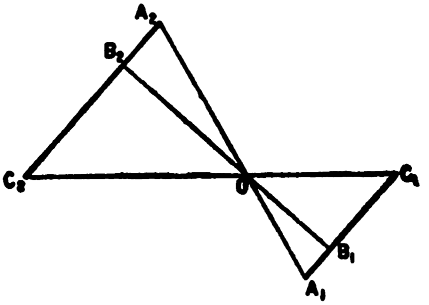


CONCENTRIC CIRCLES.

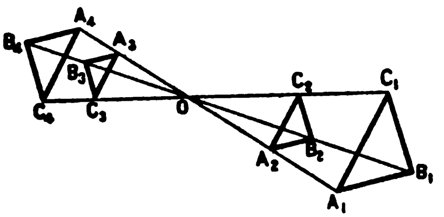


ANY CIRCLES.

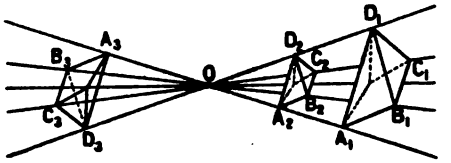
When two similar figures are so placed that lines through their corresponding points form a pencil, they are said to be in perspective, and the vertex of the pencil is called their centre of similitude. The above figures are placed in perspective, and in each case O is the centre of similitude. In similar figures, if the ratio, r, known as the ratio of similitude, is 1, the figures are evidently symmetric with respect to a centre. Hence central symmetry is a special case of similar figures in perspective. The term "centre of similitude" is due to Euler. (See Symmetry.) Some of the principal propositions of similarity are: Two triangles are similar if they have two angles of one equal to two angles of the other respectively. Mutually equiangular triangles are similar. If two triangles have the sides of the one respectively parallel or perpendicular to the sides of the other, they are similar. If two triangles have one angle of the one equal to one



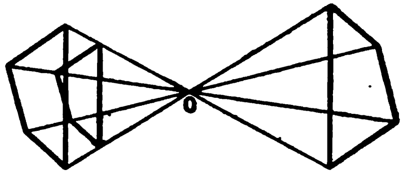
ANY LINE SEGMENTS.



FOUR SIMILAR TRIANGLES.



THREE SIMILAR TETRAHEDRA.



THREE SIMILAR QUADRILATERALS.

angle of the other and the including sides proportional, the triangles are similar. If two triangles have their sides proportional, they are similar. If two polygons are mutually equiangular and have their corresponding sides proportional, they are similar. Areas of similar polygons are proportional to the squares of the corresponding sides. Volumes of similar solids are proportional to the cubes of their like dimensions.

SIMILE, sĭm′ĭ-lē. See RHETORIC, FIGURES OF.

SIMKHOVITCH, sĭm-kō′vĭch, VLADIMIR GREGORIEVITCH (1874–). An American social economist, born in Russia. He studied at St. Petersburg, Berlin, and Halle, where he received the degree of Ph.D in 1898. As an advanced scholar he studied the literature of scientific Socialism and social economics, bringing to the notice of American students the significance of the Communist Manifesto (1847) as embodying the entire system of Marxian Socialism. In Columbia University he was associate professor of economic history from 1904 to 1915 and thereafter professor of economics. He was active and deeply interested in social-service work, particularly at Greenwich House. He wrote, besides many articles on Russian life and government and on social reform, *Marxism versus Socialism* (1913).

His wife, MARY MELINDA KINGSBURY SIMKHOVITCH (1867–), was born at Chestnut Hill, Mass., graduated from Boston University in 1890, and studied at Radcliffe College, at the University of Berlin, and at Columbia. She was married to Professor Simkhovitch in 1899. She served as head worker at the College Settlement, New York City, in 1898, at Friendly Aid House from 1898 to 1902, and at Greenwich House thereafter. She was adjunct professor of social economy at Barnard College in 1907–10, and associate in social economy at Teachers College (Columbia) in 1910–13, and lectured at the New York School of Philanthropy after 1912.

SIM′LA. The capital of a district of the Punjab, British India, on a ridge of the Himalaya, 1000 feet above the sea, 170 miles north of Delhi (Map: India, C 2). It may be termed the official health resort of India, being the residence of the Viceroy of India and his staff during the hot season and the permanent headquarters of many departments of the Government of India. There are numerous fine public buildings and a commodious town hall. In the surrounding district European fruits and vegetables are cultivated, and there is an active export trade in fruit. Pop., 1911, (winter) 14,205, (summer) 35,432.

SIM′MEL, GEORG (1858–). A German sociologist and philosopher. He was born in Berlin and became professor in the university there. His first book was *Ueber sociale Differenzirung* (1890; 4th ed., 1910), a suggestive study of the formation of social classes and groups. In his *Einleitung in die Moralwissenschaft* (1892; 3d ed., 1911) he makes an elaborate criticism of popular ethical notions. He also published *Philosophie des Geldes* (1900); *Philosophie der Mode* (1905); *Schopenhauer und Nietzsche* (1906); *Die Religion* (1906; 2d ed., 1912); *Die Probleme der Geschichtsphilosophie* (3d ed., 1907); *Soziologie* (1908); *Hauptprobleme der Philosophie* (2d ed., 1911); *Goethe* (1912); *Vorlesungen über Kant* (3d ed., 1913).

SIMMERN, HEINRICH, BARON LANGWERTH VON. See LANGWERTH VON SIMMERN, HEINRICH.

SIMMONS, DUANE (1834–89). An American physician and scholar, born at Glens Falls, N. Y. In 1859 he went to Japan as a medical missionary, but soon afterward entered the service of the Japanese government. In 1862–63 he continued medical study in Berlin. In 1869 he established the Juzen Hospital, instructing voluntary classes of Japanese doctors, and showing how cholera should be treated with the methods of modern sanitary science. In 1881, his health failing, he returned to the United States; but in 1887, settling again in Japan, he made a systematic study of Japanese feudal institutions. His studies of the Japanese village community are of the highest scientific value, and those on land tenure and social institutions have been published by Wigmore, in the *Transactions of the Asiatic Society of Japan*, vol. xix (Yokohama, 1892).

SIMMONS, EDWARD EMERSON (1852–). An American decorative painter. He was born in Concord, Mass., graduated at Harvard in 1874, and studied under Lefebvre and Boulanger. After further study in Brittany and Cornwall, about 1893, he took up his residence in New York and became one of the leading American decorative painters. His work, which is free and sure in execution, and possesses much charm of color, includes mural paintings in the Massachusetts State House and in the Appellate and Criminal Courts, New York; nine panels in the Congressional Library, Washington; four pendentives in the Minnesota State Capitol; decorations in the Waldorf Astoria Hotel, New York City, and in the Court House at Mercer, Pa. Simmons received a gold medal at the Buffalo Exposition (1901).

SIMMONS, FRANKLIN (1839–1913). An American sculptor. He was born in Webster, Me., and was self-taught in art. In 1865 he went to Washington, where he made portrait busts of Grant, Sherman, Sheridan, and other celebrated men. After 1868 he lived chiefly at Rome, and he was knighted by King Humbert in 1898. He executed about 100 portrait busts in marble, and 15 public monuments, including those to General Grant, William King, and Roger Williams in the Capitol; the Naval Monument (1898) and the effective bronze equestrian statue of General Logan—both in Washington; the Longfellow and Soldiers monuments at Portland, Me. His ideal statues include "Medusa," "Angel of the Resurrection" and "The Promised Land" (Metropolitan Museum, New York). His work is dignified, conscientious, and not without imagination, but lacks emotion and the personal accent.

SIMMONS, FURNIFOLD MCLENDEL (1854–). An American lawyer and statesman, born in Jones Co., N. C. He attended Wake Forest College and Trinity College (North Carolina), graduating from the latter in 1873. Admitted to the bar in 1875, he settled finally at Newbern as the partner of ex-Chief Justice Faircloth. In 1887–89 he was a Democratic member of Congress and in 1893–97 collector of internal revenue for North Carolina. As chairman of the State executive committee of his party (1892–1906) he was a controlling factor in the struggle for white supremacy and for the partial disfranchisement of the negro. He was elected United States Senator in 1900 and was reëlected in 1906 and in 1912. Not an orator and rarely speaking in the Senate, Senator Simmons was a tireless worker in the committees and a master of the subjects to which he gave his attention.

He was chiefly interested in the improvement of inland waterways and harbors and in bringing about industrial prosperity. Regarded as a conservative and reactionary in politics, Simmons was frequently charged with being the head of a machine. During the administration of President Wilson, whom he supported, he was chairman of the powerful Finance Committee and was one of the framers and most prominent defenders of the Underwood-Simmons Tariff Act.

SIMMONS COLLEGE. An institution for the higher education of women, incorporated in Boston in 1899 and opened in 1902. It was established in accordance with the provision of the will of John Simmons, a Boston merchant who died in 1870, to afford women a college education together with such a course in art, science, and industry as would best enable them to earn a livelihood. In 1915–16 the students in the college numbered 1083 and the faculty 118. The courses of instruction comprise household economics, secretarial studies, library studies, general science, philanthropic work, industrial teaching, salesmanship, and the special preparation for student and public-health nurses. The college offers a complete course of four years, short technical courses for students having adequate preliminary training, and partial courses. Graduation from an approved high school is a prerequisite for admission. The college graduate may ordinarily complete the technical work in one or two years. The college buildings are the main instruction building erected in 1904 on the Fenway, the School for Social Workers on Somerset Street, and eight dormitories. The value of the college property in 1915 was $3,097,454, of which $2,192,139 is a permanent endowment fund. The library contains about 22,000 volumes. The president in 1914 was H. Lefavour, Ph.D., LL.D.

SIMMONS COLLEGE. A coeducational institution for higher education, founded at Abilene, Tex., in 1891. It is under Baptist control. The college confines its courses to those leading to the degree of A.B., and it has become its pronounced policy to advance and expand along the line of vocational education. It includes industrial arts and sciences, manual arts and sciences, agriculture and stock raising. The total enrollment of students in 1914–15 was 512, and the instructors numbered 26. The college has an endowment of about $100,000, the value of the grounds and buildings is about $200,000, and the annual income is about $40,000. The president in 1915 was Jefferson D. Sandefer.

SIMMS, William Gilmore (1806–70). An American novelist, born April 17, 1806, at Charleston, S. C. He was admitted to the bar in 1827 and in the same year published *Lyrical and Other Poems*. In 1828 he became editor of the Charleston *City Gazette*, the Union proclivities of which lost him money and almost brought him physical ill treatment during the Nullification excitement. Having left Charleston temporarily in 1832, Simms resided for some months at Hingham, Mass. But the year 1833 saw him enter upon his true vocation. His *Martin Faber*, although in some respects a crude sensational novel, had genuine narrative power. In 1834 he published *Guy Rivers*, a tale of the gold fever in Georgia, the first of a series of border romances, including *Richard Hurdis* (1838), *Border Beagles* (1840), *Beauchampe* (1842), etc., full of the crime and excitement that filled the South in those years and valuable as pictures of local conditions. *Guy Rivers* was followed, however, by a story which showed Simms more profitable lines along which to walk as a disciple of Cooper. This was his *Yemassee* (1835), a tale of Indian warfare in Colonial Carolina. This is by many regarded as his best work, though perhaps equaled by some of the Revolutionary romances which began the same year with *The Parisian* and were continued with *Mellichampe* (1836); *The Kinsmen* (1841), afterward (1854) published as *The Scout; Katherine Walton* (1851); *Woodcraft* (1854); *The Forayers* (1855); *Eutaw* (1856). These romances dealing with the partisan warfare of Marion and other trackers of the Carolina swamps, in a manner almost worthy of Cooper, display a fund of historical knowledge, of vigorous description, and of narrative interest. Simms was the most representative man of letters save Poe produced by the South before the Civil War. His best short stories were collected in two volumes entitled *The Wigwam and the Cabin* (1845–46). He compiled a history of his native State and several historical monographs and wrote biographies of the Chevalier Bayard, Capt. John Smith, General Marion, and Gen. Nathanael Greene. Of the *Southern Quarterly Review* he was for a time editor, and he made a collection of the war poetry of the South. Supporting the Secession movement heartily, he lost heavily during the war. At its close he set to work to repair his fortunes by his pen, but with little success. Simms died at Charleston, June 11, 1870. Consult W. P. Trent, *William Gilmore Simms*, in the "American Men of Letters Series" (Boston, 1892), and O. Wegelin, *List of the Separate Writings of W. G. Simms* (New York, 1906). A bibliography by A. S. Sally, Jr., is one of the publications of the Southern Historical Association.

SIM'NEL, Lambert (fl. 1477–1525). An English impostor, probably born at Oxford. With the connivance of Yorkist leaders he was taken to Ireland in 1487 by one Richard Simon, a priest, and passed off as the young Earl of Warwick, who, some reports said, had died in the Tower of London. Officially recognized by Irish dignitaries, young Simnel was crowned as King Edward VI in Dublin despite the fact that the true Earl of Warwick had been exhibited in London. Later in 1487, to support his claims, a force of Irish and German levies under Sir Thomas Fitzgerald was landed in Lancashire, but they were defeated by the army of Henry VII (q.v.). Simon was thrown in prison, but the boy was pardoned and eventually became royal falconer.

SIMOIS, sĭm'ō-ĭs. A stream of the ancient Troad, flowing into the Scamander (q.v.).

SIMON, sī'mon, Sir John (1816–1904). An English hygienist. Born and educated in London, he practiced there and was connected with St. Thomas's Hospital. As medical officer of health to the city of London (from 1848) and to the government, he did much for the sanitary condition of the capital. In 1878 he became president of the Royal College of Surgeons, and in 1887 he was knighted. Among his writings are: *General Pathology* (1852); *Reports Relating to the Sanitary Condition of the City of London* (1854); *Report on the Last Two Cholera-Epidemics of London, as Affected by the Consumption of Impure Water* (1856); *Filth Diseases and their Prevention* (1876); *Public Health Report* (1887), a very important work; *English Sanitary Institutions* (1890).

SIMON, Sir John Allsebrook (1873–). An English lawyer and cabinet minister. He was educated at Fettes College, Edinburgh, and Wadham College, Oxford. Called to the bar in 1899, he practiced his profession with much success and was made king's counsel in 1908. He was one of the counsel for the British government in the Alaska Boundary Arbitration in 1903. Entering politics as a Liberal, Simon was elected member of the House of Commons for Walthamstow Division, Essex County, in 1906. He was chairman of the Departmental Committee on Street Trading (1909), and a member of the Royal Commission on Justices of the Peace (1910). In the latter year he was knighted and was made Solicitor-General in the Liberal cabinet of Premier Asquith; in 1913 he became Attorney-General, with a seat in the cabinet; and in 1915 he was appointed Home Secretary in Asquith's coalition ministry, but he resigned early the next year because of his scruples against compulsory military service. Consult A. G. Gardiner, *Pillars of Society* (London, 1913).

SIMON, John Smith (1843–). A British Wesleyan Methodist clergyman, born at Glasgow, Scotland. He was educated at Elizabeth College, Guernsey, and Victoria College, Jersey, and entered the ministry in 1863. He was elected to the Legal Hundred in 1895, was president of the Wesleyan Conference in 1907, and was a member of other important conferences. He published: *Methodism in Dorset* (1870); *A Manual of Instruction for Class Leaders* (1892); *A Summary of Methodist Law and Discipline* (1897; new ed., 1907); *The Revival of Religion in England in the Eighteenth Century*, the Fernley lecture for 1907.

SIMON, sē'môn', Jules (Jules François Simon Suisse) (1814–96). A French statesman and philosopher, born at Lorient and educated at Lorient and Vannes. He occupied positions in the lyceums at Rennes, Caen, and Versailles and in 1839 through the influence of Victor Cousin became a professor of the history of philosophy at the Sorbonne. The popularity of his lectures and the publication of two notable works, *Etudes sur la théodicée de Platon et d'Aristote* (1840) and *Histoire de l'école d'Alexandrie* (2 vols., 1844–45), led after the revolution of 1848 to his election to the Constituent Assembly as a Conservative Republican. Within a year he became a member of the Council of State. He soon resigned his seat in the Assembly, and after the coup d'état of December, 1851, his refusal to take the oath of allegiance to Napoleon's government resulted in his losing his chair in the Sorbonne also. In the period of retirement which followed, lasting for more than a decade, Simon lived quietly at Nantes and wrote: *Le devoir* (1854); *La religion naturelle* (1856); *La liberté de conscience* (1857); *La liberté politique* (1859); *La liberté civile* (1859); *L'Ouvrière* (1861). Entering the Corps Législatif in 1863, he remained until the fall of Napoleon one of the leaders of the Republican opposition. He strongly opposed the war with Germany, and after the fall of the Empire he became one of the Committee of National Defense. In February, 1871, he became Minister of Public Instruction in Thiers's cabinet, retaining his office until May, 1873. On leaving the cabinet he resumed his position as leader of the Republican Left in the National Assembly until in 1875 he was elected a life Senator. In the same year he was elected to the French Academy. In December, 1876, he was called upon by President MacMahon to form a cabinet in which he himself was Premier and Minister of the Interior. In May following, however, Simon resigned. In addition to the works already mentioned, his works include: *L'Ecole* (1864); *Le travail* (1866); *La peine de mort* (1869); *Le gouvernement de Thiers* (1871); *Victor Cousin* (1887); *La femme des XXème siècle* (1891); *Le soir de ma journée* (1901).

SIMON, Richard (1638–1712). A French theologian. He was born at Dieppe, studied at Dieppe, Rouen, and Paris, and entered the Congregation of the Oratory in 1662. His early publications involved him in controversy with the Jansenists and Benedictines of Saint-Maur and made the great Arnauld (see Arnauld, Antoine) his enemy. In 1678 Simon published the *Histoire critique du Vieux Testament*. At the instigation of Bossuet the greater part of the edition was burned. The book is a critical history of the text, translations, and expounders of the Old Testament and anticipates many of the conclusions and methods of modern scholars, particularly regarding the authorship of the Pentateuch. Simon published also: *Histoire critique du texte du Nouveau Testament* (1689; Eng. trans., 1689); *Histoire critique des versions du Nouveau Testament* (1690); *Histoire critique des principaux commentateurs du Nouveau Testament* (1693; Eng. trans., 1692), which called forth Bossuet's *Défense de la tradition et des saints pères;* and a French translation of the New Testament (1702). Consult: Bernus, *Richard Simon et son histoire critique du Vieux Testament* (Lausanne, 1869); id., *Notice bibliographique sur R. Simon* (Basel, 1882); T. K. Cheyne, *Founders of Old Testament Criticism* (New York, 1893); Archibald Duff, *History of Old Testament Criticism* (ib., 1910).

SIMON BAR COCHBA, or Kozeba. See Messiah.

SIMONDS, sī'mondz, Frank H(erbert) (1878–). An American newspaper editor. He was born at Concord, Mass., and graduated from Harvard in 1900. During the Spanish-American War he served in Porto Rico, in 1901 he was resident at the University Settlement, New York City, and then entered journalism. He served as Albany (N. Y.) correspondent for the New York *Tribune* in 1903–05 and for the New York *Evening Post* in 1903–08. Joining the editorial staff of the New York *Sun* in the latter year, he wrote on local and foreign politics, particularly on the Moroccan crisis and the Balkan War, until 1913, when he became editor of the New York *Evening Sun*. Early in 1915 he took charge of the editorial page of the New York *Tribune*, as associate editor, and for it did much notable writing. He also contributed monthly special articles on the European War to the *American Review of Reviews*. He published *The Great War—The First Phase* (1914) and *The Great War—The Second Phase* (1915).

SIMONE, sē'môn', Madame (?–). The stage name of a French emotional actress. In private life she was Madame Simone Le Bargy for a time, but was divorced and in 1909 married Claude Casimir-Périer, son of the sometime President of France. She made her first appearance in Brussels, and her Paris début occurred in 1902. She achieved her greatest successes in the plays of Henry Bernstein (q.v.), *The Thief, Samson, etc.* In Rostand's *Chantecler* she created the rôle of the pheasant. During a visit to the United States in 1911–12 Madame Simone played in English.

SIMONIDES, sī-mŏn′ĭ-dēz (Lat., from Gk. Σιμωνίδης) (556–468 B.C.). A Greek lyric poet. born on the island of Ceos. He was a finished literary craftsman in many forms of verse rather than a sublime or original poet. His life almost bridged the century from Pisistratus to Pericles, and in his multifarious activities he represents the transition from the earlier parochial isolation of the Greek cantons to the cosmopolitan culture of the Sophistic enlightenment. His poetic career began with the guidance of Apolline choruses in Ceos. Thence he was called to the court of Hipparchus at Athens, where he met Anacreon and competed with Lasus of Hermione, the teacher of Pindar. After the assassination of Hipparchus he attached himself to the ruling families of Thessaly, the Scopadæ and the Aleuadæ. His dirge in memory of Antiochus of Larissa was greatly admired. He displayed his detachment of mind by composing an epigram for the statue of Harmodius in which the assassination of Hipparchus is greeted as "a great light rising upon Athens."

Returning to Athens, now a democracy, he bore away the prize from Æschylus with an elegy on the warriors who fell at Marathon. Two epigrams dating from 476 B.C. inform us that he won the prize for the dithyramb in that year, and that no man could vie in powers of memory with Simonides at the age of 80. A year later we meet him in Sicily in the rôle of a mediator between Hiero and Theron. The remainder of his life was probably spent chiefly at the court of Hiero.

Simonides wrote for many clients in a great variety of forms—epigrams, hymns, pæans, skolia, epinikia, dithyrambs, hyporchemes (dance songs), threnoi (dirges). Though an Ionian, he used the modified Doric traditional in these forms of the Dorian choral lyric. To him, perhaps, after the initiative of Ibycus, may be attributed the full development of the encomian and epinician hymn in praise of living men.

His main opportunity came with the Persian wars. He understood as no one else did how to crystallize the sentiment of the national crisis into flawless gems of epigram, fitting memorials for the glorious dead of Thermopylæ, Salamis, and Platæa. The "tears of Simonides," the pathos of his dirges, were proverbial. The English reader may form some notion of that pathos from Milman's translation of the beautiful lament of Danaë exposed to the waves in a chest with her infant Perseus.

The vicissitudes of human destiny so amply exemplified in the century of history which he witnessed evoke from Simonides a noble but somewhat conventional strain of melancholy moralizing. For this "criticism of life" Matthew Arnold ranks him with Æschylus, Pindar, and Sophocles as a prophet of the "imaginative reason." His style is chaste, polished, and unobtrusively rhetorical rather than profoundly imaginative. The extant remains of his works are given in Bergk's *Poetæ Lyrici Græci* (Leipzig, 1843; 4th ed., 1882; reprinted, 1914). Consult E. Cesati, *Simonide di Ceo* (Casale, 1882); H. W. Smyth, *Greek Melic Poets* (London, 1900); A. and M. Croiset, *An Abridged History of Greek Literature* (Eng. trans., New York, 1904); W. Schröter, *De Simonidis Cei Melici Sermone* (Leipzig, 1906); W. C. Wright, *A Short History of Greek Literature* (New York, 1907); Christ-Schmid, *Geschichte der griechischen Litteratur*, vol. i, part i (6th ed., Munich, 1912).

SIMONIDES (or **SEMONIDES**) **OF AMORGOS.** A Greek poet who lived about 660 B.C. He ranked as second, both in time and reputation, of the three principal iambic poets of the early period of Greek literature, viz., Archilochus, Simonides, and Hipponax. He was born in Samos, whence he led a colony to the island of Amorgos. His writings are distinguished from those of his contemporary, Archilochus, by the fact that they attacked entire classes rather than single persons and contained more general reflections on the constant characteristics of human nature. Of the extant fragments of his writing the most important is Περὶ Γυναικῶν, *Peri Gynaikōn*, a satire on women, in which he gives a general description of female characters, deriving their various, though generally bad, qualities from the characteristic qualities of the animals from which he represented them to be descended. Consult Bergk, *Poetæ Lyrici Græci* (4th ed., Leipzig, 1882; reprinted, 1914); Christ-Schmid, *Geschichte der griechischen Litteratur*, vol. i, part i (6th ed., Munich, 1912).

SIMONIS, sē′mō′nē′, EUGÈNE (1810–82). A Belgian sculptor. He was born at Liége and studied at the academy there. He continued his studies in Rome under Matthias Kessels and Carlo Finelli. On his return he was appointed professor at the academy of Liége, but soon removed to Brussels, where he became director of the academy in 1863. Simonis is the most gifted Belgian sculptor of a period of "modified realism." His equestrian statue of Godfrey de Bouillon (1848, Place Royale, Brussels) is superior, in boldness, power, movement, and decorative qualities, to many other contemporary productions, but his work as a whole has no definite tendency. Among his other well-known sculptures in Brussels are the monument of Canon Triest (Cathedral), "Innocence" (Museum); the statue of Pepin of Heristal and the bas-reliefs for the Théâtre de la Monnaie (1854), the Northern Railway Station, and the Colonne du Congrès, for which he also modeled a statue of "Religious Freedom" and two "Lions."

SIMON MACCABÆUS, sī′mon măc′cȧ-bē′ŭs. One of the five famous brothers who led the Jews in their war for independence against Syria, 167–142 B.C. (See MACCABEES.) Simon succeeded his brother Jonathan in 143 B.C. and soon gained the end that Jonathan had all but realized—the recognition of Jewish independence on the part of the Syrian government. The following year (141 B.C.) the "Congregation," or popular assembly of the Jews, elected Simon high priest and civil ruler (ethnarch), the formal title of the latter position being probably "head of the Congregation." Both offices were made hereditary in Simon's family. His reign of six years was very prosperous. Syria was too weak to regain control, and Simon's right to his position was approved by Rome. The union of the religious and civil headship in one person was not in strict accord with the law, although favored by the spirit of the priestly code. Scruples as to the status of the Maccabæan prince-priesthood were set at rest by the character and ability of Simon's administration. Ancient prophecies of the Messianic era and of a Messiah from Judah were viewed as finding their fulfillment in the priestly headship (of the tribe of Levi) over Judah. Simon was assassinated in 135 B.C. by a son-in-law, Pompey, Governor of Jericho

(1 Macc. xiii–xvi). Consult Emil Schürer, *History of the Jewish People in the Times of Jesus Christ* (Eng. trans., Edinburgh, 1886–90; 4th Ger. ed., Leipzig, 1901–11); A. W. Strean, *The Age of the Maccabees* (London, 1898); R. H. Charles, *The Testament of the XII Patriarchs* (ib., 1908).

SIMON MA'GUS. A religious pretender, first mentioned in Acts viii. 9 ff. and considered by the early Church historians as the originator of the various heresies which flourished during the first three centuries A.D.

Account in Acts (viii. 9–24). Here, while Simon appears mainly in the rôle of a magician or sorcerer, he is also represented as claiming to possess divinity. For his low-minded views of the Holy Spirit he was forcibly rebuked by Peter, possibly with good results. In Acts Simon is not viewed as a heretic or founder of a school of thought, although an earlier career of some note is implied by what is said in verses 9–11.

Early Fathers. Justin Martyr, writing about 150 A.D., says (*Apol.*, i, 26) that Simon was from the Samaritan village Gitton and practiced magic or sorcery. He was worshiped by nearly all the Samaritans as a god. He had with him a woman named Helen, formerly a Tyrian prostitute, whom he declared was an emanation (*ἔννοια*, thought) from himself. He practiced in Rome in the days of Claudius and with such success (aided by demons) that he was honored with a statue inscribed *Simoni Deo Sancto* (To Simon the holy God). Other heretics, such as Menander, were disciples of Simon, according to Justin. It is evident that Justin's account is quite independent of that in Acts and yet confirmatory of it in part, and, as Justin was himself of Samaritan origin, his testimony is weighty. (Cf. further *Apol.*, i, 56; ii, 15: *Dial.*, 120.) Hegesippus, another early Palestinian writer (c.170 A.D.), also mentions Simon as the father of numerous schools of heresy (Eusebius, *H. E.*, iv, 22). Later writers, such as Irenæus (c.180 A.D.) and Hippolytus (c.225), practically repeat Justin's account, but enlarge greatly on the details of Simon's heresy, which is represented as a quite fully developed form of Gnosticism. In Hippolytus we have the first notice of Simon as the opponent of Peter in Rome.

Clementine Literature (*Homilies*, *Recognitions*, and related *Acts*). In this extensive theological romance of the second and third centuries Peter, the exponent of Christianity, is represented as combating Simon, the sorcerer and teacher of error, mainly in towns in or near Palestine. In the *Acts* the contest ends in Rome, where Simon's attempt to fly is ignominiously defeated through Peter's prayers. Here and there in this literature Simon is made to champion Pauline views, and thereby an anti-Pauline propaganda was carried on, but this may not be an original feature of this literature. Consult: A. C. Headlam in Hastings, *Dictionary of the Bible* (New York, 1902); P. W. Schmiedel, in *Encyclopædia Biblica* (ib., 1903); H. Waitz, in *Realencyklopædia für Theologie und Kirche*, vol. xviii (Leipzig, 1906).

SIMONOSEKI, sē'mō-nō-sä'kē. A town of Japan. See SHIMONOSEKI.

SI'MON PETER. See PETER.

SIMON PURE. A Pennsylvania Quaker in Mrs. Centlivre's comedy *A Bold Stroke for a Wife*, who has a letter of introduction to the guardian of an heiress. This is taken by Colonel Feignwell, who impersonates the Quaker and marries the girl. Simon afterward proves his identity; hence we have the phrase "the real Simon Pure."

SIMONS, MENNO. See MENNO SIMONS.

SIMONSTOWN. The capital of a district of Cape Colony, South Africa, on Simon's Bay, a western inlet of False Bay, 20 miles south by rail of Cape Town (Map: Cape of Good Hope, D 10). It is a naval station with fortifications of considerable strength; the docks, constructed between 1900 and 1910 at a cost of over $12,000,000, cover an area of 35 acres or, including the tidal basin, 63 acres. The town is under the headland which forms the Cape of Good Hope. Pop., 1911, 7246.

SIM'ONY (ML. *simonia*, from *Simon* Magus, who attempted to buy the power of conferring the Holy Spirit). In English law, the giving or receiving of holy orders or ecclesiastical preferment for a valuable consideration, or an attempt or agreement to do so. It was condemned by the canon law from the earliest ages, as akin to heresy. Canon 40 of 1603 required every person appointed to ecclesiastical preferment to take oath that he had not obtained it simoniacally. In addition to penalties prescribed by the ecclesiastical law, the Statute of 31 Eliz., c. 6 (1589), imposed fines upon one guilty of the offense. The statute also provided that a simoniacal presentation should be void and that the corrupt presentee should thereafter be disqualified to hold the same benefice, however appointed. It is not now simony for either a layman or an ecclesiastic to purchase a right to an advowson (q.v.) or to make presentation to a benefice, provided he is not buying for himself and the church be full. This is true even if there is an immediate prospect of a vacancy, provided it will not be caused as a result of a contract or arrangement between the parties.

As there is no Established church in the United States, simony is not recognized as a civil offense and probably not as an ecclesiastical wrong. Consult: C. A. Cripps, *Law Relating to the Church and Clergy* (6th ed., London, 1886); Sir Walter Phillimore, *Law of the Church of England* (2d ed., ib., 1895); Sir William Blackstone, *Commentaries* (4th Am. ed., 2 vols., Chicago, 1899). See ADVOWSON; BENEFICE.

SIMOOM, sĭ-mo͞om' (Ar. *samūm*, hot pestilent wind, from *samma*, to poison). A hot suffocating wind, carrying clouds of dust. These winds occur in greatest intensity in the deserts of northern Africa and western Asia, but similar winds are found in India, North America, and Australia. Simooms may be either local and like the hot winds, sand storms, and tornadoes, or more general, like the blizzards of North America. Owing to the clear sky over desert regions in the tropics, the soil and adjacent air may become intensely heated, causing local ascending currents and whirlwinds. Air temperatures of 120° F. and 140° F. have been observed in the Sahara and are not infrequent in Arizona, New Mexico, and Australia. Descriptions of the simoom indicate that, as it approaches the observer, its front extends at least from 5 to 20 miles, much like the advancing front of a series of thunder storms. The clouds of fine sand and dust that are carried up by the wind extend as a haze over the sky; the heavier sands are also transported in large quantities, and as they fall are collected in mounds around every obstacle like snowdrifts in winter. In the great storm of March 10–12, 1901, red and yellow sand and dust from the Sahara fell in nearly every portion of Germany, France, Austria, and Turkey.

The simoom is not to be confounded with the khamsin, which usually blows for about 50 days from the northeast over Egypt. The sirocco (q.v.) is a hot moist southerly wind, in Sicily and Italy; the samiel is the similar hot southerly wind of Turkey; the solano is the hot southeast wind of Spain: these may all exist without any connection with the simoom, but on some occasions dry simoom winds have advanced northward from the desert and merged into the hot moist southerly winds, the sirocco, of the northern shores of the Mediterranean.

SIMPLE HARMONIC MOTION. See Mechanics; Waves.

SIM'PLICIDENTA'TA. See Rodentia.

SIM'PLICIS'SIMUS. The first modern German novel—*Der abenteuerliche Simplicissimus Teutsch, das ist: Die Beschreibung des Lebens eines seltzamen Vaganten, genant Melchior Sternfels von Fuchshaim* (The Venturesome German Simplicissimus, that is: Description of the Life of a Remarkable Vagabond named Melchior Sternfels, of Fuchshaim) (1669). Its author was Hans Jakob Christoffel von Grimmelhausen (q.v.). The book treats of the Thirty Years' War in a most vivid and realistic way.

SIMPLICIUS, sĭm-plĭsh'ĭ-ŭs. A Neoplatonic philosopher of the sixth century, who was a native of Cilicia. He was teaching at Athens when the schools of philosophy were closed by the edict of Justinian and was one of those philosophers who found a temporary asylum at the court of the Persian King Khosru I. Subsequently he lived at Alexandria. He was chiefly famous as a commentator on Aristotle. His complete works were edited by Schweighäuser (Leipzig, 1800). His commentaries on Aristotle's *Categories*, *Physics*, *De Cœlo*, and *De Anima* were edited by Karsten (1865), and that on the *Enchiridion of Epictetus* by Enk (Vienna, 1866).

SIMPLIFICATION. See Etymology, Figures of.

SIM'PLON, *Fr. pron.* săN'plôN'. A famous Alpine mountain pass of Switzerland, 6592 feet above the sea, in the eastern part of the Canton of Valais, near the Piedmontese frontier (Map: Switzerland, C 2). The Simplon road, one of the greatest engineering achievements of modern times, leads over a shoulder of the mountain from Brig in Valais to Domodossola in the north of Piedmont. The road was commenced in 1800 under the direction of Napoleon and was completed in 1805. It is from 25 to 30 feet broad and 42 miles long. It is carried across 611 bridges, over numerous galleries cut out of the natural rock or built of solid masonry, and through great tunnels. The construction of a railway tunnel between Brig and Isella, begun in 1898, was completed in 1906. It has a length of about 12¼ miles and is the longest railway tunnel in the world. Its highest point is only about 2300 feet above sea level. Consult *La ferrovia del Sempione* (Rome, 1900).

SIMPSON, sĭm'son, Edward (1824–88). An American naval officer, born in New York City. He was appointed a midshipman in the navy in 1840, in 1845 entered the new Naval Academy at Annapolis, and in the following year graduated in the first class that ever went out from that institution. In the Mexican War he served on board the *Vixen* and took part in the bombardment of Vera Cruz. In 1855 he was commissioned lieutenant and in the following year assisted in capturing the Barrier Forts near Canton, China. After some years as instructor at Annapolis he was in July, 1862, commissioned lieutenant commander, and in command of the monitor *Passaic* he participated in attacks on Fort Wagner, Fort Sumter, and Fort Moultrie. Later he was fleet captain of the blockading squadron before Mobile. He had risen to the rank of rear admiral when he was retired in 1886. His publications include: *Ordnance and Naval Gunnery* (1862); *Report on a Naval Mission to Europe* (2 vols., 1873); *Modern Ships of War* (1887).

SIMPSON, Elspeth. See Buchanites.

SIMPSON, Sir George (1792–1860). A Canadian statesman and explorer, born in Ross-shire, Scotland. In 1820 he was sent to British America by the Earl of Selkirk, the leading spirit of the Hudson's Bay Company. In 1821, when the Hudson's Bay Company and its rival, the Northwest Company, coalesced, he was appointed governor of the northern department and subsequently general superintendent of the company's affairs in America, holding this position 35 years. In 1828 he crossed the continent to the Pacific and sent out several notable exploring expeditions. In 1841 Simpson was knighted, and in the same year he started on an "overland" journey around the world. He published an account of this as *A Narrative of a Journey round the World During the Years 1841 and 1842.* Consult A. Macdonald, *Peace River: A Canoe Voyage from Hudson's Bay to the Pacific by Sir George Simpson* (Ottawa, 1872), and J. C. Hopkins, *Canada: An Encyclopædia* (Toronto, 1898–1900).

SIMPSON, Sir James Young (1811–70). A Scottish obstetrician, born at Bathgate, Linlithgowshire. He was graduated in medicine in 1832 from the University of Edinburgh. He was elected president of the Royal Medical Society in 1835, lectured on pathology in the university, and in 1840 succeeded to the chair of midwifery. He became one of the physicians to the Queen in 1847. In 1846 he introduced ether as an anæsthetic into England, and in March, 1847, he first employed chloroform for the same purpose, being the pioneer in this method. In 1856 the Montyon prize of the French Académie des Sciences (2000 francs) was awarded to him in recognition of his services in the discovery of chloroform anæsthesia and its introduction into childbirth practice. Simpson invented acupressure in hemorrhage in 1859. In 1866 he was invested by Oxford with the degree of D.C.L. and was created Baronet the following year. Sir James was noted as an antiquary of eminence as well as a most skillful medical practitioner. His bust is in Westminster Abbey. His principal works are: *Essays on Anæsthesia* (1849); *Obstetric Memoirs* (1856); *Acupressure* (1864); *Selected Obstetrical Works* (1871); *Clinical Essays* (1871); *Clinical Lectures on the Diseases of Women* (1871). Consult the *Memoir* by Duns (1873).

SIMPSON, Matthew (1810–84). An American Methodist Episcopal bishop and educator, born at Cadiz, Ohio. He graduated at Allegheny College, Meadville, Pa., in 1832, and practiced medicine for a brief time, but entered the ministry in 1833. He became professor of natural sciences at Allegheny College in 1837, was president of Indiana Asbury (now De Pauw) University (1839–41), was editor of the *Western Chris-*

tian Advocate in 1848, was elected Bishop in 1852, and in 1859 accepted the presidency of Garrett Biblical Institute. He visited the Methodist missions in Syria and the East in 1863 and the Mexican missions in 1874 and was a delegate to the European Missionary Conferences in 1875. An intimate personal friend of President Lincoln, he was employed by the government in several important confidential commissions. He published: *A Hundred Years of Methodism* (1876); *Cyclopædia of Methodism* (1878); *Yale Lectures on Preaching* (1879); *Sermons* (1885). Consult his *Biography* by G. R. Crooks (New York, 1890) and E. M. Wood, *The Peerless Orator* (Pittsburgh, 1908).

SIMPSON, Thomas (1710–61). An English mathematician, born at Market Bosworth, Leicestershire. His interest in celestial phenomena seems to have been awakened by the solar eclipse of May 11, 1724. In 1735 he moved to London, devoting his spare time to the teaching of mathematics. In 1740 he was chosen a member of the Royal Academy of Stockholm and in 1745 a fellow of the Royal Society. In 1743 he was appointed professor of mathematics in the Royal Academy at Woolwich. In 1737 he published *A New Treatise on Fluxions*, which, although it contained some obscurities and defects, showed mathematical ability and gave him reputation.

SIMPSON COLLEGE. A coeducational institution for higher education, founded in 1867 at Indianola, Iowa. It is under the control of the Des Moines conference of the Methodist Episcopal church. The college includes departments of liberal arts, music, business, and an academy. The total value of the buildings and grounds in 1916 was $271,000. The total enrollment in all departments in the autumn of 1915 was 616, and the faculty numbered 28. The permanent endowments of the college amounted, at the end of the fiscal year ending 1915, to $261,340, and the income amounted to about $47,000. In 1915–16 a campaign was carried on to raise $400,000 for additional equipment and endowment. The library contains 10,550 bound volumes. The president in 1916 was Francis L. Strickland, D.D.

SIMROCK, zĭm'rŏk, Karl Joseph (1802–76). A German poet and scholar. He was born at Bonn, studied law there and at Berlin law and philology, entered the civil service in 1826, and in 1827 published a translation of the *Nibelungenlied*, which has become classic in more than 50 editions. He followed this with metrical renderings of Hartmann von Aue's *Der arme Heinrich* (1830), was expelled from the Prussian service for a political poem, and gave himself wholly to literature, translating the poems of Walther von der Vogelweide (1833), the *Parzival* of Wolfram von Eschenbach (1842), *Reineke Fuchs* (1845), the *Edda* (1851), Gottfried von Strassburg's *Tristan und Isolde* (1855), the Old Saxon *Heliand* (1856), the Anglo-Saxon *Beowulf* (1859), *Der Wartburgkrieg* (1858), Brant's *Narrenschiff* (1872), some of Shakespeare's dramas, and other less important works. From 1850 till his death he was professor of the Old German language and literature at Bonn. Consult Hocker, *Karl Simrock* (Leipzig, 1877).

SIMS, sĭmz, George Robert (1847–). An English journalist and playwright. He was born in London and made his home there, becoming almost as familiar with the darker sides of London life as was Dickens. He was educated at Hanwell College and at Bonn. On the death of Thomas Hood the Younger, in 1874, he joined the staff of *Fun*, and in the same year he began writing for the *Dispatch*, in which first appeared his sketches under the title of *Social Kaleidoscope*, the *Three Brass Balls*, and *The Theatre of Life*. These were popular and were translated into French and German. From the feuilleton he drifted into light verse, contributing to the *Referee* the *Dagonet Ballads* (collected in 1882). Among other volumes of his verse are *Ballads and Poems* (1879), *The Land of Gold* (1883), and *Dagonet Ditties* (1893). Turning to the drama, Sims wrote many plays—farces like the *Crutch and Toothpick* (1879), followed by *Mother-in-Law* and *The Member for Slocum*. His greatest success awaited him in melodrama. *The Lights o' London*, first produced at the Princess's Theatre in 1881, had an extraordinary run in London and afterward in the colonies and in the United States. Almost equally popular was *In the Ranks*, first performed at the Adelphi in 1883. Among Sims's other plays are: *The Romany Rye; The Golden Ring; Harbour Lights; In Gay Piccadilly; A Scarlet Sin*. His plays presented striking phases of contemporary London life. His *How the Poor Live* (1883) and his various contributions to the London *Daily News* on the housing of the poor awakened much attention and led to reforms. Throughout a long career he continued active in the fields indicated by the works already named. For Sims as a dramatist, consult William Archer, *English Dramatists of To-Day* (London, 1882), which considers his earlier work.

SIMS, James Marion (1813–83). An American gynæcologist, born in South Carolina. He was graduated in medicine by Jefferson Medical College, Philadelphia, in 1835 and entered upon the practice of his profession at Montgomery, Ala., in 1836. About 1845 he became interested in vesico-vaginal fistula, hitherto incurable, and established a private hospital for women, supporting this several years at his own expense. The success of his operations at closing these fistulæ was due, he stated, to the substitution of silver wire for silk and other sutures. He afterward extended the use of metallic sutures to general surgery. He published a full account of his operation in the *American Journal of Medical Sciences* in 1852. He settled in New York City in 1853 and was instrumental in establishing the Woman's Hospital. In 1861 Dr. Sims went to Europe, living mostly in Paris and returning to New York in 1868. While on a visit to Paris in 1870 he organized the Anglo-American ambulance corps, of which he took charge and which he accompanied to Sedan. In 1876 he was president of the American Medical Association. The so-called "Sims's position," "Sims's speculum," and "Sims's operation" have been of incalculable benefit; he deserves a place as an inventive genius among the great surgeons of the world. There is a monument to him in Bryant Park, New York. He published *Trismus Nascentium* (1846); *Silver Sutures in Surgery* (1858); *On Intra-Uterine Fibroid Tumors* (1874); *Clinical Notes on Uterine Surgery* (1866; Ger. trans.); *Anglo-American Ambulance* (1870); *The Discovery of Anæsthesia* (1877). Consult his *Story of my Life*, edited by H. M. Sims (New York, 1884); also Austin Flint, *In Memoriam James Marion Sims* (ib., 1886).

SIMS, Thomas M. A fugitive slave, returned to slavery from Boston, Mass., in 1851. He had escaped from slavery at Savannah, Ga., in 1851 and reached Boston in February on a trading vessel, but on April 3 was arrested in pursuance of the Fugitive Slave Law (q.v.) and confined in the Boston courthouse. His arrest caused great excitement in Boston, and vigorous but unavailing efforts were made by Abolitionists to secure his release, public meetings being held at which such men as Phillips, Parker, Garrison, Horace Mann, Henry Wilson, and T. W. Higginson delivered addresses. Sims was tried before United States Commissioner George T. Curtis (q.v.), was surrendered to the representative of his master, one James Potter, and returned to Savannah. Unsuccessful attempts were made by Northern people, especially by Charles Devens (q.v.), the marshal who caused his arrest, to buy and emancipate him. In 1863 he escaped to Grant's army at Vicksburg and after 1877 was a messenger in the Department of Justice in Washington. Consult C. F. Adams, *Richard Henry Dana: A Biography* (Boston, 1891); also the *New England Magazine*, vol. ii (N. S., Boston, 1890).

SIMS, William Sowden (1858–). An American naval officer, born at Port Hope, Canada. After graduating from the United States Naval Academy in 1880, he was promoted through the various grades to commander in 1907 and captain in 1911. He served on the North Atlantic, Pacific, and China stations, from 1897 to 1900 was naval attaché to the American embassies at Paris and St. Petersburg, and then served with the Asiatic fleet. In 1902–09 he was inspector of target practice at the Bureau of Navigation and in 1907–09 was also naval aid to the President. He then commanded the *Minnesota* in 1909–11, was a member of the Naval War College in 1911–13, and after 1913 commanded the Atlantic torpedo flotilla.

SIMS, Winfield Scott (1844–). An American inventor, born in New York City. He served in the Civil War in a New Jersey regiment. He experimented with electromagnets and electromotors and was the first to apply electricity to the propulsion and guidance of torpedoes. (See Torpedo.) He invented the Sims-Dudley dynamite gun, a wireless dirigible torpedo, and a dynamite gun for aëroplanes.

SIMSBURY, sĭmz'bĕr-ĭ. A town in Hartford Co., Conn., 14 miles northwest of Hartford, on the Farmington River, and on the Central New England and the New York, New Haven, and Hartford railroads (Map: Connecticut, D 2). It has a public library and a high school. The manufacture of safety fuse constitutes the chief industry. Pop., 1900, 2094; 1910, 2537. Consult Noah A. Phelps, *History of Simsbury* (1845).

SIMSON, sĭm'sôn, Martin Eduard von (1810–99). A German jurist and parliamentarian, born at Königsberg. After studying there, in Berlin, Bonn, and Paris, he began to lecture in his native city in 1831 and became professor there in 1836 and a judge of the higher court in 1846. Elected to the National Assembly at Frankfort in 1848, he was successively its Secretary, Vice President, and President, and in 1849 headed the delegation which announced to the King of Prussia his election as German Emperor. In the same year he represented Königsberg in the Prussian Second Chamber with rare oratorical skill and in 1850 presided over the Erfurt Parliament. Having confined himself to his juridical and academic duties from 1852 to 1858, he was again returned to the House of Representatives in 1859, was its president in 1860–61, and of the North German Reichstag from 1867 on, in which capacity he headed the deputation which petitioned King William I at Versailles, December, 1870, to accept the Imperial crown offered him by the German princes. In 1869 he became presiding judge of the Court of Appeals at Frankfort-on-the-Oder. Subsequently also President of the German Reichstag, he declined a reëlection in 1874, owing to impaired health, was appointed president of the Supreme Court at Leipzig in 1879, and retired in 1892, settling in Berlin.

His son, Bernhard (1840–), born at Königsberg, professor of history at Freiburg from 1877 to 1905, is known as the author of *Jahrbücher des fränkischen Reichs unter Ludwig dem Frommen* (1874–76) and *unter Karl dem Grossen* (1883) of the sixth volume of Giesebrecht's *Geschichte der deutschen Kaiserzeit* (1895) and of a biography of his father (Leipzig, 1900). He wrote also *Die Entstehungen der Pseudo-Isidorischen Fälschungen* (1886) and a number of historical essays.

SIM'SON, Robert (1687–1768). A Scottish mathematician, born at West Kilbride, Ayrshire. He was educated at Glasgow University and in London. At the age of 24 he was elected professor of mathematics in Glasgow University. Directed by Halley to the study of Greek mathematics, he devoted much of his life in making the early classics in geometry known in England. In 1761 he retired from his active work in the university and devoted the remaining years of his life to revising his works. Besides numerous memoirs, Simson published the following works: *Sectionum Conicarum Libri V* (1735; 2d ed., 1750; Eng. trans., 1804); *Apollonii Pergæi Locorum Planorum Libri II* (1749; Ger. trans., 1822); *Elements of Euclid* (1756, and many subsequent editions). His collected works were published at Glasgow in 1776.

SIMS REEVES, John. See Reeves, J. S.

SI'MULTA'NEOUS EQUATIONS. See Equation.

SIN (AS. *synn;* probably connected with Lat. *sons*, guilty). Voluntary transgression of a moral law believed to possess divine sanction. In primitive life there is no sharp distinction between human and divine law; all social customs and traditions are under the sanction of whatever divine power the tribe may recognize. In such cases the elements of a conception of sin are present, but the acts of conduct to which it is applied will vary according to the advance of civilization. In the more developed religions the conception of sin is determined by the place given to human responsibility. Where the freedom of will is emphasized, as in Zoroastrianism, there is a clear sense of sin. Where man comes to be considered as not a free personality, but determined in his action by destiny, karma, or any force outside his own control, as in Hinduism, there is no sin, in the Christian sense of the word.

Among the Greeks and Romans the idea of sin takes on the more positive character of their life and temperament. The essential excellence of human nature and the power of the human will, unaided, to attain a high standard of virtue, was part of the genius of the Græco-Roman civilization. If men did not rise to the moral heights open to them, the lack constituted sin.

With Christianity there came a change, the chief causes of which were the emphasis on the ethical code as a divine command and the teaching of the doctrine of a future life, especially the doctrine of penalty for sin. This acted as a strong deterring influence, which showed itself still further in the practice of self-accusation and in the habit of affixing personal responsibility for the smallest departures from the divine law. In their conflict with paganism and Greek philosophy the early fathers were led to define the nature of sin more fully and precisely. We find two broadly divided schools. One regarded sin as an individual affair, as a voluntary act. The other regarded it as a matter of the race, as a taint of hereditary depravity and corruption. The former school held that moral responsibility was confined to the individual's own acts; the latter, that this responsibility is shared and conditioned by the race as such. Out of these opposing views arose the distinction between actual and original (q.v.) sin. See AUGUSTINIANS; PELAGIANISM; SEMI-PELAGIANISM.

In modern thought sin is studied for the most part in connection with theodicy, psychological ethics, and sociology. The study assumes three forms: (1) the inquiry into the origin of evil; (2) the question of freedom and necessity; and (3) the relation of sin to final causes. Descartes and Spinoza practically denied the positive character of sin, as did Malebranche, who, however, maintained that sin is a phenomenon through which God occasionally acts, as He might through any other act of a human being. For Leibnitz, the author of the most original system of theodicy, evil is the contrast to the good. The origin of evil therefore is not to be found in the divine will, nor entirely in the action of man, but rather in the essential limitations of matter, which is the condition of realizing the good. Thus, evil is merely privation and has no true cause. In regard to the question of freedom Spinoza's theory of universal determinism led him to attribute freedom to God alone, and, of course, this caused him to deny the reality of free agency. Descartes's view that God creates the distinction between truth and falsehood, right and wrong, tended in the same direction. Liebnitz, on the other hand, while admitting that God is the only complete and perfect cause, nevertheless contended that He has, in creating man, conferred upon him the prerogative of freedom.

After Leibnitz we find no original systems of theodicy, and the problem of sin tends to be considered in connection with psychological ethics and sociology. Its subjective character and its reflex action on social life are the chief matters of interest to the more modern mind. Physical conditions are now admittedly agreed to be important predisposing factors of sin. The part played by choice, by feelings of fear, and by the primitive passions in perverting human nature is also fully acknowledged, especially in determining the intention of the act of sin and its relation to the universal disapproval that accompanies wrongdoing (guilt). Evolution exhibits sin as the constant struggle of the inherited lower nature against the steadily rising ideals of humanity in its progress. The vast social significance of the fact of sin has been fully recognized, as appears in all modern systems of penology in which remedial measures are applied to the correction of the habitual criminal. It is also seen in the importance now attached to the moral education of the young as a means of combating the liability to wrongdoing in the human race.

Bibliography. J. Müller, *The Christian Doctrine of Sin* (Eng. trans., 2 vols., Edinburgh, 1868); H. E. Manning, *Sin and its Consequences* (London, 1892); James Martineau, *Types of Ethical Theory* (3d rev. ed., 2 vols., Oxford, 1898); F. R. Tennant, *Origin and Propagation of Sin* (2d ed., New York, 1906); W. D. Hyde, *Sin and its Forgiveness* (Boston, 1909); W. E. Orchard, *Modern Theories of Sin* (ib., 1911); F. R. Tennant, *Concept of Sin* (New York, 1913); Robert Mackintosh, *Christianity and Sin* (ib., 1914); also the ethical works referred to under ETHICS, and the older discussions of Plato, Aristotle, Epictetus, Cicero, Descartes, Spinoza, and Leibnitz. See also DEVIL; EVIL; ORIGINAL SIN; VENIAL SIN.

SINAI, sī'nī *or* sī'nā-ī (Heb., probably "belonging to Sin," the moon god). The name of a mountain in Arabia (Gal. iv. 25) before which Israel encamped and on the top of which Moses received the Law, according to Ex. xix. ff. and whence Yahwe was regarded as coming to the help of his people (Deut. ii. 2; Judg. xxxiii. 2; Hab. iii. 3; Ps. lxviii. 9). The location is uncertain. In Christian times it has been identified with various peaks on the so-called Sinaitic Peninsula (q.v.). Hermits retreated to these mountains at least as early as in the time of Emperor Julian (361–363). Some of them looked upon Jebel Serbal as Sinai, or Horeb. This was evidently the view of Cosmas Indicopleustes (c.536), who regarded the inscriptions, which are especially numerous here, as coming from the Israelites. (See SINAITIC INSCRIPTIONS.) Others thought of Jebel Musa. It is possible that this mountain was originally named after the famous saint, Bishop Moses (c.375), whose story is told by Socrates (iv, 36) and Theodoret (iv, 23). Silvia of Aquitaine (c.390) apparently visited this place and called it Syna. Here Justinian built in 530 on the northern slope a fortress, to which the monks of Jebel Serbal gradually went for protection and which afterward became a monastery dedicated to St. Catharine of Alexandria, as well as a church of the Virgin somewhat higher up. In modern times Ras al Safsaf (Robinson) and Jebel Katherin (Rüppell) have been suggested. On the other hand Grätz considered Jebel Araif immediately south of Kadesh Barnea (q.v.) as Sinai and the views of Haynes and Cheyne are essentially in harmony with this. But more importance attaches to the opinion of Beke, who already in 1834 maintained that it should be sought east of the Gulf of Akabah. After a visit to the place in 1873, he concluded that Jebel al Nur was Sinai, though disappointed in not finding it a volcano. Musil in 1911 identified Sinai with the extinct volcano al Badr, "the moon" (lat. 37° 10′ E., long. 27° 10′ N.), near which is a wide, fruitful, and fairly well watered plain. This may be too far south; but the biblical references connecting Sinai with Mount Seir, Edom, and the land of Midian seem clearly to indicate this region east of the Ælanitic Gulf, as has been pointed out by Wellhausen (1886), Sayce (1894), Moore (1895), Stade (1897), Gall (1898), Gunkel (1903), Eduard Meyer (1906), Schmidt (1908), Gressmann (1913), Haupt (1914), and others. "The Mount of God, Horeb" (Ex. iii. 1 et al.; 1 Kings xix. 8) has generally been regarded as only another name for Sinai. According to the current system of Pentateuchal analysis Horeb is used by E. and D., Sinai by J. and P. There may, however, have been two distinct mountains in the original narrative, afterward confused. Robinson thought of Jebel Musa and Ras al Safsaf, Cheyne of a Horeb west and a Sinai east of the Gulf of Akabah, and Winckler of two neighboring mountains, like Ebal and Gerizim, in the region of Edom—one dedicated to the moon, the other to the sun (the "glowing heat"). In the present state of our knowledge this question, like that of the exact location, admits of no decisive answer.

Bibliography. Edward Robinson, *Biblical Researches in Palestine* (2d ed., London, 1856); E. H. Palmer, *The Desert of the Exodus* (New York, 1872); Charles Beke, *Discoveries of Sinai in Arabia and of Midian* (London, 1878); C. F. A. Dillmann, *Die Bücher Exodus und Leviticus* (Leipzig, 1880); Julius Wellhausen, *Prolegomena zur Geschichte Israels* (3d ed., Berlin, 1886); A. H. Sayce, *The Higher Criticism and the Verdict of the Monuments* (London, 1894); G. F. Moore, *Judges* (New York, 1895); Hugo Winckler, "Sinai and Horeb," in *Encyclopaedia Biblica* (ib., 1903); Eduard Meyer, *Die Israeliten* (Halle, 1906); Nathaniel Schmidt, in *Hibbert Journal* (London, 1908); I. Benzinger, in Baedeker, *Palestine and Syria* (Leipzig, 1912); Hugo Gressmann, *Mose und seine Zeit* (Berlin, 1913); Paul Haupt, in *Studien zur Semitischen Philologie und Religionsgeschichte Julius Wellhausen gewidmet* (Giessen, 1914).

SINAITIC (sī'nā-ĭt'ĭk) **INSCRIPTIONS.** The designation of a large number of brief inscriptions found on the Sinaitic Peninsula (q.v.), chiefly in the Wadi al Mukattib, near Feran, at Jebel Serbal, and near Jebel Musa, formerly imagined to be the work of Israelites during their sojourn at Sinai, but now known to be Nabatæan and coming from the first centuries of our era, for the most part being the graffiti of pagan pilgrims or merchants. Of the nearly 2000 inscriptions known the vast majority seem to come from the period between 189 and 250 A.D. Their true origin was first recognized by E. F. E. Beer (*Studia Asiatica* (Leipzig, 1840). Six hundred were copied by J. Euting and published by him under the title *Sinaitische Inschriften* (Berlin, 1891); the most complete collection is that of M. de Vogüé, in *Corpus Inscriptionum Semiticarum*, ii, 1 (Paris, 1902), from the copies of E. Bénédite, provided with an excellent introduction.

SINAITIC MANUSCRIPT. See Bible.

SINAITIC PENINSULA. A common designation of the territory projecting into the Red Sea between the Gulf of Suez and the Gulf of Akabah. Politically, in 1915, it belonged to the British Protectorate of Egypt. The northern part, al Tih, is an arid desert; the southern, al Tur, a mountainous region. The latter consists of three groups: a northwestern, reaching in Jebel Serbal a height of 6759 feet; a central, including Jebel Musa (7519 feet), Ras al Safsaf (6541 feet), Jebel Zebir (8531 feet) and, the highest of all, Jebel Katherin (8551 feet); and a southeastern, whose highest peak is Jebel Umm Shomer (8449). In Wadi Maghara, at Sarbut al Khadim, and in Wadi Nasb there are numerous Egyptian inscriptions, mentioning not less than 39 kings from the Ist to the XIIth dynasty. Struggles with the natives, the Menziu, are represented, and references are made to the copper and malachite (Egyptian, *mafkat*) secured in these places. At Sarbut al Khadim there are the ruins of a Hathor temple and some evidences of a still earlier Astarte temple. In the early centuries of our era especially the neighborhood of Jebel Serbal was visited by pilgrims and merchants on their way to Aila. (See Sinaitic Inscriptions.) From the fourth century the peninsula was peopled by anchorites who suffered much from the attacks of Saracens and Blemmyans. Against these Justinian's castle on Jebel Musa gave them some protection. After the Moslem invasion the convent of St. Catharine was the chief centre of Christian monastic life. In 1398 there were still six other convents, but these seem to have been abandoned soon after this time. Among the literary treasures of the convent of St. Catharine may be mentioned *Codex Sinaiticus* discovered by Tischendorf in 1844 and 1859, now in Leipzig and Petrograd, and *Codex Sinaiticus Syriacus* discovered by Mrs. Margaret Dunlop Gibson and Mrs. Agnes Smith Lewis in 1892. (See Bible.) There are at present about 6000 Tawarah Bedouins of five tribes and a few hundred Jebeliyeh, or vassals of the monastery, descendants of 200 Wallachians and 200 Egyptians given to the convent by Justinian. There is no reason to think that in historic times the peninsula has been able to support a much larger population. Consult: Edward Robinson, *Biblical Researches in Palestine* (2d ed., New York, 1856); Edward Hull, *Mount Seir, Sinai, and West Palestine* (London, 1885); A. P. Stanley, *Sinai and Palestine* (2d ed., ib., 1905); W. M. Flinders Petrie, *Researches in Sinai* (ib., 1906); M. J. Rendall, *Sinai in Spring* (ib., 1911).

SINALOA, sē'nā-lō'ā. A Pacific state of Mexico (Map: Mexico, E 5). Area, 27,553 square miles. The coast is low and lined with numerous lagoons. The interior rises gradually from the coast, and the eastern part is occupied by the Sierra Madre Mountains. The state is well watered, and some of the rivers are partly navigable. The climate is hot and unhealthful on the coast, but more moderate in the highlands. Rains are abundant in the mountains, and the mountain slopes are well wooded. Mining is the chief industry; the principal metals are gold, silver, copper, iron, and lead. Agriculture and stock raising are also carried on. The chief manufactured product is cotton cloth. Pop., 1910, 323,642, including many Indians. Capital, Culiacán (q.v.).

SINCERE BRETHREN (Ar. *Ikhwān al Safā wa Khullān al Wafā*, the Sincere Brethren and True Friends). A transcendental and scientific order of esoteric nature in Islam, existing at Basra on the lower Euphrates about 1000. (See Shiites.) Little is known of the personality of the members, the leader of whom may have been one Zayd ibn Rifaa. It was a constituent part of their philosophy that perfection could be reached only through the coöperation of souls, each contributing its share to the common treasury of goodness and knowledge; hence logically their association took the form of an esoteric society with a simple organization into which any sincere and helpful-spirited man could enter. The order was divided into four ideal grades: the first for the younger members and for those of practical ability; the second for those over 30 years who could fulfill the office of teachers; the third for those over 40 who could rule in the society, their authority being one of mildness and admonition; the fourth for those who were fit to attain the vision of

God. The *Epistles of the Sincere Brethren* (*Rasāil Ikhwān al-Ṣafā*) consists of 51 treatises and is an encyclopædia of the Arabic philosophy of the age. This is based upon Neoplatonic and other late Greek philosophies, with evident contributions from Oriental mysticism, the authors being Shiite. The doctrine is that of an All-Soul, which first projects matter from itself and continuously spiritualizes it by emanations; on the other hand these soul parts naturally yearn for return to their origin. But this redemption is hampered by the opposition of spirit and matter. The ethics of the encyclopædia therefore inculcates the gradual self-purification of those who recognize their spiritual birthright to develop away from sense to God. But while ethically dualistic, the encyclopædia has a pantheistic metaphysics and is interested in all created things as being immediately derived from God. The Sincere Brethren, among whom were such eminent men as Mukaddasi (q.v.), also seem to have accepted from Greek sources many advanced ideas of a scientific nature, such as the belief in the spherical character of the earth and its rotation around the sun. The work has been made known to modern Europe through the labors of Dieterici in a series of translations published between 1861 and 1872 (Berlin and Leipzig), concluding with a general survey in *Die Philosophie der Araber* (Leipzig, 1876–79). He has also published as a translation one of the episodes, *Der Streit zwischen Mensch und Thier* (Berlin, 1858), and its original (ib., 1879); also a selection of the original texts in *Abhandlungen der Ichwān es-Safā* (ib., 1883–86). Consult Flügel, in *Zeitschrift der deutschen morgenländischen Gesellschaft*, vol. xiii (Leipzig, 1859), and Stanley Lane-Poole, *Studies in a Mosque* (London, 1883).

SINCLAIR, sĭŋ'klâr, ALEXANDER MACLEAN (1840–). A Canadian Gaelic scholar. He was born at Glen Bard, Antigonish County, Nova Scotia, studied for the ministry at the Presbyterian College, Halifax, and was ordained in 1866. He held pastorates at Springville, Nova Scotia, Belfast, Prince Edward Island, and Hopewell, Nova Scotia. In 1907 he was appointed lecturer in the Gaelic language and literature at Dalhousie University. His publications include: *A Collection of Gaelic Poetry* (1881); *Gaelic Hymns* (1881); *The Gaelic Bards from 1411 to 1715* (1890); *The Gaelic Bards from 1775 to 1825* (1896); *The Clan Gillean, or History of the Macleans* (1899); *Mactalla nan Tur* (1901).

SINCLAIR, SIR JOHN (1754–1835). A Scottish politician and author. He was born at Thurso Castle, Caithness, studied at Edinburgh, Glasgow, and Oxford, and was admitted to the English bar (1782). With slight interruptions he sat in Parliament from 1780 to 1811. In 1793 he established the Board of Agriculture, of which he was for 13 years president. In 1786 he was created Baronet. He published his *History of the Public Revenue of the British Empire* (2 vols., 1784; 3d ed., 1803–04); but his chief work is the *Statistical Account of Scotland* (21 vols., 1791–99). Consult his *Correspondence* (2 vols., 1831).

SINCLAIR, MAY (?–). An English author, born at Rock Ferry, Cheshire, and educated at the Ladies' College, Cheltenham. Criticism, verse, short stories, and novels came from her pen before she made a substantial success—a success greater in America than in England—with her *The Divine Fire* (1904). Other publications of hers are: *Audrey Craven* (1906); *The Tysons* (*Mr. and Mrs. Nevill Tyson*) (1906); *The Helpmate* (1907); *The Judgment of Eve* (1908); *Kitty Tailleur* (1908); *The Three Brontës* (1912); *Feminism* (1912); *The Combined Maze* (1913); *The Return of the Prodigal* (1914); *The Three Sisters* (1914); *A Journal of Impressions in Belgium* (1915)—Miss Sinclair served as a nurse after the invasion of Belgium; *The Belfry* (1916).

SINCLAIR, UPTON (BEALL) (1878–). An American author and Socialist, born in Baltimore. He graduated at the College of the City of New York in 1897 and studied also at Columbia. His novel, *The Jungle* (1906), led President Roosevelt to order an investigation of the Chicago stockyards, which brought to light serious abuses. In October, 1906, Sinclair organized the New York Home Colony, in which several families agreed to try coöperative living in a building known as Helicon Hall, near Englewood, N. J. The building was destroyed by fire in 1907. He was one of the founders of the Intercollegiate Socialist Society. Among his publications are: *Springtime and Harvest* (1901); *The Journal of Arthur Stirling* (1903); *Manassas* (1904); *The Industrial Republic* (1907); *The Money-Changers* (1908); *Samuel, the Seeker* (1909); *The Fasting Cure* (1911); *Sylvia* (1913); *Sylvia's Marriage* (1914); *The Cry for Justice: An Anthology* (1915).

SIND, SINDH, or **SCINDE**, sĭnd. A region in the northwestern part of British India, now forming a division of the Bombay Presidency. It lies around the lower course of the Indus (Map: India, A 3). The area under British administration covers 46,986 square miles, and the total area, including the native State of Khairpur, is 53,036 square miles. Sind is a great silt-formed area of very low, flat doabs, or interfluvial regions, lying between the branches of the great Indus delta. These doabs consist mostly of alluvial clay baked hard in the sun. In the west Sind is like the Punjab and in the east much like Rajputana, more inhospitable and waste than anything in the Punjab, subject to scorching winds little relieved by rainfall. The arable soil consists of the rich alluvium deposited in the periodic river floods.

Agriculture is much dependent on irrigation, secured through a system of canals leading from the Indus River and from the annual overflow of that river. The extension of these canals by the government in recent years has increased cultivated areas. In 1912–13 the net area cropped was 3,990,570 acres. There are generally two harvests per annum: the first, or rabi (spring), harvest consists of wheat, barley, oil seeds, millet, durra, opium, hemp, and tobacco; the second, or kharif (autumn), harvest consists of those crops whose ripening requires much heat, as rice, sugar cane, cotton, indigo, and maize. The Northwest Railroad extends from Karachi northward through the region. Karachi (q.v.) is the principal port for the Punjab and northwest India. Pop., 1901, 3,210,910; 1911, 3,513,435. In 1911 Mohammedans numbered 2,639,929; Hindus, 837,887; Sikhs, 11,166; Christians, 10,911; Parsis, 2411; Jains, 1349; animists, 8869. The principal language is Sindhi (q.v.); in 1911 this was the language of 3,669,935 persons in India. The capital of Sind is Karachi.

From the early part of the eleventh century Sind was generally under Mohammedan domination. Among the mediæval ruling powers were the dynasties of Ghazni and Ghuri (q.v.). Towards the close of the sixteenth century it passed under the sway of the Great Mogul. (See Mogul, Great.) In 1748 it became a feudatory dependency of the Durani dynasty of Kandahar. A little more than a generation later the Talpur Baluchis, who had immigrated into Sind, raised their leader, Mir Fath Ali, to supreme power. This chief made large grants of territory to various relatives, reserving most of Lower Sind for himself and his three brothers, so that there were four ameers at Hyderabad, three at Khairpur, and one at Mirpur. On the outbreak of the Afghan War in 1838, the British government intimated its intention to take temporary possession of Shikarpur and forced the ameers of Hyderabad and Mirpur to agree to a treaty which virtually destroyed their independence. War with Great Britain broke out in 1843, following an attack on the British Residency, and an expedition under Sir Charles James Napier, the British envoy, routed the native forces at Miani and soon completed the subjugation of Sind. The conquered territory was divided into three collectorates, now the districts of Hyderabad, Karachi, and Shikarpur; the Ameer of Khairpur, by continuing faithful to the British, retained his dominions. Consult Hughes, *A Gazetteer of the Province of Scinde* (2d ed., London, 1876), and Sir R. F. Burton, *Sind Revisited* (ib., 1896).

SIND′BAD (or SINBAD) THE SAILOR. The hero of one of the tales of the *Arabian Nights*.

SINDER. See Zinder.

SINDHI (sĭn′dē *or* sĭn′d′hē) **LANGUAGE AND LITERATURE.** The modern Indian language and literature of Sind (q.v.). Sindhi is derived from Apabhraṁśa Prakrit (see Prakrit), spoken in mediæval times about the mouth of the Indus. Of all the Indian group of languages Sindhi is in many respects the most interesting linguistically. Its nearest relative is Lahnda, the language of western Punjab. While it is, generally speaking, an analytic language of the same type as English, it retains a number of Prakrit elements, which have been discarded elsewhere. There are, as in Sanskrit (q.v.), eight cases, formed chiefly by postpositions, and the verb has three simple tenses, potential, aorist, and future, from which the various periphrastic tenses are formed (e.g., *ãmũṃ halãṃ*, I may go, *halandō huãṃ*, I may be going; *haliō huãm*, I may have gone; *halãṃ thō*, I go; *halaṇdō ãṃhiyãṃ*, I am going; *halandō hōse*, I was going; *haliuse*, I went; *haliuse thē*, I used to go; *haliō ãṃhiyãm*, I have gone; *haliō hōse*, I had gone; *halanduse*, I shall go; *halaṇdō hunduse*, I shall be going; *haliō hunduse*, I shall have gone). The past tenses of the transitive verb are lacking, and their place is supplied by the passive with the agent in the instrumental case. In its vocabulary Sindhi, being the first language of India to come under Mohammedan influence, has incorporated many Persian and Arabic loan words. On the other hand it has borrowed a smaller number of Sanskrit words than any of the other modern Indian languages. Sindhi is divided into a number of dialects which shade imperceptibly one into another. The most important are Lari, in the Indus delta; Thareli, in the Sind desert; and the one which may be called the standard, Kacht, in Cutch. Among the other dialects are Jathki, Vicholi, Sirai, and Jadgali. The alphabets were formerly numerous, but fell into two classes, the Arabic and those derived from the Sanskrit Devanagari (q.v.), and uniformity in this regard has not yet been attained. The distinction in usage was primarily religious, Arabic letters being used by the Mohammedans, while the Hindus clung to the Indian characters. Sindhi literature is scanty, but there is a rich store of popular poetry, tales, and the like which are being reduced to writing. According to the census of 1901 there were 3,494,971 persons speaking Sindhi and 3,337,917 speaking Lahnda.

Bibliography. Stack, *English and Sindhi Dictionary and Sindhi Grammar* (Bombay, 1849); Ernest Trumpp, *Sindhi Reading Book* (London, 1858); id., *Grammar of the Sindhi Language* (ib., 1872); J. Beames, *Comparative Grammar of the Modern Aryan Languages of India* (3 vols., ib., 1872–79); R. N. Cust, *Modern Languages of the East Indies* (ib., 1878); Shirt, Thavurdas, and Mirza, *Sindhi-English Dictionary* (Karachi, 1879); Gajumal, *Handbook of Sindhi Proverbs with English Renderings* (ib., 1895); G. A. Grierson, "Vrăcaḍa and Sindhī," in *Journal of the Royal Asiatic Society* (London, 1902); J. D. Anderson, *The Peoples of India* (Cambridge, 1913). For literature, consult Sir R. Temple, *Legends of the Panjab* (3 vols., Bombay, 1884–1900).

SINDIA, sĭn′dĭ-ȧ. The name of a Mahratta house which played an important part in the history of India during the eighteenth and nineteenth centuries. The Sindia arose in Gwalior, of which the rulers still bear this name, and was of low caste. Its founder was Ranoji Sindia, who had risen to be commander of the Peshwa's bodyguard, and after 1743 received an hereditary fief. His natural son Madhava Rao (or Mahadji) Sindia (1750–94) became chief of the Mahratta princes in 1767. Four years later, with the coöperation of the Peshwa, Madhu Rao, he assisted the Mogul Emperor of Delhi, Shah Alam, to expel the Sikhs from his territories. As a reward for his services Madhava Rao was given control of these lands. He fought against the English in the first Mahratta War (1779–82), which terminated in the Treaty of Salbai, according to the terms of which he received the districts won in Gujarat. Later (1784) he captured Gwalior, after which he seized Delhi and almost the entire Doab (q.v.) and subjugated three of the Rajput states. Madhava Rao died in 1794 and was succeeded by his grandnephew Daulat Rao (1794–1827), who played a prominent part in the Second Mahratta War, which broke out in 1803. During the same year his forces were defeated at Assaye and Argaum by Sir Arthur Wellesley, afterward Duke of Wellington, and he renounced all his claims to territory between the Jumna and the Ganges as well as his provinces in Gujarat. After this Daulat coöperated with the English, helping them in 1804 against Jaswant Rao Holkar, for which he was given Gwalior in 1805 as his capital. In 1817 he was suspected of treasonable negotiations with Nepal and during the following year was compelled to sign a treaty by which he lost Ajmere and other states. He died in 1827 without issue, and his widow, Baiza Bai, adopted Janokji (or Mugat) Rao

Sindia (1827–43). His rule was weak, and in 1843 he died, leaving no heirs. His girl widow, Tara Bai, adopted a boy of eight years, Jayaji Rao Sindia (1843–86). The dominions of Gwalior were in such a state of anarchy that the British were forced to intervene, and a war followed, in which the Mahrattas were routed (Dec. 29, 1843) by Sir Hugh Gough at Maharajpur and on the same day by General Grey at Panniar. The British then seized Gwalior and obliged the Sindia to maintain thereafter a Sepoy contingent in that place. In 1858 this contingent joined the Sepoy mutiny and forced the Sindia, who remained loyal to the British, to flee to Agra. On June 19, 1858, he was reinstated by Sir Hugh Rose and received various tokens of appreciation of his loyalty. On his death, in 1886, Jayaji Rao was succeeded by his adopted son, Madhava Rao Sindia, an enlightened prince who was active in reform and good government. His loyalty to the British was shown in 1901, when he equipped at his own expense and accompanied a hospital ship for the China War. Consult H. G. Keene, *Madhava Rao Sindhia* (Oxford, 1891), and James Burgess, *The Chronology of Modern India, 1494–1894* (Edinburgh, 1913).

SIN'DING, Christian (1856–). A Norwegian composer, born at Kongsberg, Norway. In 1874 he became one of Reinecke's pupils at the Leipzig Conservatory and studied with him for three years. In 1880, with the Royal scholarship, he studied at Dresden, Munich, and Berlin. He finally settled as organist and teacher at Christiania. His compositions, the most notable of which are for the piano, are remarkable for their brilliancy and Norwegian characteristics. Among his works are a pianoforte quartet; a pianoforte quintet; a string quartet; two symphonies (D minor and D major); three violin sonatas; romanze for the violin with the piano; a concerto for violin, op. 45; a concerto for viola; a suite for flute and orchestra; variations for two pianos; songs and piano pieces. An opera, *Der heilige Berg*, was produced in Berlin (1910).

SINDING, Otto Ludwig (1842–1911). A Norwegian landscape and genre painter, born at Kongsberg. He studied under Eckersberg in Christiania, under Gude and Riefstahl at Karlsruhe, and under Piloty at Munich. His art is less characteristically northern than that of most Scandinavian painters, although in his coast scenes of the Lofoten, such as "From Reine" (Christiania Gallery) and "Laplanders Greeting the Return of the Sun," he proved himself a gifted interpreter of his own rugged land. He also essayed religious paintings; genre scenes, notably "Struggle at a Peasant's Wedding"; fantastic compositions in the manner of Böcklin and Thoma; and marines, such as "The Surf."

SINDING, Stefan (1846–). A Norwegian sculptor. He was born at Trondhjem and after taking the degree of Ph.D. at Christiania University he turned to sculpture, which he studied in Christiania and in Berlin (1871–74) under Albert Wolff. He afterward lived and worked in Paris, Christiania, Rome (1877–84), and Copenhagen, where his early patron, Dr. Jacobsen, collected his finest statues in the Ny-Carlsberg Glyptothek. Sinding became known as the foremost Norwegian sculptor. In his first important work, the group "A Barbarian Mother" (1882), he broke away from the classic traditions of Thorvaldsen, until then supreme in Scandinavia. This was followed by the "Captive Mother" (Medal of honor, Paris, 1889) and "Man and Woman," the first examples of a subject frequently treated by him but without sentimentality or sensualism. Among other celebrated works are the wooden statue "Eldest of her Kin" (1897); "Mother Earth" (1900); "The Valkyrie" (wood, 1902; bronze, 1908); "Adoration" (1903); "May" (1910) and the "Valhalla" frieze (1887–1904), all in the Ny-Carlsberg Glyptothek; and the monuments to Ole Bull at Bergen, to Ibsen and Björnson in Christiania. Sinding's chief characteristics are absolute truthfulness, energy, artistic imagination, creative power, and love of beautiful contours. Consult M. Rapsilber, *Stephan Sinding* (Berlin, 1911).

SINE. See Curve of Sines; Trigonometry.

SINGAKADEMIE, zing'à-kà-dâ-mē'. See Choral Societies.

SINGANFU, sēng'än'fōō', **SIGANFU,** or **SIANFU** (Chin., west tranquil city), also sometimes spelled Hsianfu. Residence of the Shen-Kan, or Governor-General of the United Provinces of Shensi and Shansi. A departmental city of China, capital of the Province of Shensi (q.v.), and noted for its antiquity as well as its importance as a commercial centre (Map: China, K 5). It is finely situated near the Wei River, the principal affluent of the Hoang-ho in the midst of a great loess plateau sloping southward from the high table-lands of Mongolia to the Tsing-ling Range, and eastward from Kansu to the Hoang-ho. Its walls are not so high as those of Peking, but the four great gates with their lofty towers surpass those of Peking in magnificence. They are well built and in 1868–71 successfully withstood the attacks of the Mohammedan hosts then in rebellion. They have a circuit of 24 miles and are built in the form of a square, with each side about 6 miles in length. The streets are wide, well paved, and clean and lined with fine shops and warehouses. An immense trade is carried on here, for here the great trade routes from the northeast, east, and south through Kansu to Ili (2773 miles), Yarkand (3198), Kashgar (3361), and other Central Asian points converge. Pop. (est.), around 1,000,000, including 50,000 Mohammedans, and many Tibetans, Mongols, etc.

On this spot or in its vicinity several dynasties established their capital, beginning with the Chow in 1122 B.C. Under the name of Kwanchang it was the capital of the Emperor Shi-Huang-ti (246–210 B.C.), the famous "burner of the books." The neighborhood of Singanfu is rich in objects of great antiquarian interest. Among them is the oldest mosque in China, built over 1100 years ago, a very old temple dedicated to Lao-tse; the Pei-lin, or "Forest of Tablets," belonging to different dynasties from 100 B.C., and collected from many quarters, consisting of some 1300 incised specimens of calligraphy, emblematic animals, historic scenes, etc., and the "Thirteen Classics" cut in stone in the T'ang dynasty (618–960); and in the Manchu City in the northwest quarter of the city is an old palace of the same period. Here in 1625 was discovered a large stone tablet (erected in 781 and still preserved), carved with Chinese and Syriac writing recording the establishment of Christianity in this neighborhood in the seventh century by the Nestorians and eulogizing it as the King-Kiao or "Luminous

Religion." (See NESTORIAN MONUMENT.) Singanfu suffered much during the Mohammedan rebellion of 1865–78, but has now almost recovered. During the advance of the allied troops for the relief of the beleaguered foreigners in Peking in 1900 the Emperor and Empress Dowager fled hither and kept their court here until November, 1901. On October, 1911, Singanfu joined the revolt against the Manchu monarchy. The position of Singanfu is of great strategic advantage, which makes it the most important city in northwest China. It has hardly yet been modernized, although a cotton mill was established in 1899.

SINGAPORE, sĭŋ'gȧ-pōr'. An island, the most important of the constituent parts of the British colony of the Straits Settlements. It lies off the southern point of the Malay Peninsula (Map: French Indo-China, D 6). The island is 27 miles long and 14 wide; area, 217 square miles. It passed to the East India Company in 1819, and in 1824 the possession was ratified by the payment to the Sultan of Johore of $60,000 and a life annuity of $24,000. The island is well watered and has a hot damp climate, the range of temperature being less than 20 degrees. The surface of the island is broken by small hills, varying in altitude from 300 to 400 feet. Vegetation is luxuriant. There is no regular rainy season, but showers are scattered throughout the year; average rainfall (1904–13), 104 inches. The principal products, raised chiefly by the Chinese, are coconuts, gambier, tapioca, cacao, aloes, nutmegs, and a great variety of fruits and vegetables. The flora and fauna resemble those of the Malay Peninsula. The population, consisting largely of Chinese, Malays, and Hindus, in 1901, excluding the military and floating, was 228,555; in 1911, 311,985. These figures include the inhabitants of Singapore's dependencies, Christmas Island, the Keeling Islands, and Labuan Island. Estimated population in 1913, 330,042 (233,674 males, 96,368 females); whites numbered 6138, Eurasians 4985, Asiatics (largely Chinese) 318,919. There is no important town besides the city of Singapore, which includes most of the population.

SINGAPORE (from Skt. *Simhapura*, lion city). The capital of the British colony of the Straits Settlements and the most important commercial emporium of southeastern Asia, situated at the southern end of the island of Singapore (Map: French-Indo China, D 6). The town is well built. Its harbor is commodious and easy of access. For 6 miles along its water front the city is lined with quays and shipyards. In the rear of the city still stands Fort Canning, erected on a hill just outside the original settlement, but now supplemented by modern batteries, which command the harbor. The Governor's palace is an impressive structure in a beautiful park at the top of one of the three hills just outside the city. A most charming spot is the turfed and shaded esplanade, fronting on the outer harbor. In it is erected a monument to Sir Stamford Raffles, the founder of the modern city. The botanical gardens rank among the best in the world. The city hall, the Gothic cathedral of St. Andrew, the Roman Catholic cathedral, and the Raffles Museum and Library are all notable buildings. The greater portion of the trade is in the hands of the Chinese.

Its geographical position at the eastern entrance to the Strait of Malacca, about midway between Hongkong and Calcutta, its proximity to the Malay Archipelago, and the policy of absolute free trade have made Singapore the centre of a transshipping trade surpassed in the East only by that of the Chinese ports. The list of imports and exports comprises cotton piece goods, copra, rice, tin, silks, tobacco, spices, petroleum, sugar, coffee, pepper, opium, gambier, coal, fish, rattans, skins, and rubber. The manufactures are not extensive, but include white pepper, tapioca, sago, gambier, vehicles, tools, and furniture, and there are shipbuilding establishments, pineapple canneries, and biscuit factories. The net tonnage entered at the port in 1913 was 8,636,467 and cleared 8,618,486. The resident population of the municipality of Singapore in 1891 was 155,683; in 1900, 193,089. Of the latter number 141,865 were Chinese, 26,230 Malays, 15,646 natives of India, 2748 Europeans and Americans, and 3982 Eurasians. The increase of population is due to immigration; the death rate is greatly in excess of the birth rate, as by far the larger part of the Chinese population is male.

Singapore has its own municipal organization under the supervision of the colonial government. The founding of the city in 1819 was due to the desire of Sir Stamford Raffles, an employee of the East India Company, to establish an outpost to counteract the growth of Dutch influence in this quarter of the globe. Despite opposition on the part of the Dutch and only half-hearted support from the home government, he succeeded in gaining the island for Great Britain, and the continuously rapid growth of the city of Singapore has fully demonstrated his wisdom. After the formal cession of the island to Great Britain in 1824, it was the capital of the consolidated governments of Penang, Singapore, and Malacca, which in 1867 became a crown colony as the Straits Settlements.

SING'ER, FREDERIC (1847–). An American naval officer, born at Carlsruhe, Baden, Germany. His parents brought him to the United States in 1848, and in 1868 he graduated from the United States Naval Academy. Besides serving in other capacities he was a member of the Naval Intelligence Office in 1888–90 and 1893–94 and chief intelligence officer in 1895–96. As executive officer of the cruiser *Raleigh* he participated in the battle of Manila Bay in 1898 and later commanded the captured transport *Manila*. He was promoted to commander in 1899, captain in 1904, and rear admiral in 1906. In 1904–09 Singer was commandant of the United States Naval Station at New Orleans, La. By operation of law he was retired in 1906, but continued in service for some time.

SINGER, ISAAC MERRITT (1811–75). An American inventor, born at Oswego, N. Y. He became a mechanic and after a time interested himself in the sewing machine. He constructed an improved machine with a rigid overhanging arm to guide a vertical needle in combination with a shuttle and what was called a wheel feed. With the aid of Edward Clark he established a factory in New York and subsequently became very wealthy. The "Singer Tower" in New York was for some time the highest skyscraper office building.

SINGER, ISIDORE (1859–). An American Jewish editor and author, born at Weisskirchen, Moravia (Austria), and educated at the universities of Vienna and Berlin. He founded and published the *Allgemeine Oesterreichische Literaturzeitung* (Vienna) in 1884–85, and was founder and editor in chief of *La Vraie Parole* (Paris), having gone to France in 1887. He went to Italy in 1891 and to New York in 1895. His most important work was as managing editor of the *Jewish Encyclopædia* (12 vols., 1901–05). He edited also *The World's Debt to the Jew* (15 vols.), *German Classics of the Nineteenth and Twentieth Centuries* (20 vols.), and *International Insurance Encyclopædia* (1910 et seq.). His writings include: *Berlin, Wien, und der Antisemitismus* (1882); *Sollen die Juden Christen werden?* (1884); *Auf dem Grabe meiner Mutter* (1888); *Le prestige de la France en Europe* (1889); *La question juive* (1893); *Anarchie et antisémitisme* (1894); *Der Judenkampf ums Recht* (1902); *Russia at the Bar of the American People* (1904); *Christ or God?* (1908).

SINGER, zing'ĕr, Paul (1844–1911). A German political agitator, born in Berlin of Jewish parents. Engaged in business from 1858, he established a cloak manufactory in Berlin in 1869, joined the Social Democrats in 1870, and was elected to the Reichstag in 1884. He became, next to Bebel, the principal leader of the party.

SING'ER, Simeon (1846–1906). An English rabbi, born in London and educated at the Jews' College, of which he was later headmaster for a brief period. In 1867 he became minister of the Borough Synagogue and in 1878 of the New West End Synagogue. In religious matters Dr. Singer aimed to reconcile the views of the Conservative and Liberal Jews and was instrumental in introducing a few moderate reforms in the Hebrew service. In 1892 he organized the first conference of Jewish preachers in England. He was also actively interested in the welfare of Jews on the Continent, especially in Russia. A preacher of ability, he was one of the first to introduce regular sermons for children. He was joint editor of *Talmudic Fragments in the Bodleian Library* (1896) and edited a widely used edition of the *Authorized Daily Prayer Book*, with English translation. Consult I. Abraham, *Literary Remains of the Rev. Simeon Singer* (3 vols., London, 1908), with memoir.

SINGH, Sir Pertab. See Pertab Singh.

SINGH, Ranjit. See Ranjit Singh.

SINGHALESE, sĭŋ'gȧ-lēz' *or* lēs' (or **SINHALESE** [sĭn'hȧ-lēz' *or* -lēs']) **LANGUAGE AND LITERATURE.** See Ceylon, *Language and Literature.*

SINGHARA (sĭng-hä'rä) **NUT.** See Trapa.

SINGING (from *sing*, AS. *singan*, to sing, Goth. *siggwan*, to sing, read). The production of sustained musical tones by the voice. The physical apparatus consists of the larynx (containing the vocal cords), the lungs, and the muscles of the chest and diaphragm; also, as accessories, the cavity of the mouth, the hard palate, and the nasal chambers, all of which aid in modifying the character of the tones produced, and serve as sounding boards to increase their power. The tones of the human voice, either in speaking or singing, are formed by the vibration of the vocal cords. These are two parallel elastic membranous bands situated in the larynx, which thus resembles a reed instrument, like an oboe. The blast of the air column driven from the lungs sets these bands vibrating. By the act of volition they are set to receive the impact of the column of air in such a way as to produce tone. By closing or opening so as to vibrate at different portions of their length, they give tones of different pitch.

The lungs supply the air and are operated by the muscles before mentioned. The diaphragm, the use of which is often neglected by singers, is of great service in giving power and control to the breathing, which is of the first importance in singing. Clavicular or upper-chest breathing is regarded as the least satisfactory method and is not employed by any great singer. The abdominal method, advocated by Mandl in 1855 and introduced into the Paris Conservatory and among Italian teachers, consists in keeping the chest as quiet as possible and forcing the diaphragm down and the anterior wall of the abdomen out in inspiration. The leading singers of to-day advocate the use of all the external intercostal muscles and the drawing in of the anterior wall of the abdomen in inspiration. They hold that this method sets the diaphragm firmly, gives greater mastery, and enables the singer better to graduate the power of the air column.

The compass of the human voice extends from C to C^3. Some exceptional voices have exceeded this range. No one voice has this compass, of course, for the average human voice has an extent of about 12 tones, while trained singers usually have two octaves. Some have had more than three. Five general divisions of singing voices are recognized: two women's, soprano and contralto, and three men's, tenor, barytone, and bass. These are here named in the order of their pitch from the highest to the lowest. Music for sopranos, contraltos, and tenors is written on the treble clef, for the other voices on the bass clef. The tenor voice, however, produces tones an octave lower than those written.

The pitch of voices is the result of the length of the vocal cords. These cords are shorter in women than in men; hence the former have higher voices. The longest vocal cords are those of a deep bass. Pitch, however, is not the only trait which determines the title of a voice, for tone quality must be considered. Tenor and barytone voices of exactly the same range exist, but the character of the tones is different, voice quality being modified by resonance and muscle action.

Each voice is divided into several "registers," a term borrowed from the organ. It means a succession of sounds having similar character or produced by the same mechanism. Authorities differ as to the number of registers which exist in the human voice, but the majority follow Manuel García, inventor of the laryngoscope and a famous singing teacher. He holds that there are three registers, which he calls chest, falsetto, and head. Some writers have named as many as five registers, and others find that the voices of men and women differ in their divisions of this kind. The mechanical action of the larynx and certain of the resonating apparatus changes as the singer ascends the scale, and the tendency is towards modifications in the quality of the tones, so that the different registers are dissimilar in character. Between the registers, especially between the highest and the next lower, there are audible breaks, and usually the tones on either side of this are weak and uncertain. One of the most important labors of the teacher is the equalization of the registers, so that the quality of tone may be homogeneous throughout the scale. This is accomplished by cultivated methods of tone formation, in which the air column is voluntarily directed towards certain resonators.

The training of the voice for singing is a slow and painstaking process. Most of the training is directed towards securing correct tone formation (or tone placing, as it is usually called). Upon the correctness of the placing depend the strength, carrying power, smoothness, and beauty of the tone. The acquirement of a perfect method of tone formation is the only road to the strengthening of comparatively weak vocal organs. No teacher can make a big voice out of a little one. Nevertheless it is undeniable that the lungs can be developed by the practice of deep breathing exercises, and the diaphragm and other expulsive muscles developed by systematic use. So, too, the vocal cords and the muscles and ligaments of the larynx can be made stronger by training, but the limit of development is not large. The principal efforts of wise teachers, therefore, are directed to giving their pupils a firm, round, pure tone, which will carry well; the general management of the breath is quite important. Proper employment of the resonating chambers is also necessary.

Every tone ought to sound to the hearer as if it were sung just behind the teeth of the singer. By keeping the tongue depressed, by allowing a part of the air-blast free passage through the nasal chambers, and by bringing the main body of it to bear upon the roof of the mouth at the proper point, tones may be made to sound as if formed well forward and may be actually projected into the auditorium more sonorously than when improperly made. The requirements of good tone are that it shall be pure, i.e., that all the breath must be turned into tone and none allowed to escape in a hissing sound; that it shall be clear, i.e., shall never sound as if there were some obstacle in the singer's mouth; and that it shall be free, i.e., not muffled or squeezed down in the throat. A correct "attack" is the most important essential of good tone production. The breath must strike the vocal cords at precisely the instant when they form the tone, neither before nor after. Weak voices are made stronger and good voices better by the mastery of the art of tone formation.

To this must be added the requisites of expression. These are a perfect legato, command of the messa di voce, perfect vocalization of the vowels, and perfect articulation of the consonants. *Legato* means "bound," and in singing it is the passage of the voice smoothly and connectedly from one note to the next in succession. Without a command of the legato no flowing melody can be sung properly. Variety is sometimes added to a melody by the use of the portamento, a sliding or carrying of the voice through the infinitesimal degrees of pitch lying between two notes. This is opposed to the legato and is often so much abused as to preclude all possibility of singing in tune. The legato is the foundation of all good vocal style, and it was in this that the famous singers of the eighteenth century surpassed their successors. The messa di voce is the swelling of a tone from pianissimo to its full power and then diminishing it to the starting point. This is accomplished entirely by control of the breath, though some mistaken singers try to reach the result by straining the muscles of their throats. The messa di voce is of the greatest importance in expression, as it enables the singer to vitalize his song with minute dynamic gradations of tone, similar to those employed in speech.

The vowels present many difficulties to the singer, as the position of the throat and tongue in sounding some of them, especially at full voice, is inimical to good tone production. Much practice is necessary to give the effect of the vowel sounds to an audience while preserving the essentials of good tone. The articulation of the consonants, which is greatly neglected by English singers and greatly exaggerated by the Wagnerian school of German declaimers, is absolutely necessary to intelligible delivery of the text. The problem to be solved is how to enunciate clearly consonants which naturally cut off the flow of vowel sounds, on which alone tones can be made, and yet not interrupt the fluency of a pure legato style. The problem is solved by learning how to separate the articulative apparatus from the sound-producing mechanism and to operate the two independently without letting them disturb each other. This, like all the rest of singing, requires long and patient self-study under the guidance of a skilled teacher.

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SINGING BEACHES. See Musical Sand.

SINGING FISH. See Sapo.

SINGLE CARRICK BEND. See Knotting and Splicing.

SINGLE TAX. A tax designed to meet all or the principal needs of government, levied upon a single object of taxation. The single tax on the rent of land was introduced into general economic discussion about the middle of the eighteenth century by the Physiocrats (q.v.) and was popularized by Henry George (q.v.), particularly in his *Progress and Poverty* (1879) and his speeches in the New York mayoralty campaigns of 1886 and 1897. George advocated the abolition of all taxes upon industry and the products of industry, and the taking, by taxation upon land values, irrespective of improvements, of the annual rental value of all those various forms of natural opportunities embraced under the general term "land."

Three classes of arguments are adduced in support of the appropriation by the state of economic rent: 1. The ethical argument rests upon the theory of natural rights. Man, it is asserted, has an absolute, inalienable right to life, to equality of opportunity, and to private property. By virtue of the right to live he may claim access to those natural opportunities—land—which are necessary for the maintenance of life. This is an individual right. But land differs in fertility and value. By virtue of the right of equality, then, men have a joint claim to the difference between the annual values of the worst and the better lands in cultivation; this differential value is economic rent, and it belongs to the community. Finally, man has an absolute and inalienable right to the property created by his own exertions, and this property cannot be rightfully taken from him for any cause whatsoever. Other forms of taxation than land taxes are therefore inequitable. Single taxers of course made frequent use of the familiar argument that economic rent is created by the community, not by the labor of the individual owner, and that in consequence it cannot in justice be appropriated by the owner.

2. The second general argument rests upon the economic theory of distribution. With some modifications George followed the Ricardian theory of economic progress. (See POLITICAL ECONOMY, *Classical School.*) With the increase of population, George held, mankind is forced to resort to poorer and poorer lands in order to produce the necessary food supply. But as the margin of cultivation is thus forced down, economic rent—which is the difference between the productivity of the worst and the better lands in cultivation—increases and wages decrease, because wages in general are fixed by the income which can be earned by the occupiers and tillers of the free land which pays no rent. The share of capital in the product of industry, George also maintained, would follow the same course as wages, capital being in all essential respects simply labor impressed or congealed into matter. Wages and interest therefore rise and fall together, varying inversely as rent. Not only does rent increase with the increase in population, but every invention involves a further demand upon the soil for raw produce and thus increases rent. Everything that lowers interest depresses wages and exalts rent; every new increment of capital, being a demand for land, has the same effect; the accession of every new laborer acts similarly; time that increases the population, science that stimulates invention, frugality that multiplies capital, in short material *Progress* itself, under the régime of the private ownership of land, is synonymous with *Poverty*. Hence the title of George's principal work.

3. The third class George designated as the arguments from expediency. Some of the most important may be briefly summarized as follows: First, the appropriation of economic rent would yield sufficient revenue to defray all the legitimate expenditures of government. On the other hand the abolition of all other taxes would dispose of a large army of tax gatherers, make the government simpler, and hence purer and less expensive. Secondly, it would enormously increase the productivity of wealth by removing the taxes upon capital, production, and consumption which now repress or discourage industry and by forcing into use and cultivation the lands now held idle for speculative purposes. There could be no speculative holding of land for a rise in value if this value, when it accrued, would be appropriated by the state. Finally, the tax on rent could not be shifted, while it would preserve private property in everything except land and prevent Socialism or the public management and operation of land. It is important to note that single taxers in the United States are in general vigorously opposed both to Socialism and land nationalization.

Economists have opposed with practical unanimity the extreme theory upon which the single-tax reform is based, involving, as is admitted, the confiscation of economic rent without compensation, and the dual proposition that the failure to appropriate all land values and any taxation of other values are both species of robbery. Some of the objections most frequently urged against the single tax may be summarized as follows: 1. That land is similar to all other forms of wealth in respect to the fact that it consists of indestructible matter adapted by human exertions to satisfy human wants, and that in consequence George's distinction between property in land and other forms of property is invalid. 2. That private property in land is permitted and encouraged because it conduces to the greatest good of the greatest number and supplies a fund of wealth from which the state can easily derive all necessary revenues by the ordinary methods of taxation; that, acting in this belief, the United States has encouraged innocent parties to invest in lands, or to settle the public domain, clear it, till it, and by their labor and residence invest it with a value; that under such circumstances arbitrarily to confiscate the values so created would be fundamentally inexpedient and intolerably unjust. 3. That the single tax would be inelastic, yielding too much revenue in some districts and too little in others—a dangerous surplus in times of peace, perhaps, and an equally dangerous deficit in times of war and public emergency. 4. That the error of George's theory of distribution is shown by the facts, inter alia, that in many communities during the last 50 years rents have fallen, not risen, while in the same period wages have risen with practical universality. 5. That the single tax would prevent the utilization of the taxing power for sumptuary purposes (e.g., taxation of intoxicating liquors), for the protection of home industry, and for the improvement of the present distribution of wealth (e.g., a progressive income tax). 6. That it is difficult theoretically to determine the value of land irrespective of the improvements upon it, that in practice the assessment of land is notoriously inexact, and that the single tax would intensify the injustice from this unequal assessment. 7. Finally, it is denied that the single tax would appreciably facilitate the accessibility to the soil, help the farmer, reduce overcrowding in cities, for the reasons among others that the tenant class would be in no better position than at present, merely paying rent to the state instead of the private landlord, while the large number of small landowners would not only be expropriated, but would in the future have to pay large rentals to the state.

While economists have with practical unanimity rejected the proposition to tax all economic rent and abolish all other taxes, a large number have advocated measures looking to the gradual appropriation by the state either of all the future unearned increment of land or of a larger share of this future unearned increment than is taken at the present time in taxes. This idea has met with particular favor in regard to urban land. John Stuart Mill advocated the appropriation of the future unearned increment of land. Prof. Adolph Wagner, the distinguished German economist, advocates private ownership of agricultural land, but favors public ownership of urban land, which would, of course, bring into the public treasury all future increment in land values. The exemption of improvements for a period of years, especially buildings, has met with favor and, indeed, has been adopted in many European countries. This, so far as it goes, is in harmony with the idea of the single tax. In his famous budget of 1909 Mr. Lloyd-George, Chancellor of the English Exchequer, provided a tax of 20 per cent on the unearned increment in land values. Improvements of every sort were exempted. There were included additional taxes of ½d. per pound on the value of wholly undeveloped land; and of 5 per cent on the rental value of mineral rights. Quite in harmony with single-tax aims also was Lloyd-George's land-reform scheme put forth in October, 1913. This aimed greatly to reduce the power of land monopoly by bringing all questions of the control and use of land under a proposed Ministry of Lands. The war prevented the development of this proposal. See Lloyd-George.

The single taxers are now endeavoring to secure, first, a separation in the assessments of property, of land values, and the value of improvements on land; and, second, what they call home rule in taxation, or the authorization of local political units to place a tax upon land values and to free personal property from taxation, in case they desire to do so.

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SIN′GLETON, Esther (?–). An American author, born in Baltimore, Md. After 1887 she lived in New York City. For six years she was employed on the editorial staffs of various encyclopædias. Among her many publications are: *Turrets, Towers, and Temples* (1898); *The Furniture of our Forefathers* (2 vols., 1900); *Famous Paintings* (1902); *Social New York under the Georges* (1902); *Historic Buildings of America* (1906); *Dutch and Flemish Furniture* (1907); *A Guide to the Modern Operas* (1909); *Dutch New York* (1909); *Modern Pictures* (1911); *Furniture* (1911); *How to Visit the English Cathedrals* (1912); *A Daughter of the Revolution* (1915), a novel.

SINGPHOS, sing′fôz. A people of northern Burma of doubtful racial affinities. They were formerly called Cacobees and, by the Burmese, Kakhyens. Consult Dalton, *Ethnology of Bengal* (Calcutta, 1872).

SING SING. The former name of Ossining (q.v.).

SINGSING, sing′sing′ (African name). An antelope (*Cobus defassa*) of western and Central Africa, which differs from the waterbuck (q.v.) in its smaller size, the fineness and softness of its hair, a continuous whitish patch on the buttocks, but none on the throat. See authorities cited under Antelope, and Plate of Antelopes.

SINGSPIEL, zing′shpēl (Ger., song play). See Music, History of, *XVII*.

SINGULARITIES. See Curve.

SINGUL′TUS. See Hiccough.

SINIBALDI, sē′nē-bäl′dē, Guittoncino. See Cino da Pistoja.

SINIGAGLIA, sē nē-gä′lyȧ. A city of Italy. See Senigallia.

SINIGAGLIA, Leone (1868–). An Italian composer, born at Turin. He received his first musical instruction from Bolzoni in his native town. Then he went to Vienna, where he studied systematically under Eusebius Mandyczewsky and profited greatly from his association with Dvořák and Goldmark. He is one of the few modern Italian composers to win fame in the field of instrumental music. In several of his works he employs Piedmontese folk melodies. His talent was first recognized in Germany, where his beautiful concerto for violin in A, performed by Arrigo Serato during his tour of 1901, attracted much attention. His compositions include an overture, *Le Baruffe Chiozzotte; Danze Piemontesi; Rapsodia Piemontese;* variations on a theme of Brahms; a *Romanza* for violin and orchestra; a string quartet; numerous pieces for violin, cello, and horn; choruses; songs.

SI′NIM. A land mentioned in Isa. xlix. 12. The oldest Greek version rendered "the land of the Persians"; Jerome and the Aramaic Targum translated "the South Land." Arias Montanus was the first to suggest China and has had many followers, but it has been shown, particularly by Terrien de Lacouperie, that this is impossible. As the territories of Tsin and Thien on the Hoang-ho in the north cannot have been intended, the name Tsin for China can only be the designation derived from the Tsin dynasty, which came upon the throne in 255 B.C. This was indeed rendered Sin by Ptolemy (vii, 3), but Syrians and Arabs always transcribe it as Zin, and that would have been the probable pronunciation among the Hebrews. Nor is Shina at the foot of Hindu Kush, proposed by De Lacouperie, more probable. Duhm has suggested the Phœnician Sinim (Gen. x. 17), but the connection is more favorable to a location in the south. Saadia thought of Sin (Pelusium in Egypt), and he has been followed by Bochart and Ewald. Dillmann thought of the wilderness of Sin (Ex. xvi. 1) and the mountain of Sinai. J. D. Michaelis and Doederlein first proposed, and Klostermann, Cheyne, and Marti have adopted, the explanation of "the land of Sinim" as southern Egypt from Syene (Assuan; q.v.). Cheyne reads Sewanim. The recent discovery of Aramaic papyri from Elephantine has rendered it practically certain that there were Jewish colonies at the southern end of Egypt when this passage was written. See ELEPHANTINE PAPYRI. Consult Terrien de Lacouperie, *Babylonian and Oriental Record* (London, 1886), and the commentaries on Isaiah by Dillmann (Leipzig, 1890), Duhm (Göttingen, 1892), Cheyne (New York, 1898), Marti (Tübingen, 1900).

SINISTRALITY. The condition of being left-handed. Right-handedness is the general condition of about 91–98 per cent of humans, the preference for the right side extending to the foot, and persons walking blindfold show an inclination some to turn to the right, but not all. Ambidexterity is the state of having equal abilities with both hands. Many ambidextrous persons were born left-handed, having trained their right hands to be as skillful as the left. Right-handedness seems to be correlative with a greater development of the left hemisphere of the brain. See HAND.

Consult: Daniel Wilson, *The Right Hand: Left-Handedness* (London, 1891); J. M. Baldwin, *Mental Development in the Child and the Race* (3d rev. ed., New York, 1906); for symbolism of right and left, Silberer, *Probleme der Mystik und ihrer Symbolik* (Vienna, 1914).

SINIT'IC. A term used by certain ethnologists to designate the group of peoples made up of the Chinese proper, the Tibetans, and the Indo-Chinese, all of whose languages have peculiar features and such affinities that they all point to one ancestral stock.

SINK HOLES. See CAVE.

SINKING FUND. See FINANCE, *Sinking Fund.*

SINKIUSE, sin'kĭ-ūs'. See COLUMBIA INDIANS.

SIN'NETT, ALFRED PERCY (1840–). An English journalist and theosophist, born in London. He was educated at the London University School. In 1859 he became assistant subeditor of the *Globe* and subsequently leader writer on other London newspapers. In 1865 he went out to Hongkong as editor of the *Daily Press.* Returning to England in 1868, he served on the staff of the *Standard* till 1872, when he became editor of the *Pioneer* of Allahabad in India. In 1879 he joined the Theosophical Society of London, of which he afterward became vice president. His occult works have had extensive circulation. They include: *The Occult World* (1881); *Esoteric Buddhism* (1883); *Life of Madame Blavatsky* (1886); *The Growth of the Soul* (1896); two occult romances, *Karma* (1885) and *United* (1886). He made numerous contributions to the published transactions of the London Lodge of the Theosophical Society. In 1904 he fathered a new monthly review, *Broad Views,* publication of which was given up in 1907. In 1911 his play, *Married by Degrees,* was produced in London.

SINOPE, sĭ-nō'pė. A town in the Vilayet of Kastamuni, Asiatic Turkey, on the south shore of the Black Sea. 185 miles northeast of Angora (Map: Turkey in Asia, C 2). The Bay of Sinope affords the finest anchorage for ships along the north coast of Asiatic Turkey. The town exports timber, dried fruits, skins, and silk. Pop., 7000. The ancient city of Sinope was founded by a colony of Milesian Greeks in the eighth century B.C. For 200 years after the Peloponnesian War it was almost the mistress of the Euxine. Of its former splendor there remain only the castle of Mithridates and a few Roman substructures. The Bay of Sinope was the scene of a naval engagement Nov. 30, 1853, in which a Turkish squadron was destroyed by the Russian fleet. (See CRIMEAN WAR.) Consult D. M. Robinson, *Ancient Sinope* (Baltimore, 1906).

SINTRAM (zĭn'trȧm) **AND HIS COMPANIONS.** A German romance by Fouqué, published in 1814 as the fourth part of the *Jahreszeiten,* of which *Undine* formed the first.

SINUBE, sė-nōōb'. See SINOPE.

SI'NUS (Lat., bend, hollow). The cells or cavities contained in certain bones, as the frontal, ethmoid, sphenoid, and superior maxillary, are called sinuses. The frontal sinuses are two irregular cavities extending upward and outward, from their openings on each side of the nasal spine, between the inner and outer layers of the skull, and separated from one another by a thin bony septum. They give rise to the prominences above the root of the nose called the nasal eminences. They are not fully developed till after puberty and vary considerably in size, being usually larger in men than in women and young persons, in consequence of the greater prominence of the superciliary ridges in the former. They communicate on each side with the upper part of the nostril by a funnel-shaped opening, which transmits a prolongation of mucous membrane to line their interior. The sphenoidal sinuses are two irregular cavities, formed, after the period of childhood, in the body of the sphenoid bone. They communicate with the upper and posterior part of the nose, from which they receive a layer of mucous membrane. Like the frontal sinuses, they serve to lessen the weight of the skull and to add to the resonance of the voice. The ethmoid sinuses or cells lie in the lateral masses of the ethmoid bone. They open into the cavities of the nose. The superior maxillary sinus, commonly known as the antrum of Highmore (after the anatomist who first accurately described it), is the largest of the facial sinuses. Its uses are the same as those of the others, and like them it communicates with the nasal cavities. The sinuses of the dura mater are quite distinct from the above-described bony sinuses; they are irregular channels for the transmission of venous blood. In surgery the term "sinus" is nearly equivalent to fistula (q.v.).

SION, sė'ôɴ' (Ger. *Sitten*). The capital of the Canton of Valais, Switzerland, situated on the Sionne, which flows through the town in an artificial channel, not far from its junction with the Rhone and 17 miles east of Saint-Maurice (Map: Switzerland, B 2). Ruins of the thirteenth-century castle of Tourbillon are to the north and the castle of Valeria, the former residence of the canons, to the south. The town proper contains the fifteenth-century cathedral, the thirteenth-century church of St. Catharine, and the Gothic town hall. Pop., 1900, 6095; 1910, 6251.

SIOUAN (sōō'an) **STOCK.** One of the most widely extended and important linguistic groups of North America, occupying within the recent historic period the greater portion of the Plains area, but in earlier times holding also the coast and midland region of Virginia and the Carolinas, with outlying tribes upon the Gulf coast. According to language the tribes of this stock fall into the following subdivisions: 1. Sioux (Dakota)—Assiniboin group. (For minor divisions, see Sioux.) 2. Dhegiha group: the Omaha, Ponca, Quapaw, Osage, and Kansa. 3. Chiwere group: the Iowa, Oto, and Missouri. 4. Hidatsa—Crow group: the Hidatsa (Minitari) and Crow (Absaroka). 5. Mandan. 6. Winnebago. 7. Biloxi group: the Biloxi and Ofo. 8. Eastern Sioux: the Monacan, Catawba, Tutelo, Saponi, Occaneechi, Manahoac, and numerous extinct divisions.

The first six of the above occupied various parts of the Missouri and upper Mississippi river basins, the seventh the Gulf coast of the State of Mississippi, and the last parts of Virginia, North and South Carolina. These geographical divisions differed greatly in culture, as did also the first six tribal groups enumerated above; hence, for a cultural characterization the reader must turn to the special articles on the various tribes. The time and manner of the distribution of these tribes cannot be determined for want of positive data, but McGee believed the assumption of an Atlantic coast origin was justified by indirect and inferential evidence. Consult: Riggs, *Grammar and Dictionary of the Dakota Language* (Washington, 1852); J. C. Pilling, "Bibliography of the Siouan Languages," in *Bureau of American Ethnology, Bulletin No. 5* (ib., 1887); J. O. Dorsey, *The Cegiha Language* (ib., 1890); James Mooney, "The Siouan Tribes of the East," in *Bureau of American Ethnology, Bulletin No. 22* (ib., 1895); McGee, *The Siouan Indians* (ib., 1897); Franz Boas, *Handbook of American Indian Languages* (ib., 1911).

SIOUX, so͞o, or Dakota. One of the most important Indian tribes north of Mexico, being the largest in the United States with the possible exception of the Ojibwa. Their popular name is supposed to be an abbreviation from Nadowesiwug (corrupted by the French to Nadaouesioux), "little snakes," i.e., "enemies," their ancient name among the Ojibwa, as distinguished from the Nadowe or Iroquois, the "snakes" proper. They are now more usually called Buanag, "enemies," by the Ojibwa, whence Asini-buanag, "Stone Sioux" of Assiniboin. The Sioux call themselves Lakota, Nakota, or Dakota, according to the respective dialect, the word meaning "allies."

Their historic habitat was in northwestern Wisconsin and eastern Minnesota around the end of Lake Superior and the headwaters of the Mississippi; thence southwestward through North and South Dakota, with the Assiniboin to the north and westward through Manitoba and Saskatchewan. In the early part of the French occupation of Canada the eastern wing of the Dakota was forced back from the lakes by the Ojibwa, but aside from this movement the various divisions of the Dakota occupied the same territory from the time of their discovery until placed upon reservations by the United States government. In 1815 the eastern bands made their first treaties of friendship with the government after having sided with the English in the War of 1812. By the general treaty made at Prairie du Chien in 1825 the hereditary war between the Sioux and the Ojibwa was ended by the adjustment of tribal boundaries and the Sioux confirmed in possession of an immense territory from the east bank of the Mississippi almost to the Rocky Mountains and from near Devils Lake southward to about the present Sioux City, including nearly half of Minnesota, two-thirds of the Dakotas, and large portions of Wisconsin, Iowa, Missouri, and Wyoming. The headwaters of the Mississippi were left to the Ojibwa by right of former conquest and existing occupancy. In 1835 missions were established among the eastern (Santee) bands by the American Board, which started schools and printed books in the language. In 1837 the Sioux sold all their claims east of the Mississippi. In 1851 they sold the greater part of Minnesota, but dissatisfaction at the delay of the government in fulfilling the terms of the treaty led to a massacre of settlers at Spirit Lake on the Minnesota-Iowa border in 1857, followed a few years later by a second rising inaugurated by the terrible Minnesota Massacre in 1862, in which nearly 1000 settlers lost their lives. The outbreak was put down by General Sibley, who crushed the Indians and hung 39 of the leaders from the same scaffold. The result was the expulsion of the Sioux from Minnesota. From this time until 1868 the western bands, together with other Plains tribes and under the leadership of Red Cloud and others, were almost constantly at war with the whites. A principal event of this was the massacre of Fetterman's entire command of about 100 men near Fort Kearney, Neb., in 1866. In 1868 a treaty of peace was made which remained unbroken until the invasion of the Black Hills by the miners, consequent upon the discovery of gold, led to another war in 1876–77, the principal event of which was the massacre of General Custer's entire command of nearly 300 regular troops, June 25, 1876. (See Custer, George Armstrong.) Sitting Bull (q.v.), the leader of the irreconcilables, escaped to Canada with several thousand followers, but returned in 1881 on promise of amnesty. After being held two years as a prisoner of war Sitting Bull again took up his residence at Standing Rock Agency, where he remained until his death. In 1889 another treaty was made by which the Great Sioux Reservation, embracing all of South Dakota west of the Missouri, was reduced by about one-half and the remainder cut up into five distinct smaller reservations. The opposition of a powerful minority to this sale, coupled with dissatisfaction at treaty grievances and the excitement aroused by the reported advent of an Indian messiah in the West, led to another outbreak in the winter of 1890–91. Leading events were the killing of Sitting Bull, Dec. 15, 1890, and the Wounded Knee Massacre, Dec. 29, 1890, by which about 300 Indians lost their lives. The outbreak was soon afterward successfully brought to a close by General Miles.

These struggles brought to notice more distinguished chiefs than any other Indian nation. The best known in addition to the above are Tohami, Short Bull, Kicking Bear, American Horse, Crow King, Spotted Tail, Crazy Horse, Gall, Young Man Afraid of his Horses, Rain in the Face, Waneta, Little Crow, Wapasha, and Wamditanka. The Dakota have seven principal divisions or council fires, viz., Mde-wakanton-wan, "spirit lake village" (Mde-wakanton); Waqpekuté, "leaf shooters"; Waqpetonwan, "leaf village" (Wahpeton); Sisitonwan, "swamp village" (Sisseton); Ihanktonwan, "end village" (Yankton); Ihanktonwanna, "upper end village" (Yanktonais); Titonwan, "prairie village" (Teton). The first four are known collectively as Isañati or Santee. The Yankton and Yanktonais resided in that part of Dakota east of the Missouri. The Teton, constituting two-thirds of the whole nation, lived west of the Missouri upon the buffalo plains. The Teton are further subdivided into Ogalala (at Pine Ridge), Brulé (at Rosebud and Lower Brulé agencies), Hunkpapa (at Standing Rock Agency), Two Kettle, Sans Arc, Miniconjou, and Sihasapa (Blackfoot Sioux). There are three principal dialects, Teton, Yankton, and Santee, distinguished chiefly by differences in the use of *l*, *n*, and *d*, as exemplified in the various forms of the tribal name. (See above.) The languages have been much cultivated, an alphabet having been adapted to it by the missionaries, so that it now has a considerable literature, including newspapers, while nearly all the men can read and write it. It is vocalic, euphonious, but strongly nasal.

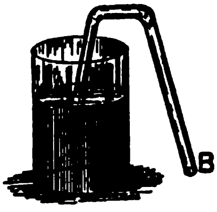
The sedentary and agricultural eastern Santee-Dakota were commonly rated as inferior to their western brethren, who were typical nomad warriors and hunters, the lords of the Plains, before whom no other tribe could stand. A great ceremony was their annual sun dance (q.v.), held under the direction of the warrior societies and usually accompanied by voluntary self-torture. The Santee have been civilized and Christianized for a generation. The western bands are only now beginning to accept the white man's road, but their high character and intelligence are bringing them rapidly to the front. According to the census of 1910 the total for all divisions of the Dakota is 22,780, not including some 600 refugees in Canada. See SIOUAN STOCK, and Colored Plate of AMERICAN INDIANS under INDIANS.

SIOUX CITY. A city and the county seat of Woodbury Co., Iowa, 100 miles north by west of Omaha, Neb., on the Missouri River, at the junction of the Big Sioux and the Floyd (Map: Iowa, A 2). The railroads that enter the city are the Chicago, Milwaukee, and St. Paul, the Chicago and Northwestern, the Chicago, St. Paul, Minneapolis, and Omaha, the Sioux City Terminal, the Illinois Central, the Great Northern, and the Chicago, Burlington, and Quincy. It is the seat of Morningside College (Methodist Episcopal), opened in 1890, and of Trinity College (Roman Catholic), founded in 1912. Other noteworthy features include the public library, containing 48,000 volumes, the high-school building, costing $500,000, the new courthouse, costing $700,000, St. Joseph's, Samaritan, German Lutheran, and St. Vincent hospitals, the tuberculosis sanitarium, auditorium, and the Wall Street and Helping Hand missions. The 1914 government census of manufactures showed an invested capital of $22,610,000 and a production valued at $49,452,000. The volume of its jobbing business in 1915 amounted to about $60,000,000. There are large packing houses, flour mills, sash and door factories, brick and tile works, and manufactories of gas engines, metal tanks, candy, crackers, saddlery and harness, etc.; and the Chicago, Milwaukee, and St. Paul and the Chicago, St. Paul, Minneapolis, and Omaha railways have extensive machine and repair shops. The city spent, in the fiscal year 1914–15, $89,000 for fire department, $55,000 for police department, $157,000 for water works, $96,000 for streets, $34,000 for municipal lighting, and $300,000 for schools. The water works are owned by the municipality. The city has adopted the commission form of government. Settled as a trading station in 1849, Sioux City was chartered as a city in 1857. During its early years it was an important military post and was the place where the various Black Hills expeditions were fitted out. Pop., 1900, 33,111; 1910, 47,828; 1915 (State census), 61,787.

SIOUX FALLS. A city and the county seat of Minnehaha Co., S. Dak., about 186 miles (direct) southeast of Pierre, the State capital, on the big Sioux River, here spanned by four bridges, and on the Chicago, Milwaukee, and St. Paul, the Great Northern, the Illinois Central, the Chicago and Northwestern, the Chicago, Rock Island, and Pacific, and the South Dakota Central railroads (Map: South Dakota, H 4). It is the business centre of the State. Here are the Sioux Falls College (Baptist), a Lutheran Normal School, All Saints School, and the State School for Deaf Mutes. Other prominent features are the State Penitentiary, Children's Home, the United States government building, the courthouse, and the public library. Sioux Falls is chiefly important as the centre of extensive stone-quarrying, manufacturing, and jobbing interests. The leading manufactures are biscuits and crackers, beer, boilers, brick, brooms, candy, cigars, foundry products, mattresses, paper boxes, barrows, soap, metal culverts, creamery products, flour, grain bins, etc. Job printing and meat packing are also important. It has adopted the commission form of government. Pop., 1900, 10,266; 1910, 14,094; 1915 (State census), 21,160.

SIPEIRA, sê-pä′rá, or SIPIRI. See GREENHEART.

SI′PHON (Lat. *sipho*, from Gk. *σίφων*, *siphōn*, pipe, tube; perhaps connected with Lat. *tibia*, pipe, shin bone). A tube in the form of an inverted U, used to convey a liquid from a higher to a lower level over an intermediate point higher than either. One arm of the tube, *A*, is placed in the liquid, while the other, *B*, which must extend below the level of the liquid, is outside and forms the outlet. If now the air is exhausted from the tube, the liquid will rise from the pressure of the atmosphere and will fill the tube and flow through the lower end, unless the bend of the tube is more than 33 feet above the surface of water or a liquid of equal density. The reason can readily be seen, since a column of water 33 feet in height weighs as much as a column of atmosphere of equal cross section, and consequently the effective pressure would be downward instead of up, that of the liquid being greater than that of the atmosphere. The lower the outside tube below the surface of the liquid the more rapid will be the flow, which will continue until the level of the liquid either sinks below that of the outlet or air finds its way into the tube. In large



SIPHON.

siphons, such as are sometimes used in connection with municipal water supplies, it is customary to install at the highest point a device for removing the air which, if allowed to accumulate, will stop the flow.

Inverted siphons are occasionally used in place of an aqueduct to carry water across a valley.

SI′PHONA′LES. See ALGÆ; CHLOROPHYCEÆ.

SI′PHONOPH′ORA (Neo-Lat. nom. pl., from Gk. *σιφωνοφόρος*, *siphōnophoros*, carrying tubes, from *σίφων*, *siphōn*, pipe, tube + *φέρειν*, *pherein*, to carry). An order of the cœlenterate class Hydrozoa. They are the so-called compound hydroids, living in free-swimming colonies, consisting of polymorphic individuals or zooids, i.e., organs with a strongly marked individuality, but all more or less dependent on one another and originating from a common cœnosarcal tube. In *Physalia* there are four kinds of zooids, i.e., (1) locomotive and (2) reproductive, with (3) barren medusa buds (in which the proboscis is wanting) which, by their contractions and dilatations, impel the free-swimming animal through the water; in addition there are (4) the feeders, a set of digestive tubes which nourish the entire colony. The upper end of the cœnosarcal tube is usually closed by a float, very large in *Physalia*. This float is filled with air, acts as a hydrostatic apparatus, and enables the colony to maintain a vertical position in the water. See PORTUGUESE MAN-OF-WAR; also Colored Plate of MEDUSÆ AND SIPHONOPHORA.

SI′PHONOSTE′LE (from Gk. *σίφων*, *siphōn*, tube + *στήλη*, *stēlē*, post). The central woody cylinder of stems which includes the pith region. It is in contrast with protostele, in which the woody cylinder is solid, including no pith.

SIPO, sē′pō. See WOOD SNAKE.

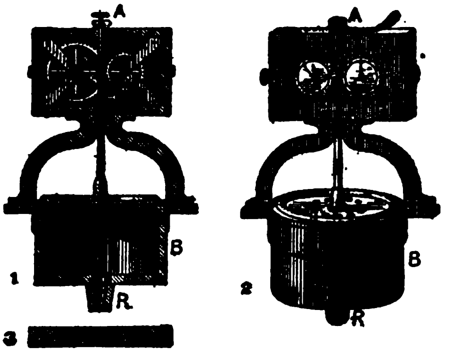
SIPON′TUM. See MANFREDONIA.

SIPPAR, sĭp-pär′. An ancient city in Babylonia. It is already mentioned in the time of Lugalzaggisi of Uruk and Sargon II of Agade and was the first residence of the dynasty to which Hammurapi belonged. As a centre of the worship of Babbar or Shamash, the sun god, it enjoyed a high reputation and continued to flourish, not only in the days of the Chaldæan kings and Nabunaid, but also during the Achæmenian rulers. The ruins were discovered in 1881 by Hormuzd Rassam, who conducted excavations there for more than a year. Of the 300 rooms on the temple hill, 130 were excavated by Rassam, and almost 60,000 inscribed tablets were found. Among them the so-called cult tablet of Sippar possesses peculiar interest. It was here that Nabunaid, after prolonged labors, found the foundation stone of Naram Sin, the son of Sargon II, who is said to have reigned 3200 years before his time. Victor Scheil conducted excavations in 1893. There was a twin city, probably on the eastern bank of the Euphrates, called Sippar of Anunit, or Agade (see ACCAD), which has not yet been identified, and it still remains most probable that the double city was referred to by the Jews as Sepharvaim (q.v.). In the time of Nebuchadnezzar and Nabunaid another city grew up on the Palakattu Canal. Sippar is not likely to have had more than 15,000 inhabitants at any time. Consult: Hormuzd Rassam, *Asshur and the Land of Nimrod* (New York, 1897); V. Scheil, in *Mémoires Français d'Archéologie Orientale de l'Institut de Caire* (Cairo, 1902); Rudolph Zehnpfund, *Babylonien in seinen wichtigsten Ruinenstätten* (Leipzig, 1910).

SIR-DARYA, sēr′där′yȧ. A river and territory of Russian Turkestan. See SYR-DARYA.

SI′REN (Lat. *siren*, from Gk. *σειρήν*, *seirēn*, siren). In Greek legend, one of several sea maidens with voices of such sweetness that all who heard their songs were drawn to them, only to meet death, so that the shores of their lovely island were covered with bones and corpses. In the *Odyssey*, xii, Circe gives Ulysses advice by which alone the hero passes in safety. He stopped the ears of his companions with wax, that they might not be turned from their rowing, while he caused himself to be bound firmly to the mast so that he might hear the songs without danger. The sirens figure also in the voyage of the Argonauts (q.v.), who escaped only because of the superior charms of the song of Orpheus. Later legend represented that, once successfully resisted, the Sirens were doomed. Another legend connected them with the rape of Persephone. Here they were said to have grieved excessively at the loss of their friend and to have sought for her over land and sea. They are represented in art at first as birds with female heads, but more and more the human element predominates, until little of the bird is left but wings and legs. The type seems connected with the representations of the souls of the dead in the form of birds. Consult: Weicker, *Der Seelenvogel in der alten Litteratur und Kunst* (Leipzig, 1903); Otto Gruppe, *Griechische Mythologie und Religionsgeschichte* (2 vols., Munich, 1906); C. M. Gayley, *Classic Myths in English Literature and in Art* (2d ed., Boston, 1911); the article "Seirenes," in Friedrich Lübker, *Reallexikon des klassischen Altertums*, vol. ii (8th ed., Leipzig, 1914).

SIREN. An instrument or device for the production of sounds. In the simplest form of siren there is a revolving disk pierced with a series of holes arranged in a circle. If air from a source of pressure strikes the disk at a point which is passed by the holes in their revolution, a series of sounds will be produced by the successive puffs of air escaping through these openings. While the disk revolves slowly, the ear distinguishes these successive puffs; but when the revolutions are more numerous than about 10 per second, the successive puffs cannot be distinguished, and the recurrent sounds are merged into a uniform note, whose pitch rises the faster the disk revolves. This device shows that musical sounds consist of the repetition, at equal and very small intervals of time, of



CROSS SECTION OF SIREN.

some definite noise. By turning the disk by means of a train of wheels, so as to give it a definite rate of rotation, the number of such repetitions per second necessary for the production of a given musical note may be determined.

The siren invented by Caignard de la Tour in 1819 registers the number of revolutions per second. In principle it is identical with the simpler instrument just described, but in construction it consists essentially of two circular disks, the upper of which is free to revolve upon the lower, being pivoted at *A* and *b*. In each a series of holes is cut, arranged at equal distances in a circle about its axis. Through the holes in the lower (fixed) plate streams of air are admitted from a reservoir, *B*, connected with a bellows, and pass through the corresponding holes in the upper (movable) plate, when the pair of holes are superposed, but are checked when the upper plate is turned a little, readmitted when the plate turns a little farther, and so on. The holes are pierced *obliquely* through the upper plate, so that the issuing stream makes it turn about its axis. The sounds given by this instrument are exceedingly pure (see ACOUSTICS), like those of the flute or tuning fork. The axis of the upper plate carries an endless screw, *S*, which turns a light train of wheels, *G* and *H*, with hands and dials resembling those of a gas meter, so that when, by proper adjustment of the pressure of the bellows, the instrument gives steadily some definite note, corresponding with that of an organ pipe or tuning fork whose pitch we desire to ascertain, we may observe the number of turns in any number of seconds by a stop watch. The number of puffs is obviously to be found from this by multiplying the number of holes in the plate.

Large instruments operated by steam are used as fog signals. Complex forms, such as Helmholtz's double siren and the apparatus of Moraye, have been devised for investigations in the more advanced fields of acoustics. Consult: Tyndall, *Sound* (3d ed., New York, 1908); H. L. F. von Helmholtz, *Die Lehre von den Tonempfindlungen* (6th ed., Brunswick, 1913; Eng. trans. of earlier ed., New York, 1895); Muhler-Pouillet, *Lehrbuch der Physik* (Brunswick, 1897). See FOG SIGNALS.

SIREN. An eel-like batrachian of the degraded family Sirenidæ. See MUD PUPPY.

SIRE'NIA (Neo-Lat. nom. pl., from Lat. *siren*, siren). An order of large aquatic herbivorous mammals, of doubtful affinity, including the sea cows, manatees, and dugongs (qq.v.). The early fossil members of this group, found in the Eocene deposits, differ from the modern forms in showing a slightly less marked degeneration from the normal mammalian type. They have more primitive dentition and better developed hind limbs. Their origin is unknown, for they appeared suddenly with their peculiar characters fully evolved in the Eocene. The principal fossil genera are *Prorastomus* and *Halitherium*.

SIR'IUS (Lat., from Gk. Σείριος, *Seirios*, scorching). The brightest star in the heavens, its magnitude being 1.4. It is situated in the constellation Canis Major (q.v.), or the Great Dog. For this reason it is also called the Dog Star. It has long been known to possess a proper motion, i.e., an independent progressive motion, which was once believed to be uniform. The nonuniformity of the motion was first suspected by Bessel, who in 1844 announced that Sirius possessed an obscure companion and that the irregularity was due to the revolution of the pair about their common centre of gravity in about 50 years. Safford predicted the position of this companion, supposing it to be too minute to be seen, but it was actually discovered in the predicted place in January, 1862, by Alvan Clark while observing Sirius through a new and powerful telescope which he had just made. Gill found the parallax of Sirius to be 0.37″, corresponding to a distance of 8.8 light years.

The Egyptians called Sirius "Sothis," and at one time its heliacal rising (q.v.) was a sure forerunner of the rising of the Nile, while among the Romans it was considered as a star of evil omen. The term Dog Star was also applied to Procyon, a bright double star in Canis Minor, the small companion of which was found by Schaeberle at the Lick Observatory in 1896.

SIR JOHN OLD'CAS'TLE. A play by Drayton, Munday, Wilson, and Hathaway, printed in 1600 with Shakespeare's name on the title-page, afterward withdrawn. It is founded on the story of Lord Cobham, whose name was first used by Shakespeare for Sir John Falstaff.

SIR LAUNCELOT (lán'se-lŏt) **GREAVES,** THE ADVENTURES OF. A romance by Smollett (1761) in imitation of *Don Quixote*.

SIROC'CO (It., from Ar. *sharq*, east, from *sharaqa*, to rise [of the sun]). A hot wind. In the desert of Sahara, a hot, dry wind with clouds of dust, not so violent as a simoom (q.v.). On the northern Mediterranean two classes of warm winds—the moist, sultry wind followed by rain, and the hot dry wind from the south that brings a dusty haze.

SIR ROGER DE COV'ERLEY. See COVERLEY, SIR ROGER DE.

SIRVENTES, sêr'väNt', or SIRVENTE (Fr. *sirvente*, Prov. *sirventes*, *serventes*, a song, from *servir*, serve). A name applied to a class of poems important in Provençal literature of the twelfth and thirteenth centuries, usually, in contradistinction from the love songs, dealing with contemporary social or political conditions and frequently of a satiric nature. See PROVENÇAL LITERATURE

SISAL, sē-säl', sis'*a*l, *or* sī's*a*l. A fibre obtained from an American agave, which is cultivated in tropical America and elsewhere. See HEMP, SISAL. For Mexican sisal, see HENEQUEN.

SIS'CO. A whitefish. See CISCO.

SIS'COWET. A salmon (*Salmo siscowet*) of the deeper waters of Lake Superior, where it is numerous. It differs so little from the landlocked salmon of other northern lakes, called namaycush in Canada, that some ichthyologists regard it as a mere variety of that widespread form.

SISEN'NA, LUCIUS CORNELIUS (c.119–67 B.C.). A Roman annalist (see ANNALS), considered by Cicero (*Brutus*, 288) superior as an historian to any of his predecessors. He was prætor in 78 B.C. and during the war against the pirates (67 B.C.) was appointed by Pompey commander of the army in Crete. He was a friend and defender of Verres. (Cicero, *Verres*, ii, 100.) Sisenna's works included his *Historiæ*, in more than 12 books, which embraced the history of his own time, and a Latin translation of the Milesian tales (Μιλησιακά) of Aristides. (See MILESIAN TALES.) The commentaries on Plautus which were formerly ascribed to him were probably written by another person of the same name. The few extant fragments of the *Historiæ* are published in Peter's *Historicorum Romanorum Fragmenta* (Leipzig, 1883). Consult Schneider, *De Sisennæ Historiæ Reliquiis* (Jena, 1882), and Martin Schanz, *Geschichte der römischen Litteratur*, vol. i, part ii (3d ed., Munich, 1909).

SIS'KIN (from Slov. *chishek*, Russ. *chizhŭ*, siskin; connected with OPers. *csilia*, siskin). A small finch of the Old World (*Spinus*, or *Carduelis, spinus*), allied to the goldfinch, 4½ inches long and greenish gray, yellow, and black. It is found in the temperate parts of Europe and Asia and is often kept and bred in cages and called by dealers aberdevine. The siskin of America is the pine finch (q.v.).

SISLEY, sē'slā', **ALFRED** (1830–99). A French landscape painter. He was born in Paris, of English parentage, and studied under Gleyre, but was little known until after the first Impressionist exhibition of 1874. His early work was influenced by Corot, but this influence was afterward modified by the color theories of the Impressionists, particularly as practiced by Monet. His subjects are confined almost entirely to landscape and generally to calm, smiling country scenes or gliding rivers. He was one of the most remarkable landscape painters of his day, and one whose bold, honest, and withal delicately charming and poetic view was combined with high qualities as a colorist and uncommon facility in rendering the luminous quality of atmosphere. His numerous works include "Inundation, Marly," "Bridge at Moret-sur-Loing," and eight paintings in the Luxembourg. Sisley was not appreciated and struggled with poverty during his lifetime, but his pictures brought high prices after his death. Consult George Moore, *Modern Painting* (London, 1893).

SISMON'DI, *Fr. pron.* sēs'mōN'dē', **JEAN CHARLES LÉONARD SIMONDE DE** (1773–1842). A French historian and economist, born at Geneva. The French Revolution forced his family to leave Geneva and take refuge in England. In 1795 they went to Italy, to a small farm near Pescia in Tuscany, where circumstances rendered it necessary for Sismondi to engage in farm work. In 1798 he began to collect materials for a history of the Italian republics. In 1803 appeared a work on political economy, *De la richesse commerciale*, in which he seems a follower of Adam Smith, though later, in his *Nouveaux principes d'économie politique* (2 vols., 1819), he abandoned those views and opposed the ideas of the English economists. In history, however, his best work was done. The *Histoire des républiques italiennes* (16 vols., 1807–18) placed him in the first rank among contemporary historians and brought him great praise. In 1813 appeared his *Littérature du midi de l'Europe*, since translated into English and frequently reprinted. In 1819 he began his best work, the *Histoire des Français* (31 vols., 1821–44), of which he published an abstract later: *Précis de l'histoire des Français* (2 vols., 1839). Besides the works mentioned above, Sismondi wrote: *Histoire de la renaissance de la liberté en Italie* (2 vols., 1832); *Histoire de la chute de l'empire romain* (2 vols., 1835); *Études sur les sciences sociales* (Paris, 1836–38). His letters have been published in various editions as: *Fragments du journal et de la correspondance de S. de Sismondi* (Geneva, 1857); Taillaudier, *Lettres inédites de Sismondi* (Paris, 1863); Villari and Monod, *Lettres inédites de Sismondi* (ib., 1878). Consult Aftalion, *L'Œuvre économique de Sismondi* (Paris, 1889).

SIS'SOO. See DALBERGIA.

SISTAN. See SEISTAN.

SISTER DORA. See PATTISON, DOROTHY.

SISTERHOODS. Communities of women in the Roman Catholic and Anglican churches, organized for religious and charitable purposes. The earlier communities for women were nearly always outgrowths of an earlier institute for men, after which their organization was closely modeled; these second orders for women exist, e.g., under the rules of the Benedictine, Cistercian, Dominican, and Franciscan orders. They were, until the seventeenth century, nearly always cloistered communities.

With the increase of security for the weak in modern society their activity was widened, and they took part in active charitable work among the poor, the sick, and the ignorant.

The more important Roman Catholic sisterhoods are treated under their own titles. About the middle of the nineteenth century a movement developed among non-Catholics, in England and Germany, for the organization of women's work in the same fields. In the latter country it developed chiefly a class known as deaconesses (q.v.), but in England the movement, coinciding with the Tractarian revival of the older doctrine and customs, assumed a form practically identical with that already described. After one or two tentative efforts in London (1845) and Oxford (1847) the movement took definite root with the foundation of the community at Devonport in 1848. Its members, known as Sisters of Mercy, were bound by no vows except one of obedience to the superior, while they remained connected with it. Three years earlier Dr. Muhlenberg had established the Sisters of the Holy Communion in New York. These had no fixed costume, were required to be between 25 and 40 years old, and they might leave the sisterhood at pleasure. This community was placed in charge of St. Luke's Hospital, which Dr. Muhlenberg founded. Numerous organizations of the kind have since grown up both in England and America and have proved useful auxiliaries to the clergy in work among the poor. The later ones usually follow the model of the Roman Catholic sisterhoods, have similar ideals of life, and follow similar practices. In 1903, besides some communities of deaconesses, there were 21 organizations of this kind in the United States. In 1914 there were 165 Roman Catholic sisterhoods. Consult: Goodman, *Sisterhoods in the Church of England* (London, 1863); Potter, *Sisterhoods and Deaconesses* (New York, 1873); Littledale, *Papers on Sisterhoods* (London, 1874–78); T. Schäfer, *Geschichte der weiblichen Diakonie* (3 vols., Stuttgart, 1887–94); Christian Golder, *History of the Deaconess Movement in the Christian Church* (New York, 1903); for the growth of the Roman Catholic communities, the bibliography under MONASTICISM.

SISTER HOOK. See CLIP HOOKS.

SISTERS OF CHARITY. See BROTHERS AND SISTERS OF CHARITY.

SISTERS OF MERCY. See MERCY, SISTERS OF.

SISTERS OF THE CONCEPTION OF OUR LADY. See CONCEPTION OF OUR LADY, SISTERS OF THE.

SISTINE (sĭs′tēn *or* -tĭn) **CHAPEL.** The private chapel of the Pope in the Vatican. It was built for Sixtus IV in 1473 by the Florentine architect Giovanni de' Dolci. The apartment is 133 feet long, 45 feet wide, and somewhat higher than its width. It is lighted by six windows on each side and three in the rear. The screen separating the congregation from the part reserved for the Pope and cardinals is one of the best pieces of marble decoration of the early Renaissance, and the tribune of the singers is equally good. The floor is decorated with beautiful mosaics in imitation of early Christian work. The walls and ceiling are without adornment excepting the frescoes, which form the chief attraction of the chapel. The walls are a museum of the works of the best Tuscan and Umbrian painters of the later fifteenth century, and they contain works by Botticelli, Roselli, Ghirlandaio, Signorelli, Perugino, and Pinturicchio (qq.v.). On the left wall are incidents from the "History of Moses," while on the right are six corresponding scenes from the "Life of Christ." Above these are portraits of the different popes; below them formerly hung, on great occasions, the famous tapestries of Raphael (q.v.). On the ceiling are the wonderful frescoes of Michelangelo: the "Creation," the "History of Noah," etc., together with the celebrated "Prophets" and "Sibyls"—one of the greatest creations of modern art. The entire altar wall is covered by his "Last Judgment," the largest fresco in the world. (See MICHELANGELO.) The paintings have been greatly damaged by time and incense. The Sistine Chapel is the scene of most of the great functions at which the Pope personally assists, and here the papal elections are held. Its choir was founded by Gregory the Great and is composed of about 30 priests and papal chaplains. They sing without accompaniment, and their style, the *messa di voce*, is of world-wide celebrity. Consult Ernst Steinmann, *Die sixtinische Kapelle* (Munich, 1901–05), a monumental publication of reproductions with text.

SISTINE MADONNA. See MADONNA, and Plate with RAPHAEL SANTI.

SISTOVA, sĭs′tō-vȧ. A town of Bulgaria, on the Danube, about 40 miles above Rustchuk (Map: Balkan Peninsula, E 3). It has a considerable trade in grain and wine. Pop., 1905, 13,408. Sistova is noted for the treaty of peace concluded here between Austria and Turkey in 1791.

SISUPALA, shĭsh′ōō-pä′lȧ. In Hindu legend, the sovereign of Chedi, a country of central India. Although he was the cousin of Krishna (q.v.), he was his enemy and ultimately was slain by him. The history of this enmity forms the subject of the *Sisupālavadha* attributed to Magha, because of which it also goes by the name of *Māghakāvya*. This is a highly artificial Sanskrit epic in 20 cantos, which dates probably from the ninth century. It has been edited several times in India, notably, with Mallinatha's commentary, by Durgaprasad and Sivadatta (3d ed., Bombay, 1902), and was translated by Fauche in his *Tétrade*, vol. iii (Paris, 1863). Consult V. Henry, *Les littératures de l'Inde* (Paris, 1904), and A. A. Macdonell, *History of Sanskrit Literature* (London, 1913).

SIS′YPHUS (Lat., from Gk. Σίσυφος). In Greek legend, the son of Æolus and Enarete. According to the earlier myth he was married to Merope, but later tradition made him the father of Odysseus by Anticlea. Sisyphus is said to have been the founder and King of Ephyra, afterward Corinth, and became notorious as a wicked ruler. For this he was punished in the lower world by being condemned to roll from the bottom to the summit of a hill an immense bowlder which, whenever it reached the top, rolled down again and compelled him to begin his task anew.

SITA, sē′tȧ (Skt., furrow). In the Sanskrit epic of the *Ramayaṇa* (q.v.), the daughter of Janaka, King of Videha, and the wife of Rama. She seems to have been originally an earth goddess, as Sita (the furrow) is invoked in the Rig and Atharva Vedas (see VEDAS) to grant rich blessings and crops. In the later Hindu accounts she is said to have arisen from a furrow when her father was plowing the ground. Consult A. A. Macdonell, *Vedic Mythology* (Strassburg, 1897).

SITATUNGA, sĭt′ȧ-tōōŋ′gȧ. A "harnessed" antelope. See NAKONG.

SIT′KA. An Indian tribe, the largest of the Kolushan (Tlinkit) stock, occupying Chichagof, Baranov, Kupreanof, Kuiu, and a part of the Prince of Wales islands, southern Alaska, and numbering with subtribes about 600. The town of Sitka derives its name from them. From the enormous wooden labrets worn by their women the Russians called the tribe Kalush, from the Russian *kalushka* (a wooden trough or bowl); hence the name Kolushan now applied to the stock. They were formerly a fierce and independent people, but are now greatly demoralized and wasted. Their general culture is that common to the Tlinkit (q.v.).

SITKA. A town and the former capital of Alaska (Map: Alaska, N 7). It is situated on the west coast of Baranov Island, facing Sitka Sound, in close proximity to several snow-clad peaks. The climate, in spite of its northern latitude, is mild, the average temperature of December being 32° F. and of August 56° F. The rainfall is heavy, amounting to 84 inches annually. Among the noteworthy features are the Russo-Greek church, dating from 1816, the church of St. Peter's by the Sea, erected in 1899, and the Sheldon Jackson Museum, connected with the Presbyterian Mission. The educational institutions include United States public schools, a Russo-Greek parochial school, and the Presbyterian Industrial Training School for natives. There are also to be mentioned the headquarters of the agricultural experiment stations of Alaska, the Coast Survey Magnetic Base Station, and a customs office. Sitka is the residence of the Episcopal Bishop of Alaska and of the Russian Bishop. In 1799 the Russian American Company established a trading post at Sitka, which, under the name of New Archangel, was permanently occupied by the Russians in 1804. It became later the seat of the Russian territorial government. Pop., 1910, 1039.

SI′TOPHO′BIA (Neo-Lat., from Gk. *σῖτος*, *sitos*, food + *-φοβία*, *-phobia*, fear, from *φοβεῖσθαι*, *phobeisthai*, to fear). A dread or fear of food, experienced by insane people, which leads them to refuse to eat.

SITTEN, zĭt′*e*n. A city of Switzerland. See SION.

SITTEWALD, zĭt′*e*-vält, PHILANDER VON. See MOSCHEROSCH, J. M.

SITTING BULL (Tatanka Yotanka) (1837–

90). A chief of the Sioux tribe of North American Indians, born in Willow Creek in the region later Dakota Territory, the son of Chief Jumping Bull. He became the leader of the most unruly and warlike band of bucks in the tribe. During the Civil War he led raids and engaged in attacks upon white settlements in Iowa and Minnesota and in 1864 was driven by General Sully into the Yellowstone and Big Horn valleys. He was on the warpath almost continuously from 1869 to 1876, raiding the frontier posts and settlements or making war on the Crows and other tribes. His refusal to return to his reservation in 1876 led General Sheridan to begin against him the campaign in which Gen. G. A. Custer (q.v.) and his force were surprised and massacred on the Little Big Horn in June of that year. Sitting Bull and his braves escaped over the Canadian border, remaining there until 1881, when he received from General Miles a promise of amnesty and returned. He continued to wield great power among the Northwestern Indians, and in 1888 he influenced the Sioux to refuse to sell their lands. In 1890 during the prevalence of the Messiah craze among the Indians of the West he was considered the principal instigator of the threatened uprising. His arrest in his camp on the Grand River in North Dakota on Dec. 15, 1890, was followed by an attempt at rescue, during which he was killed. See Sioux.

SIUT. See Assiut.

SIUYEN, shyōō′yĕn′. A walled city of Shingking, Manchuria, on the right bank of the Tayang River, which flows southward to the Yellow Sea at the port of Takushan, distant 35 miles (Map: China, M 3). It is famous for the finely grained marble found in the neighborhood and its stone-cutting and polishing industry.

SIVA, shĭ′vȧ (Skt., gracious, auspicious). The name of the third god of the Hindu Trimurti or triad, in which he represents the principle of destruction. As a deity he is unknown in the Vedic hymns, but is found in the later Brahmanic literature, the epic poems, the Puranas (q.v.), and the Tantras (q.v.). Thus, in the *Mahabharata* (q.v.), Siva is already known as the all-containing god, and even in the Upanishads (q.v.) he is identified with the Vedic Rudra (q.v.) as the All-god. His symbol is the linga (q.v.), a phallic emblem, and from each of his numerous attributes he derives a name or epithet. He has five heads (hence his name Pancanana, the five-faced) and three eyes (hence his name Trinetra, the three-eyed). On his head he bears the Ganges, whose course he intercepted by his hair when this river descended from heaven upon the Himalaya. Besides he carries a garland of human skulls and wears a rosary (afterward adopted by the Buddhists) and a necklace of serpents. In his hands he holds a trident, a club or pole resembling in form the breastbone and ribs adjoining, which in turn are surmounted by a skull. His weapons are a bow, a thunderbolt, and an axe. As the destroyer of the world he is also called Kala (time or death) and represented as of black color. One of his representations is also half male and half female, emblematic of the indissoluble unity of the creative principle (hence his name Ardhanarisa, half-female lord). He is often clothed in a deerskin and may be represented as sitting on a tiger skin. His sacred animal is the bull Nandi; his home is on Mount Kailasa in the Himalaya, his principal wife is Durga, or Uma (q.v.); his sons are Ganesa (q.v.) and Kartikeya (q.v.).

Siva is the god of asceticism, but also of all art, especially of dancing. In the earlier accounts he is represented as an opponent of the Vedic gods, and especially as destroying Daksha, symbolic of the older Vedic rites, an intimation of the overthrow of the orthodox religion by the more popular cult of Siva. As a symbol of asceticism he is the destroyer of Kama, the god of love. Though Siva has no incarnations, he is identified with various local gods, especially Bhairava and Vitthoba. He has a great many names, but is generally called Lord, Mahesvara, or Sankara, Beneficent, or Pasupati, Kine Lord, or simply Mahadeva, great god. The cult of Siva is probably of non-Aryan origin and has much in common with Buddhism, and in the art of c.800 A.D. the two are confused. To-day the Siva cult (see Saivas) is the most universal in India. Consult E. W. Hopkins, *Religions of India* (Boston, 1895); A. A. Macdonell, *Vedic Mythology* (Strassburg, 1898); L. D. Barnett, *Antiquities of India* (London, 1913). See Hinduism; Siva in Plate of Hindu Deities, under India.

SIVAS, sē′väs′. The capital of the Vilayet of Sivas, Asiatic Turkey, situated on the Kizil Irmak at an altitude of 4420 feet (Map: Turkey in Asia, C 2). It covers a large extent of ground, is well built, and has numerous old mosques, khans, gardens, and excellent bazars. It contains several interesting ruined medresses, or colleges, beautifully decorated. Besides the Greek churches, there are a Roman Catholic and a Protestant church. The manufactures include coarse woolens and copper utensils. Sivas is built on the site of the ancient Sebastia. It was formerly one of the most important cities of Asia Minor on account of its strategic position. In the fourteenth century it had 100,000 inhabitants. Pop., about 65,000.

SIVASH, sē̆′väsh′, or Putrid Sea (Russ. *Gniloye More*). A lagoon on the east coast of the Crimea, cut off from the Sea of Azov by a narrow sand bar, the Tongue of Arabat (Map: Russia, D 5). It is 68 miles long, from 2 to 14 miles wide, and extremely shallow, consisting largely of salt marshes. The water is stagnant and excessively salt.

SIV′ATHE′RIUM (Neo-Lat., from Skt. *Siva*, name of a Hindu god + Gk. *θηρίον*, *thērion*, dim. of *θήρ*, *thēr*, wild beast). An extinct giraffe, of much larger size than the living species, found fossil in the Siwalik beds of Pliocene age in India. The skull was heavily built and provided with two pairs of horns, of which the anterior pair were small and pointed, while the posterior pair were large and slightly palmate with a few short prongs. Another genus, *Samotherium*, from the Pliocene of the isle of Samos, had shorter neck and limbs than those of the modern giraffe, and the skull of the male alone was provided with a single pair of frontal horns.

SIVERTSEN, sē̆′vĕrt-sen, Curt. See Adelaar.

SIVORI, sḗ-vō̆′rḗ, Ernesto Camillo (1815–94). An Italian violin virtuoso, born in Genoa. At the age of five years he commenced his studies with Restano, after which he became a pupil of Costa and then of Paganini. In 1827 he went to Paris, where he won remarkable success by his marvelous technique. In 1829 he toured Italy, Germany, and Russia and in 1846

America. He composed concertos and other works for the violin.

SIWAH, sē'wä (anc. *Ammonium*). An oasis in the Libyan Desert in northwest Egypt, 280 miles southwest of Alexandria (Map: Africa, G 2), with which it has telegraph connection. It is nearly 20 miles long, over 1 mile broad, and has about 25 square miles of agricultural land. It lies nearly 100 feet below sea level, is watered by numerous streamlets, small lakes, and marshes, and is covered with palm groves and orchards. Pop., 1909, 3884, mostly engaged in the cultivation of dates, which form a very important item of export, amounting to 3,000,000 pounds annually. There is a theological seminary. The temple of Ammon was famous for its oracle in ancient times. In the vicinity is situated the celebrated Fountain of the Sun, mentioned by Herodotus. The miniature town of Siwah is compactly built with lofty dwellings. There is also another settlement, called Aghormi, 2 miles distant, with remains of ancient temples.

SIX ACTS, The. The name given to a number of measures enacted by the British Parliament in 1819–20 aiming at the repression of the growing democratic movement. The freedom of speech and of the press and the right of association were greatly restricted. See under United Kingdom.

SIX ARTICLES, The Statute of. See Articles, The Six.

SIX COMPANIES, The Chinese. Six mutual-aid associations representing six different parts of the Province of Kwangtung, China. They are partly benevolent and partly commercial, taking care of emigrants from China, giving advice and aid when needed, acting as their bankers, looking after the sick, and forwarding the bodies of the dead to their friends in China for burial in their native place. Membership is entirely voluntary, and they are in no sense secret societies. They are an outgrowth of the conditions prevailing in the middle of the nineteenth century, when coolie labor was needed and was supplied to contractors in the United States by contractors in Hongkong, Canton, Macao, and elsewhere, whose agents were settled in San Francisco. In course of time groups of these agents combined for self-protection, but on the abolition of coolie traffic and all forms of contract labor and restriction of immigration these developed into benefit and protection societies, lending money, etc. The Six Companies are Ning Yeung, the largest and most powerful, Hop Wo, Kong Chow, Yung Yo, Sam Yup, and Yang Ying.

SIX NATIONS. See Iroquois.

SIX-PRINCIPLE BAPTISTS. See Baptists.

SIXTH. See Interval.

SIX'TUS. The name of five popes.—Sixtus or Xystus I, Saint. Pope, c.116–125, under the reign of Hadrian. His day is April 6.—Sixtus or Xystus II, Saint. Pope, 257–258. Under him the communion between Rome and the North African churches, broken off by the controversy over heretic baptism (q.v.), was restored. He died a martyr under Valerian. His day is August 6.—Sixtus III, Saint. Pope, 432–440. He restored the Liberian basilica (Santa Maria Maggiore), in which his work is extant to-day, as also in the nave of another basilica, the church of San Lorenzo. His day is March 28.—Sixtus IV (Francesco della Rovere). Pope, 1471–84. He was born in 1414 and became general of the Franciscan Order in 1464. His nepotism is the worst blot upon his pontificate and led indirectly, through the ambition of his brother Girolamo, to unfortunate connection with the affairs of Florence. The Pope's 18-year-old nephew, Cardinal Sansoni-Riario, having been arrested in connection with the assassination of Giuliano de' Medici, Sixtus demanded his release. Interdict, excommunication, and war followed; but after Lorenzo had won over the Pope's ally, the King of Naples, peace was made in 1480. Sixtus, bitterly humiliated by complications with Venice in 1484, died five days later. Many public works were furthered by him, of which the most famous is the Sistine Chapel and the Ponte Sisto. Taxation, increased to carry out these projects and to provide for the Pope's family, heightened the disaffection against the Church. Consult: Frantz, *Sixtus IV. und die Republik Florenz* (Regensburg, 1880); Mandell Creighton, *History of the Papacy*, vol. iv (London, 1903); Ludwig Pastor, *History of the Popes*, vol. iv (Eng. trans. by Antrobus and Kerr, ib., 1910).—Sixtus V (Felice Peretti). Pope, 1585–90. He was born in 1521 in the March of Ancona, the son of a poor gardener. Like Sixtus IV he entered the Franciscan Order and became Bishop of Sant' Agata in 1566 and Cardinal in 1570. Being in disfavor with the preceding Pope, Gregory XIII, he had lived a quiet and retired life before and surprised the world by the masterful vigor of his reign. He began by repressing lawless disorders in the Papal States, reformed the administration of law and the disposal of patronage, and entered on projects for the improvement of Rome. He laid down new regulations for the College of Cardinals, restricting its number to 70, and organized the modern system of congregations (q.v.), reorganizing that of the Inquisition which already existed; at the same time he disapproved the rigor of the Spanish Inquisition as a state tribunal under Philip II. He published a new edition of the Septuagint and an edition of the Vulgate (1590). He died Aug. 27, 1590. Many of the popular stories concerning him are derived from the *Life* by Gregorio Leti (1669; Eng. trans., 1754), a thoroughly untrustworthy work, answered by Tempesti, a Franciscan, in 1755. The best modern *Life* is by Baron von Hübner (Eng. trans., London, 1872). Consult also Capranica, *Papa Sisto* (Milan, 1884), and *Cambridge Modern History*, vol. iii (New York, 1904).

SIZE. See Gelatin; Glue.

SIZERANNE, Maurice and Robert de La. See La Sizeranne.

SIZING. See Paper.

SJÖBERG, shē'bârj, Erik (1794–1828). A Swedish poet, born at Ludgo and known in literature as Vitalis. He was educated at the University of Upsala, where he lived before removing to Stockholm. His poems—erotic, religious, humorous, melancholy—appeared between 1819 and 1826, and were collected after his death by Geijer (1828). In 1873 a new edition by Forselius appeared as *Samlade skrifter af Vitalis*. A German translation was published at Leipzig in 1843.

SJÖSTEDT, shēs'tĕt, Ernest Adolf (1854–). A Canadian mining and metallurgical engineer. He was born in Sweden and graduated in 1876 at the Royal School of Mines, Stockholm. He was assistant chemist at the Bethlehem (Pa.) Steel Works (1877), was in charge of the charcoal iron furnaces at Shelby, Ala., and Cherokee, Ga. (1880–85); superintendent of furnaces at Katahdin, Me. (1885–90), general manager of the Charcoal Iron Company at Pictou, Nova Scotia (1890–96), and in 1898 became chief metallurgist of the Lake Superior Power Company at Sault Ste. Marie. Among his inventions are iron-ore and sulphide roasters, electric smelting furnaces, and an electrolytic process which accomplishes the separation of copper and nickel.

SKABITCHEVSKY, skä'bė-chĕf'skĭ, Alexandre Mikhailovitch (1838–1911). A Russian critic and literary historian. He graduated from St. Petersburg University in 1861. Besides literary essays, which were several times collected, he published *A History of the Newest Russian Literature* (5th ed., 1903), *An Outline History of Russian Censorship* (1890), and *Russian Writers since Peter the Great* (1908), a textbook. As a critic Skabitchevsky lacked originality and philosophic breadth, but as a historian he was notable for a lucid style.

SKAGEN, skä'gen, Cape, or The Skaw. The most northerly point of Jutland, Denmark (Map: Denmark, D 1), a narrow sand spit on which stands a high stone lighthouse. Near it is the busy port of Skagen.

SKAGER-RAK, skä'gĕr-råk'. An arm of the North Sea between the south coast of Norway and the peninsula of Jutland, Denmark, and washing also the coast of Sweden (Map: Denmark, C 1). Together with the Cattegat and the sound, it connects the North Sea with the Baltic and is about 130 miles long by 80 miles wide. It is shallow near Jutland, where the coast has dangerous sand banks, but deepens northward, being over 2000 feet deep near the Norwegian coast. The latter, as well as the Swedish coast, is indented with bays affording good harbors. The Skager-rak is subject to violent northwest storms.

SKAGIT, skăg'ĭt. See Salishan Stock.

SKAG'WAY. A subport of entry in the southern district of Alaska, on Lynn Canal (Map: Alaska, N 6). It is the terminus of the White Pass and Yukon Railroad and of the Seattle and Skagway steamship lines. Skagway lies amid attractive scenery. It has a public library, a United States government building, and three hospitals. An army post, Fort W. H. Seward, is 15 miles distant. The city is chiefly important as the distributing point of supplies for the interior and is the port through which pass all supplies and travel to and from the Canadian Klondike. Skagway was settled in 1897. Pop., 1910, 872.

SKALD (Icel., poet), or **SCALD**, skąld *or* skäld. The name given in Old Norse to poets who exercised their art as a vocation requiring learning, i.e., a knowledge of the construction of verse and of the enigmatical imagery, roughly shaped out of obscure tradition, to which Scandinavian poets were prone. The great aim of the Skaldic poets was to celebrate the deeds of living warriors or of ancestors. Princes attached skalds to their courts and competed with each other, by magnificent presents, to retain the most skillful minstrels. See Icelandic Literature.

SKAMDRUP, Sophus. See Schandorph, Sophus.

SKAT, skät (derivation obscure). A game of cards that had its origin in Germany about the beginning of the nineteenth century. A special deck of cards is used, and the game is so intricate and scientific that it is impossible to describe it within the space at our disposal. Consult R. F. Foster, *Skat Manual* (2d ed., New York, 1906).

SKATE (from Icel. *skata*, skate; perhaps from Lat. *squatus, squatina*, sort of shark, angel fish). The name of certain species of the ray (q.v.). The commonest as well as the smallest species along the east coast of the United States is the tobacco box (*Raja erinacea*); the largest is the barn-door skate (*Raja lævis*), 4 feet long. The big skate of California is the largest of the American skates. It sometimes reaches a length of 6 feet, and its egg case is nearly 1 foot long. The flesh, though rather coarse, is at times eaten by Europeans. See Plate of Rays and Skates.

SKATING (from *skate*, from Dutch *schaats*, ODutch, *schaetse*, high-heeled shoe). One of the primitive methods of man's progression over the clear ice. The earliest form of skate was a shin or rib bone of some animal, tied to the foot, and was a Norse invention. Skates of bone are in the Guildhall collection in London and in other museums. The date of the origin of the skate with metal runners is unknown, but it seems likely that it is early, perhaps in the third century. With the development of a metal foot piece bearing a cutting edge progress without the aid of the stick was acquired, the blade being set within a base of wood strapped to the foot. Holland is still the best country for skating; aside from practical uses, it is there a national sport. Other notable skating countries are Russia, Norway, and Germany. It had become a common sport in England in the twelfth century, and famous skaters have been produced, especially from the Fens on the east coast. The United States and Canada have produced many fast skaters who vie with the best of those abroad. On the Hudson River have been made some of the fastest skating records, although Minnesota and the Middle West generally now rank well. In 1884 a national amateur association was formed, with W. B. Curtis as president, and this has held successful championships ever since. Afterward Eastern and Western sectional championships were instituted, and in 1899 the distances were measured by meters, in accordance with the custom abroad. In 1915–16 the sport had a great revival in the eastern United States.

The development of the skate used in the United States embraces three distinct periods. The old-fashioned skate had a straight thick blade, sometimes with a double edge (gutter), affixed to a piece of wood, the skate being bound on by straps and by a screw in the heel. Then came the club skate, an improvement in that it was entirely of metal and could be instantly clamped to the foot, though the earlier form was attached to the heel by means of a heel plate set in the boot. The blades were of a rocker shape from end to end, which allowed fancy skating, but which reduced the speed in straightaway skating. Finally the Hudson River or Donoghue skate was introduced, at once finding favor, in the West especially. This was a return to the old-fashioned form, the skate being straight-bladed with wooden top and straps. The blade is long, projecting behind and before the foot and very narrow, and the club or foot piece, when properly made of apple wood, is very light. With it has come into popular favor the Norwegian skate, the best skate known, which has a similar blade, fastened permanently to the shoe by metal pieces screwed to the sole. Its weight is but a few ounces. The hockey skate, a combination of the club and the Norwegian form, viz., a short, thick, and straight-bladed skate screwed to the shoe, is another popular form.

The style of skating in America has been not a little influenced by the speed skate, which by its nature has added considerable grace and power to the stroke. In pushing off therefore, with either foot, the whole length of the blade is obtained as a purchase instead of the toe only, as in the case of the club skate. The result is the greatest imaginable ease in skating, while the length of the stroke is two to three times as long, saving considerable energy.

The National Skating Association of the United States has championship contests both for speed and figure skaters, which are held annually usually in the neighborhood of New York, the figure skating being held indoors on artificial ice. Consult: E. F. Benson, *English Figure Skating* (London, 1908); H. H. Cobb, *Figure Skating in English Style* (ib., 1913); G. H. Browne, *Handbook of Figure Skating* (Springfield, Mass., 1913).

SKAW, skạ, The. The most northerly point of Denmark. See Skagen, Cape.

SKEAT, skēt, Walter William (1835–1912). An English philologist. He was born in London, Nov. 21, 1835, and passed his boyhood at Sydenham, where he became familiar with the Kentish dialect. He graduated in 1858 at Christ's College, Cambridge, of which he was elected a fellow in 1860. He held two curacies, but an affection of the throat compelled him to give up the ministry. He resumed his studies at Cambridge in English philology and literature. In 1873 he helped to found the English Dialect Society, becoming its first director and afterward its president. He had already begun editing Middle English texts for the Early English Text Society, established by his friend F. J. Furnivall (q.v.). In 1878 he was appointed to the professorship of Anglo-Saxon at Cambridge, and in 1883 he was reëlected fellow of Christ's College. Professor Skeat died Oct. 7, 1912. He wrote or edited in addition to many philological articles in magazines, the following separate works: *The Songs and Ballads of Uhland* (Ger. trans., 1864); *Lancelot of the Laik* (1865; revised, 1870); the three texts of Langland's *Piers Plowman* (1867–84; reprinted together, 1886); *An Etymological Dictionary of the English Language* (1879–82; 4th ed., 1910); *A Concise Etymological Dictionary of the English Language* (1882); *Principles of English Etymology* (2 vols., 1887–91); Barbour's *Bruce* (1870–77; and for the Scottish Text Society, 1893–94); *Complete Works of Geoffrey Chaucer* (6 vols., 1894–1900); *The Student's Chaucer* (1895); *A Student's Pastime*, being a select series of articles reprinted from *Notes and Queries* (1896); *The Chaucer Canon* (1900); *Place Names of Cambridgeshire* (1901); *Primer of Classical and English Philology* (1905); *Chaucer's Poems in Modern English* (6 vols., 1904–08); *Proverbs of Alfred* (1907); *Early English Proverbs* (1910); *Place Names of Berkshire* (1911); *The Science of Etymology* (1912); *Place Names of Suffolk* (1913); *Glossary of Tudor and Stuart Words* (1914); and many other works. Skeat was one of the leading scholars in the revival of our older literature and has done much to popularize his subject. To him more than to all others is due the revival of interest in Chaucer.

SKEL′ETON (from Gk. *σκελετόν*, *skeleton*, mummy, dried body, neut. sing. of *σκελετός*, *skeletos*, dried, from *σκέλλειν*, *skellein*, to parch, dry up). The framework of hard structure which protects and supports the soft tissues of animals. The skeleton either lies outside the soft tissues (exoskeleton) or is embedded within them (endoskeleton).

Exoskeleton. Exoskeletal structures surround and shield the vital organs and muscles and are represented by the shells or chitinous covering of mollusks, insects, and crustaceans, the shields of turtles, and the hair, scales, feathers, nails, and hoofs (qq.v.) of other vertebrates; also by the so-called "membrane bones" of the skull. Phylogenetically the exoskeleton of vertebrates is older than the endoskeleton, and its structures were derived from the inner layer of the epidermis.

Endoskeleton. Endoskeletal structures appear in a few invertebrates (as cuttlefishes, certain annelids, etc.), but are highly characteristic of vertebrates, in which arises a wholly new tissue—bone. Endoskeletal structures of vertebrates arise from two sources, the endoderm and the mesoderm, and are either membranous, cartilaginous, or bony. In the lower vertebrates conversion of cartilage into bone takes place on the outside and proceeds inward. In the higher vertebrates ossification also takes place at certain internal centres. In the conversion of cartilage into bone the chondrin or matrix of the cartilage becomes converted into a calcified matrix. The matrix is then dissolved away by certain cells (osteoclasts). Around the walls of the cavities thus produced certain cells (osteoblasts) arrange themselves in a layer and secrete about themselves salts (carbonate and phosphate) of lime. The spaces occupied by these cells and their amœboid processes become much restricted, but persist as the lacunæ and canaliculi of bone. This calcified layer is in turn covered by another internal layer of osteoblasts, and these in turn by others, until a Haversian system with its concentric layers is produced. Bone is always thus being torn down by the osteoclasts and made over by the osteoblasts. See Bone.

The skeleton of vertebrates may be treated under two heads: (1) the axial and (2) the appendicular skeleton.

Vertebral Column. The axial skeleton includes the vertebral column, ribs, sternum, and head skeleton. The vertebral column, or backbone, first appears in cyclostomes, where it occurs as fibrous tissue, surrounding the notochord, which thus comes to lie as a rod in the axis of the primitive vertebrate column and is known as the "skeletogenous layer." From this point on it becomes a more and more important organ, while the chorda takes less and less part in the composition of the body of the adult. In the lowest vertebrates the skeletogenous layer is replaced at intervals by cartilage, which forms arches around the neural canal. In ganoids and higher forms these consist of five cartilaginous pieces for each somite, the fifth or unpaired piece forming the dorsal spinous process. Ventral cartilaginous pieces also occur ventral to the chorda. The bodies (centra) of the vertebræ definitely appear, and the chorda becomes constricted intravertebrally, giving the vertebræ an hourglass form. The rings of cartilage formed by intravertebral constrictions are biconcave or amphicœlous in all fishes with bony vertebræ and in most Urodela; also in a few fossil and living reptiles (q.v.) and in a few fossil birds. So long as the separate vertebræ of the vertebral column are amphicœlous their connection with one another must depend upon something else than the bony vertebræ themselves. In the lower fishes this union is effected by the chorda and chordal sheath. In the lower Urodela it is effected by the intervertebral, nonossified cartilage. In the higher Urodela, the Anura, and almost all the reptiles, however, the vertebræ are linked together by means of a ball-and-socket joint. The concavity may be on the posterior and the convexity on the anterior end (opisthocœlous) or conversely (procœlous). In crocodiles, birds, and mammals opposed faces of vertebræ are approximately plane surfaces. In the development of the vertebræ of man the phylogenetic stages are recapitulated. The typical vertebra of man consists of a centrum from which an arch arises dorsally to protect the spinal cord. These arches together constitute the neural canal. Each half arch is composed of the rounded pedicle and the broad flat lamina. There are three kinds of processes: (1) the dorsal or neuropophysis; (2) the transverse process, serving for the attachment of the muscles which keep the vertebræ together; (3) the forward and backward articulating processes (zygopophyses). The relation of the centra to the somites of the body is interesting. They do not arise one in the middle of each somite, but at the plane of separation of adjacent somites, thus insuring flexibility in the column.

The number of vertebræ in mammals is highly variable in different species. With one or two exceptions all mammals have seven cervical (nonrib-bearing) vertebræ. All the artiodactyls possess 19 thoracico-lumbar vertebræ. The smallest number (14) occurs in armadillos; the largest (30) in hyracoids. Since the number of vertebræ corresponds to that of the somites of the body, it seems necessary to conclude that the latter are highly variable in number. If we seek an interpretation of the differences in the vertebral column we may find it in the different tasks the parts perform, and the differentiation of vertebræ is a late acquisition, gradually acquired with advancing age. The sacral bones begin their fusion only at 16 years, and this is not completed until the age of 30. The sacrum is composed of four or five caudal vertebræ fused together.

Ribs. Ribs are also a part of the axial skeleton. Ventrally they end in cartilage and dorsally in two articular surfaces. The main part of the bone is the shaft or body, and its dorsal articular surface the head; on the side near the head is a second articular surface, the tuberosity; between this and the head there is a constriction, the neck. In man the last of the normally 12 ribs is occasionally reduced to an insignificant rudiment, or a thirteenth rib may be present. The transverse process of the seventh cervical vertebra and that of the first thoracic are quite different. The ventral arm of the transverse process of the seventh vertebra represents the rib. Similarly it may be inferred, even from the adult conditions, that all the cervical and trunk vertebræ possess ribs or the rudiments of ribs; and embryology bears out this conclusion.

Sternum. The sternum or breastbone of man is a flat bone to which the ventral ends of the ribs are attached. Its anterior part is known as the manubrium, the middle part as the gladiolus, and the posterior cartilaginous tip as the xiphoid or ensiform appendix. The middle part is composed of more than one piece. In nearly all the lower mammals it is made up of as many bones as there are pairs of ribs attached to it, and this composition may be plainly seen in the sternum of a child. Moreover, the sternum of the young of many mammals shows a double origin, and it is plain that the sternum, if a product of the fusion of the ventral ends of the thoracic ribs, was originally laid down as a paired structure. The sternum of lower vertebrates is often closely united to the shoulder girdle and possesses an accessory bone, the episternum. The sternum of Amphibia is small, and the ribs do not meet ventrally. The sternum of most carinate birds is strongly keeled to permit of the attachment of powerful muscles of flight. See Bird.

Skull. We may distinguish in the skull the cranium or brain case and the visceral skeleton. In the development of the human skull three stages may be distinguished which correspond with phylogenetic stages: 1. The fibro-connective tissue stage. This is represented in phylogeny by the condition in *Amphioxus*, where a fibrous cordal sheath surrounds the notochord. 2. The cartilaginous stage. In the anterior region of adult selachians a large cartilaginous capsule, open above, completely surrounds the brain below and laterally, derived from two pairs of cartilage plates. Ventral to the skull the visceral skeleton arises, consisting of the upper and lower jaws and the six branchial arches, the foremost of which early differentiated itself from the other five, entered into connection with the lower jaw, and constitutes the hyoid arch. The lower jaw arises in a manner precisely equivalent to a typical gill arch, and is composed of two pieces on each side, the quadrate and Meckel's cartilage. Very early a forward outgrowth from the quadrate gives rise to the upper jaw. 3. The bony stage is represented in the bony ganoids, where the frame case is covered by enamel plates. Dermal bones also cover the branchial arches and gills, forming the operculum. Even in the Amphibia the bones of the skull preformed in cartilage can be artificially separated from dermal bones, but the higher we go in the vertebrate scale the more intimate is the union, until in mammals the two bones are developed at the same time and are inseparably fused in the adult. With the loss of gills goes that of the opercular apparatus, and the cranium becomes more compact. Of the branchial apparatus there remains the first, the mandibular, the second, the hyoid, and a part of the third, which fuses with the hyoid. Finally, the axis of the cranium curves. The curve is first considerable in reptiles and birds and reaches its maximum in man. See Skull; for the anatomy of the bones of the ear, see Ear; and for that of the dental apparatus, see Teeth.

The Appendicular Skeleton. Appendages in vertebrates may be divided into two kinds: (1) paired, and (2) unpaired or median. Paired appendages are represented by the lateral fins of fishes and the legs and wings of higher animals. Unpaired appendages are confined chiefly to fishes and occur in the sagittal plane dorsally, posteriorly, and ventrally. Certain deep-lying structures which support the appendages must be considered in connection with them. The origin of the appendages is a much disputed question. Two views, however, have gained currency. That of Gegenbaur depends wholly upon anatomical evidences; that of Balfour, Dohrn, and others is based wholly upon embryological evidence. Gegenbaur's theory is that the shoulder and pelvic girdles have each been derived from one gill arch and that the appendages are modified gill rays—the bony processes of the gill arches, supporting the gill membrane. Now in such a gill arch one frequently finds one of the middle gill rays much more highly developed than the others. Sometimes on this larger ray lateral rays arrange themselves. From this latter condition, which occurs in *Ceratodus*, may be derived and explained the skeleton of the limbs of fishes and of all the higher vertebrates. The girdles have been derived from gill arches. The theory of Dohrn rests almost wholly upon the evidence afforded by ontogenetic development. The muscles which enter the arm are not derived from one mesodermal somite, but from a number (10 to 30), and as each gill arch corresponds to one metamere, the appendages cannot be derived from gill arches and their rays. Moreover, the muscles of the appendages are derived from the dorsal muscle plates and those of the branchial arches from the lateral plates of the head; hence the musculature of the two is derived from entirely different sources. Dohrn believes the limbs have arisen from a continuous fin, which is paired anteriorly, but fuses posteriorly to form an unpaired ventral fin that extends up over the tail to the mid-dorsal line. By a failure of the development of a part of this continuous fin two paired ventral fins appear, as well as median or unpaired ventral, caudal, and dorsal fins. The evidence for this Dohrn finds in the fact that masses of muscles are constricted off from the muscle plate in the interappendicular region just as at the appendages; these muscles later degenerate. Dohrn also finds muscle masses given off in each somite to the median fin. Hence the median fin is to be regarded as derived from two fused lateral fins.

The paired appendages of vertebrates fall into two types: (1) that of fishes, and (2) that of higher vertebrates. We may distinguish in each case two parts: an axial, the girdle, and a peripheral, the free appendage. It seems probable that the free appendage was developed first, and that the girdle arose from the necessity of a firmer axial support. The skeleton of the fins of fishes is composed of bone, whereas in selachians it is cartilaginous. The plan of the formation of the anterior and posterior appendages of higher vertebrates is the same, and the remarkable correspondence of their anterior and posterior limbs is to be accounted for by force of similar conditions, for in none of the existing fishes are fore and hind limbs alike. A striking instance of a loss of parts as well as of fusion of parts occurs in the wing of the bird (q.v.), where are present a humerus, a radius and ulna, and two separate carpal bones only. The metacarpals are represented by two bones fused at their extremities and by a small bone on the radial side. Still distal to these are two rows of bones, one composed of two pieces and one of one piece only. The fossil bird *Archæopteryx* had three fingers. The fourth and fifth phalanges have dropped out entirely or are inextricably fused with the other cartilages. In mammals two toes, the third and fourth, remain in artiodactyls (ox, etc.), and in perissodactyls (horses) only one, the third, persists, but in fossil horses (q.v.) all intermediate stages from a five-toed condition have been discovered. In man a number of cases of supernumerary parts (polydactylism) occur. This is a highly inheritable character, regarded by Gegenbaur as a monstrosity, but by Bardeleben considered as a case of atavism. Such a six-fingered condition is found in the adult in some amphibians and reptiles and also in a rodent (*Pedetes*). The human carpals are eight in number, arranged in two rows. The tarsal bones are seven in number.

The pectoral girdle arises ontogenetically later than the free appendages. In mammals, however, this part is characterized by a reduction in the ventral pair of pectoral girdle bones, which may result in their entire absence. The coracoid is lost wherever the movement of the arm is restricted to an ambulatory one, since in carnivores and ungulates the clavicle is wanting. In such mammals as use their forefeet for digging, flying, or feeding the clavicle persists. In man the outer surface of the sternum is provided with a prominent ridge, the "spine of the scapula," which runs out into a prominent process, the acromium. See PELVIS.

The human skeleton is composed of 200 distinct bones, exclusive of the 32 teeth and the ossicles in each tympanum. It is divided into four regions: (1) the skull, composed of 22 bones; (2) the trunk, composed of 54 bones; (3) the upper extremities, composed of 64 bones; and (4) the lower extremities, composed of 60 bones.

KEY TO SKELETON PLATE

1. Frontal bone.
2. Parietal bone.
3. Temporal bone.
4. Occipital bone.
5. Malar bone.
6. Superior maxillary.
7. Inferior maxillary.
8. Cervical vetebræ.
9. Nasal bone.
10. Sternum.
11. Humerus.
12. Ulna.
13. Radius.
14. Lumbar vertebræ.
15. Innominate bones.
16. Sacrum.
17. Head of femur.
18. Shaft of femur.
19. Patella.
20. Shaft of tibia.
21. Fibula.
22. Greater trochanter of femur.
23. Condyles of femur.
24. Tuberosity of tibia.
25. Clavicle.
26. Condyles of humerus.
27. Head of radius.
28. Dorsal vertebræ.
29. Scapula.

HAND

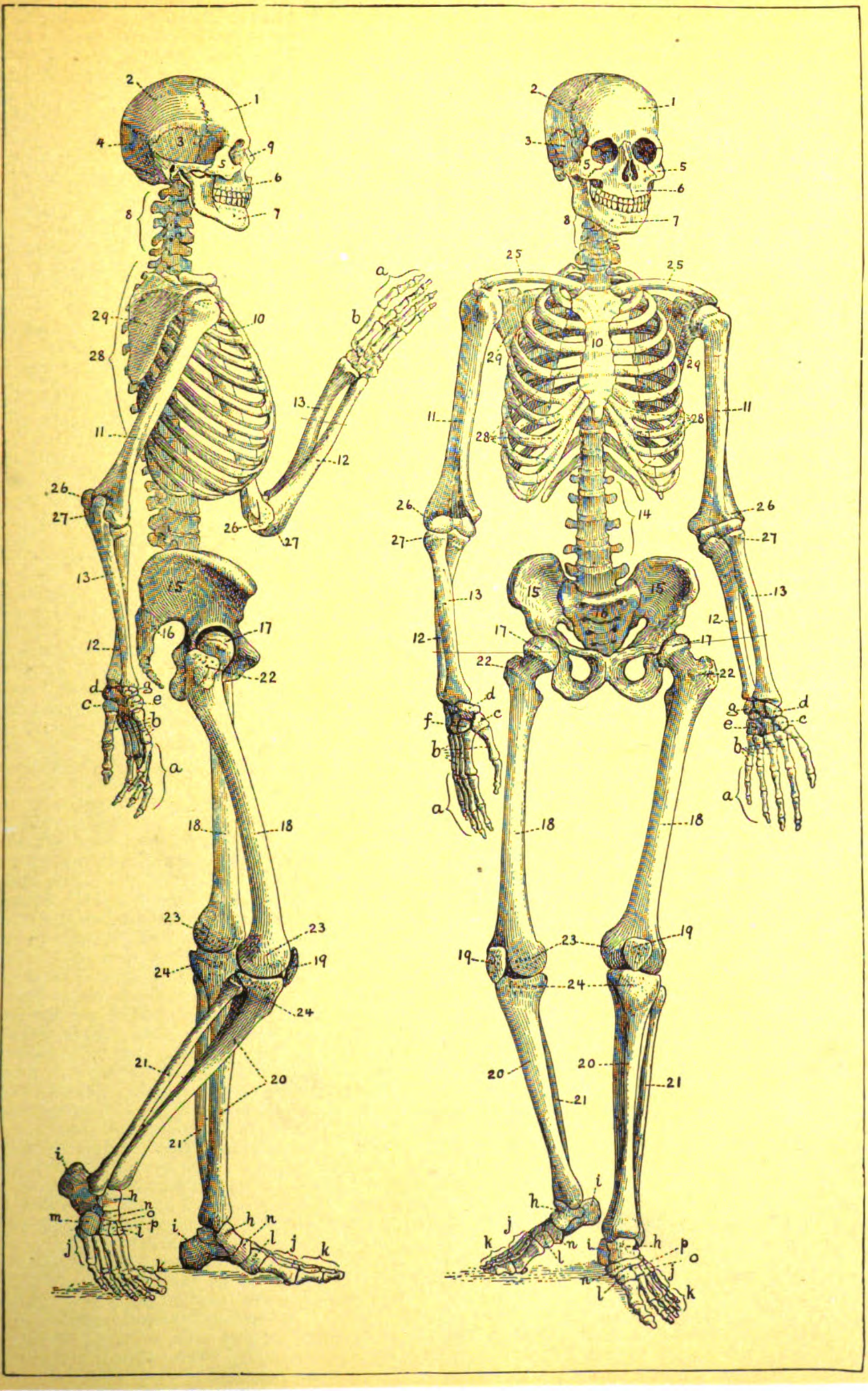
a. Phalanges.
b. Metacarpals.
c. Trapesium.
d. Scaphoid.
e. Unciform.
f. Trapesoid.
g. Pisiform.

FOOT

h. Astragalus.
i. Calcaneum.
j. Metatarsus.
k. Phalanges.
l. Entocuneiform.
m. Cuboid.
n. Navicular.
o. Ectocuneiform.
p. Mesocuneiform.

Bibliography. Parker, *Monograph of the Shoulder Girdle and Sternum*, published by the Ray Society (London, 1868); Emil Dursy, *Zur Entwicklungsgeschichte des Kopfes des Menschen und der höhern Wirbelthiere* (Tübingen, 1869); Parker and Bettamy, *Morphology of the Skull* (London, 1877); W. H. Flower, *Osteology of the Mammalia* (3d ed. rev. by Hans Gadow, ib., 1886); S. H. Reynolds, *The Vertebrate Skeleton* (Cambridge, 1897); Carl Gegenbauer, *Lehrbuch*

SKELETON



For Key and Description, see Text.

der Anatomie des Menschen (7th ed., 2 vols., Leipzig, 1899); Thomas Dwight, *Clinical Atlas* (Philadelphia, 1907); J. E. S. Frazer, *Anatomy of the Human Skeleton* (ib., 1914). See ANATOMY; BONE; CARTILAGE.

SKELETON CONSTRUCTION. See BUILDING, *Skeleton Construction;* STREET.

SKEL'LIGS, THE. A group of rocky islets off the southwest coast of Ireland (Map: Ireland, A 8). They belong to the County of Kerry. Great Skellig rises 714 feet and has two lighthouses and the ruins of a monastery.

SKEL'LY. A fish, the common British chub. See CHUB, and Plate of CARPS AND ALLIES.

SKEL'TON, JOHN (?1460–1529). An English satirical poet, born probably in Norfolk. He claimed to have studied at both Cambridge and Oxford, from each of which he received the academical honor of laureate. Some time before 1500 Henry VII appointed him tutor to Prince Henry, afterward King Henry VIII; and Erasmus, in allusion to his learning, styled him "a light and honour of British literature." At this time Skelton had produced some translations and had written elegies on Edward IV (1483) and the Duke of Northumberland (1489), to which was later to be added (1509) a poem on the death of Henry VII. He entered the Church in 1498 and became rector of Diss in Norfolk. Shortly after, he struck into that vein of original vernacular poetry for which he is noted: a flow of voluble verse, unrestrained satire and jocularity, and a profusion of grotesque imagery mixed with Latin and colloquial (East-Anglian) phrases. For a jingling and ludicrous effect he employed short lines, varying from four to six syllables and running on rhymes sometimes repeated seven times over. Caxton said that Skelton improved the English tongue. Very graceful are many passages in a long allegorical poem entitled *The Garlande of Laurell,* such, e.g., as the ballad on Margaret Hussey. Noteworthy, too, is *The Bowge of Court,* an early allegory on the right to rations at the King's table. Humorous pictures of low life are contained in *The Tunnynge* [or brewing] *of Elynour Rummyng,* an alewife at Leatherhead in Surrey. This poem was highly popular and often reprinted. His best satires are *Colyn Cloute,* which gave suggestions to Spenser, and *Why Come ye not to Courte?* The former is a general satire on the clergy, and the latter a furious attack on Cardinal Wolsey, from whom the poet had not received expected preferment. The angry Cardinal ordered his libeler to be arrested, but Skelton took sanctuary at Westminster under the protection of Abbot John Islip. In this retreat Skelton remained till his death. Skelton wrote three morality plays, of which only *Magnyfycence* has survived. In the development of the English drama it occupies an important place. Of Skelton's many other lost pieces *A Balade of the Scottyshe Kynge* was discovered in 1878, and it is certainly one of the earliest extant ballads. It was reprinted by J. Ashton in 1882. Skelton was not the author of the jests and merry tales which have circulated under his name. His free verse and allegory had marked influence on Sackville, Spenser, and other Elizabethans. His works were collected in 1568 and reprinted in 1736. The standard edition is by Alexander Dyce (2 vols., London, 1843). Consult W. F. Gray, in *Poets Laureate of England: Their History and their Odes* (London, 1914).

SKELTON AND BROT'TON. A manufacturing town in the North Riding of Yorkshire, England, 10 miles southeast of Middlesbrough. It contains an ancient and interesting church of early English architecture and Skelton Castle, the family seat of the Barons de Brus (Bruce), the ancestors of the famous line of Scottish Kings Bruce. It exports large quantities of stone from the neighboring quarries. Pop., 1901, 13,260; 1911, 15,194.

SKENE, skēn, ALEXANDER JOHNSON CHALMERS (1837–1900). An American gynæcologist, born in Fyvie, Aberdeenshire, Scotland. He graduated in 1863 from the Long Island College Hospital, where he became professor of gynæcology in 1872 and where he was dean of the faculty from 1886 to 1893. In this latter office he greatly increased the clinical facilities of the college. He wrote on subjects connected with his specialty.

SKENE, PHILIP (1725–1810). See article on the village of WHITEHALL.

SKENE, WILLIAM FORBES (1809–92). A Scottish historian. He was educated in Germany and at St. Andrews. Apprenticed to an uncle, he became a writer to the signet (1832) and followed his profession in Edinburgh for 40 years. He was also until 1865 clerk of the bills of the Court of Session. In 1881 he became historiographer royal for Scotland. Skene was one of the most thoroughly equipped Celtic scholars of the time, and as an historian he ranks among the first that Scotland has produced. His principal works are *The Highlanders of Scotland* (1837; 2d ed., 1902); *The Four Ancient Books of Wales* (1868); and, his chief work, *Celtic Scotland* (3 vols., 1876–80). Besides these works and numerous papers Skene also edited *The Chronicles of the Picts and Scots* (1867), *The Chronicles of John Fordun* (1871), and Bishop Reeve's edition of Adamnan's *Life of Saint Columba* (1874). Consult his *Memorials of the Family of Skene* (Aberdeen, 1887) and *Proceedings of the Society of Scottish Antiquaries* (Edinburgh, 1892).

SKEP'TICISM (from *skeptic,* OF., Fr. *sceptique,* from Gk. *σκεπτικός, skeptikos,* inquiring). A term applied in philosophy to any system whose predominant attitude is that of doubt. The objects of doubt may be various, but the most common objects of doubt in skeptical systems are the existence of a world of reality transcending experience (metaphysical skepticism) and the possibility of a valid knowledge (epistemological skepticism). As, however, doubt as to metaphysical reality in the last resort rests on suspicion of man's ability to know anything about such reality, all skepticism is ultimately epistemological, i.e., it rests upon views as to the scope and validity of knowledge. The Sophists (q.v.) of the fifth century B.C. were for the most part skeptics. Gorgias (q.v.) declared that all statements are false, and the reason he gave was that a true judgment is an expression of absolute identity; this contention may be illustrated by an insistence that no man is good, for the simple reason that every man is *man,* and only *good* is good. Gorgias even went further and argued that there is nothing (nihilism), adding that if there were anything it could not be known (skepticism), and even if it could be known it could not be taught. Protagoras (q.v.) of Abdera taught that all we could know is our perception of things, but not things. Man is the measure of the knowable universe. After the constructive work of Socrates, Plato, and Aristotle, it was natural that skepticism should by reaction take a more definite stand, and this it did in Pyrrho and his school, which was the first to receive the name of skeptics. Pyrrho's main thesis was that things are inaccessible to our knowledge and hence it is becoming in us to suspend judgment. Timon, Pyrrho's pupil, carried skepticism to its logical conclusion, which of course is contradictory to and yet necessitated by the premise from which it is drawn. This premise is that equally good reasons can be given for any proposition and for its contradiction. This principle applied to the doctrines of skepticism themselves involves the result that as good reasons can be given for an antiskeptical as for a skeptical view. This result of course takes away all reasonable advantage which the doubter may claim to have over his opponent, and the only course left for him is to give expression to his suspense of judgment by silence on the subject of skepticism. The Middle Academy, of whom Arcesilaus (q.v.) and Carneades (q.v.) were the most prominent leaders, were somewhat less radical in their skepticism; they had the logical grace to have some doubts as to the truth of a skepticism that doubted everything. Ænesidemus (q.v.) elaborated 10 reasons for skepticism and called them tropes. Agrippa and Sextus Empiricus (q.v.) were other noted skeptics of antiquity. In the Middle Ages Algazel in Arabia and Duns Scotus (q.v.) in Europe joined a philosophical skepticism with an unswerving religious faith. With the Renaissance the influence of ancient skepticism began to show itself in the writings of such men as Montaigne (q.v.), Sanchez, and Charron (q.v.), but modern skepticism did not find its adequate expression till Hume (q.v.) wrote his celebrated *Treatise of Human Nature* (1739). In book i of this work is to be found the conclusion which Hume draws from his previous speculations, and not even those experiences of life which have a practical import here escape the touch of doubt. Kant (q.v.) and Spencer (q.v.) are skeptics with regard to ultimate reality. We know the phenomenal world, but the world of things-in-themselves (Kant) or the absolute (Spencer) is unknowable. This dogmatic skepticism is at the present day called agnosticism (q.v.). In theology skepticism is used to designate the attitude of doubt towards the fundamental tenets of religion, such as the existence of God and the immortality of the soul. See KNOWLEDGE, THEORY OF.

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SKER'RYVORE. A dangerous rock in the Atlantic Ocean, 12 miles southwest of the island of Tiree of the Inner Hebrides. A large lighthouse was with great difficulty constructed here in 1838–44. See LIGHTHOUSE.

SKETCH-BOOK, THE. A collection of tales and sketches of travel by Washington Irving (1820) under the name Geoffrey Crayon. Best known are "Rip Van Winkle" and "The Legend of Sleepy Hollow."

SKETCH'LEY, ARTHUR. See ROSE, GEORGE.

SKIAG'RAPHY. See X RAYS.

SKIEN, skĕn. A town of south Norway, on the Skiens Elv, 62 miles southwest of Christiania (Map: Norway, D 7). It has a handsome town hall and has been substantially rebuilt since a fire in 1886. It has cotton, flour, and saw mills and manufactures wood pulp, paper, furniture, and chemicals. There is a copper mine in the neighborhood, and the chief exports are ice, timber, wood pulp, and copper. Skien is the birthplace of Ibsen. Pop., 1910, 11,870. In 1915 its boundaries were extended, making the estimated population 16,000.

SKIFF, FREDERICK JAMES VOLNEY (1851–). An American museum director and authority on expositions, born at Chicopee, Mass. After several years' service on the Denver *Tribune* he became its manager in 1881. While a member of the Colorado Legislature (1885–86) he became interested in mining conditions. In 1889 he was made Commissioner of Immigration and Statistics, and in 1891–93 was chief of the Department of Mines. He was a director of important exhibits in the expositions at Chicago (1893), Nashville (1897), Paris (1898–1901), St. Louis (1901–05), and San Francisco (1915); and of the Japanese Exposition for 1917. In 1894 he became the director of the Field Museum of Natural History, Chicago. He was decorated by many foreign governments.

SKIING, skē'ing, *Norw. pron.* shē'ing (from Norw. *ski*, from ONorse *skiþ*, snowshoe billet of wood, AS. *scid*, OHG. *scit*, Ger. *Scheit*, billet of wood). The method by which the inhabitants of Norway, Sweden, parts of Russia, and parts of North and South America propel themselves over snow. The ski is, in fact, the Norseman's snowshoe, differing from the American Indian snowshoe in having its bearing surface of solid wood and not a webbed frame.

The antiquity of the ski is very great. The runners are made of ash, white pine, or hickory. As to the length an expert (Caulfield) lays down this rule: "When you are standing with your arm stretched at full length above your head, the ski, placed upright, should be at least long enough for its tip to reach the roots of your fingers; it may well reach a few inches beyond the finger *ends*." The width should be from about 2¾ inches in the narrowest part, where the foot rests, to 3¾ inches at the front bend, and the thickness should be from 1¼ inches to ⅝ of an inch. The toe end of it is sloped gradually upward to avoid obstacles and narrows to a point at its extreme limit. A shallow groove about ⅛ of an inch deep and 1 inch wide is cut in the under surface or palm, as it is called; this forms a slender ridge in the snow and prevents slipping. Sometimes the palm is left bare; sometimes it is covered with skin, the hair on which acts as a grip in climbing hills; and sometimes with horn, which facilitates its down-hill glide. Midway on the top of the skin is a strap or laced thong called the binding, with which the foot is held in position, and generally a heel strap is used. Special shoes are worn made of thick soft leather, pointed and bent upward at the toes so as to fit the loop or binding. The rider carries a *stav*, a strong wooden stick with a small wheel at the trailing end, by which he starts himself and steers. The motion differs from the step of the Indian snowshoe; it is a glide, zigzagging up hill, and a slide or shoot down hill.

Both in Norway and America skiing is the occasion of gatherings for competition. In America the first ski club was formed in Minneapolis in 1881 and others soon followed. In 1890 a national association of clubs was organized for the regulation of the annual tourneys, called the Ski Association of the Northwest. Great ski contests are held at Holmenkollen and Frognersæteren, near Christiania, Norway, in February each year, with contests in long and short distance skiing runs and jumping. The long-distance run is generally about 20 miles, round trip. The jump is from a take-off erected midway down a hillside, and when the sliding skiman reaches it he stoops, rises in the air, and must, to be successful, land on his feet and retain equilibrium to the end of the course. Experts will cover in this leap from 130 to 140 feet, and in 1914, at Marquette, Mich., Axel Hendrickson performed the remarkable feat of turning a complete somersault in a jump of 110 feet, retaining his footing. At the tournament at Steamboat Springs, Colo., on Feb. 18, 1916, Regnar Omtvedt, of Chicago, broke all previous world records for long jumps, clearing 192 feet, 9 inches. The previous record was made in 1915 by Amle Omundsen, near Christiania, Norway, and was 177 feet. Consult: W. R. Rickmers, *Ski-ing* (New York, 1909); J. H. W. Fulton, *With Ski in Norway and Lapland* (London, 1911); Vivian Caulfield, *How to Ski* (3d ed., New York, 1914).

SKILFISH. See COALFISH.

SKIM'BACK. A local name in the Mississippi valley for a fish, one of the most common of the carp suckers (*Carpiodes cyprinus*), otherwise known as sailfish, quillback, etc.

SKIM'MER, or SCISSORBILL. A sea bird of the genus *Rynchops*, related to the gulls, remarkable for having a bill of a straight, compressed, unequal form. The common skimmer of the North Atlantic (*Rynchops nigra*), which occurs in late summer as far north as the Bay of Fundy, is about 19 inches long, spreading its wings 44 inches, and is black above and white below, with the legs and webbed feet red, and the bill orange and black. It breeds along coasts after the manner of gulls and is confined to the tropics in winter. When feeding the bird flies to the ocean surface, the bladelike lower mandible under water, and plows the water, skimming up its food. Two other species are Asiatic.

SKIM'MERTON. See CHARIVARI.

SKIM MILK. The fat-free liquid remaining after the cream has been removed from milk by skimming. It contains all of the original constituents of the milk except the fat. The average composition of separator skim milk is: water 90.1, ash 0.7, casein 3.8, milk sugar 5.2, and fat 0.2 per cent. It is largely used for feeding young animals and is valuable as a human food. The product is often dried and used in the form of milk powder. Several preparations are made by separating and drying the casein, which are used for human food, for glazing paper, for cheap paint, for making buttons, and otherwise in the arts. Milk sugar is also made from skim milk.

SKIN (Icel. *skinn;* connected with OHG. *scintan, scindan*, Ger. *schinden*, to flay). Considered in its general physiological and histological relation, the skin is merely a part of the great mucous system to which the mucous membrane and secreting glands also belong, and which consists of two essential elements—a basement tissue, composed of simple cutaneous membrane, and an epithelium of nucleated particles resting on it, while beneath the basement membrane are vessels, nerves, and connective tissue. (See EPITHELIUM; MUCOUS MEMBRANE.) In the skin the hard and thick epithelium is termed cuticle or epidermis, and the true skin below it is termed the derma, corium, or cutis vera, and is chiefly formed of modified, dense connective tissue.

The external surface of the skin formed by the cuticle is marked by furrows of different kinds. Some (termed furrows of motion) occur transversely in the neighborhood of joints, on the side of flexion; others correspond to the insertion of cutaneous muscles; while others, of quite another kind, are seen in aged and emaciated persons and after the subsidence of any great distention of the integument; and, besides these coarse lines, most parts of the skin are grooved with very minute furrows, which assume various courses in relation to one another. These furrows are most distinctly seen on the palm side of the hand and fingers and on the sole of the foot. The outer surface of the skin also presents innumerable pores for the discharge of the contents of the sweat and fat glands; and the modifications of epidermis known as hair and nails occur on the same surface. The epidermis is composed of stratified epithelial cells united to each other by a cement substance. Its thickness varies from 0.08 to 0.12 of a micromillimeter. The outermost layer is known as the stratum corneum, composed of several strata of dry, horny scales, without nuclei. Beneath this lies the stratum lucidum, a thin, clear, transparent layer of horny cells with faint nuclei, and next beneath lies the stratum granulosum (or rete mucosum, or rete Malpighii), which overlies and dips into the spaces between the papillæ of the corium. The Malphigian layer is composed of many strata of nucleated cells, which are flattened in the superficial layers, but polyhedral in the deep portion. The pigment of the skin is found in the rete Malpighii.

The deep layer of the skin consists of connective tissue, in which both the white and yellow fibrous elements occur in varying proportions; unstriped muscular fibre is present in some parts of the skin. Where great extensibility with elasticity is required, the yellow (elastic) element predominates; and where strength and resistance are specially needed, as in the sole of the foot, the corium is chiefly composed of a dense interweaving of the white (inelastic) element. The skin is thicker on the hinder surface of the body than in front and on the outer than on the inner sides of the limbs. It is unusually thin over the flexures of the joints and very delicate in the eyelids, while somewhat so in other situations where great mobility is demanded. In regions most subject to external pressure, as the soles of the feet, it is firmly united by very dense laminæ to the subcutaneous fascia; and the intervals between these are provided with pellets of fat, forming a cushion, as an additional protection to the organs it covers. On the external surface of the cutis the tactile papillæ, or organs of touch, are developed. They are most abundant and largest in the palm of the hand and the sole of the foot and occur as small, semitransparent, flexible elevations, usually conical or club-shaped in form. In one square line (a line being $\frac{1}{12}$ of an inch) of the palm of the hand it has been calculated that there are 81 compound and from 150 to 200 smaller papillæ, arranged in tolerably regular rows.

The glands occurring in the skin are the sudoriferous or sweat glands, the sebaceous or fat glands, and the ceruminous glands. The sweat glands exist almost everywhere in the human skin—in small pits in the deepest portions of the true skin and sometimes entirely below the skin. Their size and number in different regions of the skin determine the amount of perspiration yielded by each part; they are nowhere so much developed as in the axilla or armpit. In that part of the region which in the adult is covered with hair, they form a reddish layer, about ⅛ of an inch thick. They are soft and flattened by their pressure on one another, being embedded in delicate connective tissue and covered and permeated with a network of capillaries. Under the microscope such a gland is seen to consist of a solitary tube, one end of which is closed and hidden within the glandular mass, while the other emerges from the gland. The wall of the tube consists of an outer or basement membrane, with which the blood vessels are in contact, and an epithelium, lining the interior, the former disappearing when the tube reaches the surface of the papillæ. The duct, on leaving the gland, follows a rather spiral direction through the reticular portion of the cutis to the interval between the papillæ, when it becomes straight, and it again assumes a spiral course in perforating the cuticle.

The sebaceous glands are small whitish glands in almost every part of the skin except the palms and soles and especially abundant in the scalp, face (the nose being particularly rich in them), and about the anus. They are usually connected with the hairs and consist of a duct terminating in a blind pouchlike or pear-shaped extremity. The basement membrane of these glands is lined by an epithelium in the particles of which are included granules of fatty or sebaceous matter, which, having become detached, constitutes the secretion. These glands are the habitat of the parasite known as *Acarus folliculorum*.

The ceruminous glands are brownish simple glands, in external appearance like the sudoriferous glands, occurring in the cartilaginous portion of the external meatus of the ear. They yield an adhesive bitter secretion which protects the deeper structures from the access of dust, insects, etc.

As a protective covering, the skin possesses the combined advantages of toughness, resistance, flexibility, and elasticity; the connective framework being the part which mainly confers these properties, although the epidermis is also a factor. The subcutaneous layer of fat and the modifications of epidermis in various forms, as hairs, wool, feathers, scales, etc., serve for the preservation of warmth and occasionally (when they occur as claws, talons, etc.) as means of offense or defense. Besides preserving warmth the skin has also the power of reducing body temperature by the evaporation of sweat. The skin is the seat of a twofold excretion, viz., of that formed by the sudoriferous glands and that formed by the sebaceous glands. The fluid secreted by the sudoriferous glands is usually formed so gradually that the watery portions of it escape by evaporation as soon as it reaches the surface; but in certain conditions, as during exercise, or when the external heat is excessive, or in certain diseases, or when the evaporation is prevented by the application of a texture impermeable to air, as, e.g., oiled silk, or India-rubber cloth, the secretion, instead of evaporating, collects on the skin in drops. Since the sweat contains urea, lactates, extractive matters, etc., and the amount of watery vapor exhaled from the skin averages two pounds daily, the importance of the sudoriferous glands as organs of exertion is manifest. The secretion of the sebaceous glands is a semifluid oily mass, which often solidifies into a white viscid tallow-like matter on the surface or in the glandular ducts, from which it can be removed by pressure, in a form resembling that of a small worm or maggot.

The skin is, moreover, an organ of absorption. Mercurial preparations, when rubbed into the skin, have the same action as when given internally. Potassio-tartrate of antimony, when rubbed into the skin in the form of ointment or solution, may excite vomiting or an eruption extending over the whole body; and many other illustrations might be given. The effect of rubbing is probably to force the particles of the matter into the orifices of the glands, where they are more easily absorbed than they would be through the epidermis. The skin has the power of absorbing water, although to a less extent than occurs in thin-skinned animals, such as frogs and lizards. Lastly, the skin possesses a respiratory function, giving off carbon dioxide and taking up oxygen in small quantities. In thin-skinned animals, such as the frog, the excretion of carbon dioxide through this channel is very active. Consult W. S. Kirkes, *Handbook of Physiology* (8th Am. ed., rev. by C. W. Greene, New York, 1914), and R. D. Maurer, *The Skin: Its Care and Treatment* (5th ed., Chicago, 1914).

SKIN DISEASE. A morbid condition of the skin, occurring as a local disorder or as a local symptom of a constitutional disease. Skin diseases are classed according to the anatomical manifestations or the pathological relations involved. Maculæ include spots which do not disappear on pressure, such as freckles, moles, and birthmarks. Exanthemata include rashes in which there are eruptions of spots variously grouped, red, inflammatory, and fading on pressure, as in measles, roseola, purpura, and urticaria. Papulæ are pointed or rounded elevations with or without change of color. Tubercles are solid elevations of the cutis of various sizes. Vesicles are small blebs containing fluid, such as occur in eczema, miliaria, or varicella. Bullæ are larger vesicles, seen in pemphigus. Pustules are vesicles containing purulent fluid. Furfura is the term given to branlike scales, easily separable, as in dandruff. Squamæ are scales of larger size than furfura. Scabs, or crusts, are collections of mottled epidermis, exudation, dust, and blood or pus, of varying tint and thickness. Skin diseases are largely classified according to the existence of the characteristics above named. They are separately treated in this work. Consult: O. S. Ormsby, *Practical Treatise on Diseases of the Skin* (Philadelphia, 1915); J. F. Schamberg, *Diseases of the Skin and the Eruptive Fevers* (3d ed., ib., 1915); R. P. White, *Occupational Diseases of the Skin* (New York, 1915).

SKIN GRAFTING. In cases of extensive destruction of the skin, leaving large sores that do not heal, and also in treating old ulcers, small particles of skin, cut from the patient or another person, are placed upon the raw surface. Here they soon become attached and grow, forming a number of small islands or patches of skin over the surface of the ulcer; these in time spread till all is covered. Four methods of skin grafting are used. Reverdin's method, proposed in 1869, consists in transplanting small isolated grafts of epidermis about the size of a pin's head, which are deposited in little depressions made with a knife on the granulating surface. From these minute islands epidermization spreads until the entire surface is covered. Wolfe's method consists in removing the entire thickness of the skin and transplanting it to the desired situation; while Krause's method modified Wolfe's graft in that it does not include the subcutaneous fat. The method of Thiersch, advocated in 1874, consists in the transplantation of only the superficial layers of the skin and is the one now generally employed. See RHINOPLASTIC OPERATION.

SKINK (from Lat. *scincus*, from Gk. σκίγκος, *skinkos*, sort of lizard). A small lizard (*Scincus officinalis*) of the sandy deserts of North Africa and southwestern Asia. It is from 6 to 8 inches long, reddish dun in color, with darker transverse bands, a wedge-shaped head, and four strong limbs that give it extraordinary swiftness. It has been in great repute for imaginary medicinal virtues and is esteemed in the East, dried skinks finding a ready sale. It represents the pleurodont family Scincidæ, whose genera and species are scattered over the world, exhibiting many variations, five, four, three, or two toes distinguishing species even within the same genus. An aberrant and curious form is the Australian *Trachysaurus*, illustrated on the Plate of LIZARDS (q.v.). A few true skinks of the genus *Mabouia* dwell in tropical America, but the small swift lizard frequently so called in the northern United States (see FENCE LIZARD) is not of this family. Consult Hans Gadow, "Amphibia and Reptiles," in *Cambridge Natural History*, vol. viii (London, 1901); R. L. Ditmars, *Reptiles of the World* (New York, 1910); E. G. Boulenger, *Reptiles and Batrachians* (ib., 1915).

SKINNER, CHARLES RUFUS (1844-). An American educator. He was born in Oswego Co., N. Y., and attended the Clinton Liberal Institute. He was a member of the New York Assembly (1877-81) and of Congress (1881-85). From 1895 to 1904 he was New York State Superintendent of Public Instruction, having previously been deputy superintendent for six years. In 1897 he served as president of the National Education Association. In 1906-11 he was assistant appraiser at the port of New York. He wrote: *New York Question Book* (1890); *Manual of Patriotism for the Schools of New York* (1900); *The Bright Side* (1909).

SKINNER, JOHN (1721-1807). A Scottish poet, born at Balfour in Aberdeenshire, where his father was a schoolmaster. He was educated at Marischal College, Aberdeen, and thereafter passed several years as a teacher in parish schools. Abandoning Presbyterianism, in which he was brought up, he was appointed in 1742 Episcopal minister at Longside in Aberdeenshire, where he passed his life. Owing to his Jacobite sympathies during the excitement of 1745, his church was destroyed. He published several theological and controversial works, and, notably, an *Ecclesiastical History of Scotland* (1788). It is by his songs, however, that he is remembered. Burns ranked *Tullochgorum* as "the best Scotch song ever Scotland saw," and he praised the pathos of *The Ewie wi' the Crookit Horn*. Consult Skinner's *Theological Works* (3 vols., Edinburgh, 1809), with a biography by his son, John Skinner, and his *Songs and Poems* (ed. by H. G. Reid, Peterhead, 1859). Individual songs appear in T. H. Ward, *English Poets* (New York, 1894-1903), and in similar collections.

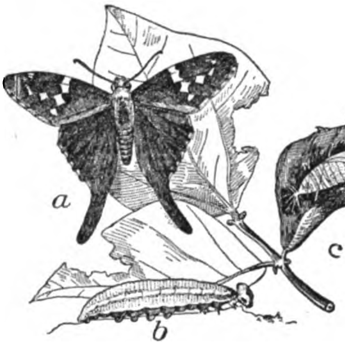
SKINNER, OTIS (1858-). An American actor, born in Cambridge, Mass. He appeared as an amateur actor and reader while living at Hartford, Conn., but his professional début was made in Philadelphia in 1887 as Jim in *Woodleigh*. After playing a two-year engagement there with the Walnut Street Stock Company he went to New York (1879) and won instant recognition by his talent, acting successively with Edwin Booth and Lawrence Barrett in important rôles. In 1884 he joined Augustin Daly's company, with which he remained the next five years, appearing in New York, London, Paris, and Berlin. From 1892 to 1895 he was leading man with Madame Modjeska. In later years he starred in *Kismet* and other romantic plays, with a change in the season of 1915-16 to a character comedy *Cock o' the Walk*.

SKIP. In music, a term denoting the progression of a part by an interval greater than a second.

SKIP'JACK'. 1. An oceanic fish (*Scomberesox saurus*) of the family Scomberesocidæ, called also Saury and billfish, and in Great Britain skipper and garonook. The body is elongated, with the snout drawn out into a long bill. The scales are minute and deciduous. It is 18 inches long and found in temperate waters of the North Atlantic. The sauries travel in great schools and when pursued by larger fishes often leap and skim the water surface for great distances. The flesh is good. See Plate of NEEDLEFISH, PIKES, ETC. 2. A fish (*Pomolobus chrysochloris*) of the Mississippi valley, let into the Great Lakes through canals and known there as blue herring. It is closely related to the alewife (q.v.), is about 12 inches long, and is a brilliant blue above, with silvery sides. It is not good food, being too bony. It is also taken in deep water in the Gulf of Mexico. 3. The bluefish (q.v.). 4. The cutlass fish (q.v.).

SKIPJACK or SNAPPING BEETLE. See CLICK BEETLE.

SKIPPER. A butterfly of the family Hesperiidæ. The skippers are usually rather small, but have stout bodies with an especially strongly developed thorax. Their wings are short but powerful, and the butterflies are very erratic in movement. Both sexes have six legs adapted to walking. The family comprises more than 2500 species, of which over 200 occur in the United States. The caterpillars are cylindrical and smooth, with large globular heads. The name "skipper" is also applied to the cheese maggot or cheese hopper, larva of *Piophila casei*. See Cheese Insects, and Colored Plate of Butterflies, American.



SWALLOW-TAILED SKIPPER.

a, butterfly, or bean-leaf roller (*Eudamus proteus*); *b*, caterpillar; *c*, chrysalis in rolled-up leaf.

SKIPPING SPIDER. See Water Spider.

SKIP'TON. A market town in the West Riding of Yorkshire, England, on the Aire, 15 miles northeast of Burnley (Map: England, E 3). It is the centre of a large cattle and sheep raising district and has manufactures of cotton and woolen goods and a considerable quarrying industry. It has an old castle, a church in the late Perpendicular style, and a grammar school of the sixteenth century, restored in 1877. Pop., 1901, 12,000; 1911, 12,977.

SKIR'MISH (OF., Fr. *escarmouche*, It. *scaramuccia*, formerly *schermuzio*, skirmish, from *schermire*, to fence, fight, from OHG. *scirman*, Ger. *schirmen*, to shield, defend, from OHG. *scirm*, *scerm*, Ger. *Schirm*, shield, shelter; probably connected with Gk. *σκίρον*, *skiron*, parasol, *σκιά*, *skia*, shadow, Skt. *chāyā*, shadow). Irregular engagements between small bodies of combatants are usually described as skirmishes, and a company or a battalion of infantry extended so as to cover a wide front is said to be in skirmishing or extended order. The art of skirmishing (see Patrol) is a most important branch of the infantry soldier's training and difficult to acquire. It enables contact with an enemy with a low percentage of loss. Skirmishing makes the individual the unit; consequently much depends on the intelligence and resourcefulness of the individual soldier. In the United States the squad is the basis of extended order, and men are trained to regard the squad as the unit from which they must never be separated, or, if their squad is broken up, to place themselves with the nearest group and to act under the orders of its leader. Before advancing to the attack infantry is deployed in a skirmish line, the normal interval between skirmishers being one-half pace, resulting practically in one man per yard of front. See Tactics, Military; Patrols.

SKIRRET, skĭr'ĕt (probably a corruption of *sugar root* or *sugar wort*), *Sium sisarum*. A perennial plant of the family Umbelliferæ, a native of China and Japan, cultivated for its tuberous, clustered, sweet, succulent roots, used like salsify and also to make a spirituous liquor. The root, sometimes 6 inches long, and ¾ of an inch thick, is propagated by sowing seed, division, or by offsets. In Europe it is highly esteemed.

SKIRT DANCE. A spectacular performance in which the dancer wears a very full skirt of light material, so that, grasped by the fingers, it may be waved in accord with rhythmical motions of the body. The steps are less important than the movement of body or limbs and the convoluted and graceful skirt effects. Sometimes wands are used. The skirt dance was made popular in England by Kate Vaughan and was developed there and in the United States by Sylvia Grey, Letty Lind, Topsy Sindon, and others. In 1897 Loie Fuller, famous as a danseuse in both America and Europe, introduced the modification of the skirt dance known as the serpentine dance, and later the fire dance, and she has had many imitators.

SKITTAGETAN, skĭt'tȧ-gē'tan. A North American Indian linguistic family. See Haida.

SKITTLES (variant of *shittle*, *shuttle*, from AS. *scēotan*, OHG. *sciozan*, Ger. *schiessen*, to shoot; ultimately connected with Skt. *skand*, to leap, Lat. *scandere*, to climb). A sport similar to bowling. The nine pins are set in the same pattern at the end of an alley, but are much heavier, weighing nine pounds each. The ball, which is of a different pattern from that used in bowling, is in the shape of a flat cheese rounded at the edges and usually weighs from 12 to 14 pounds. It is cast at the pins and not rolled. No hit counts which is caused by a rebound of the ball from the alley's side. Each skittle fairly downed counts one. It is a game considerably played in Great Britain in the agricultural districts, but in the eastern counties the usual number of pins is four, one at each angle.

SKLALAM, sklăl'*a*m. See Clallam.

SKOBELEV, skŏ'be-lyĕf, Mikhail Dmitrivitch (1843–82). A Russian general. He entered a guard regiment in 1861 and fought with renown against the Polish insurgents in 1863. As a member of the general staff he was sent in 1869 to Samarkand, and in 1873 commanded a column in the Khiva expedition. Two years later he led the cavalry in the expedition against Khokand and after the city had surrendered pursued the fleeing Khan and took him prisoner. He was made major general in 1876 and placed over the newly organized Province of Ferghana. As commander of a division in the Russo-Turkish War he stormed Lovatz (Sept. 3, 1877) and fought bravely around Plevna, which he occupied on December 10, after the defeat of Osman Pasha. He led the Russian advance over the Balkans and on Jan. 9, 1878, with Generals Mirski and Radetzky, captured the Turkish forces in the Shipka Pass, proceeding thence to Adrianople. In 1880 he was once more in Turkestan to help suppress the marauding Tekké tribes and achieved a brilliant feat in the storming of Geök-Tepe (Jan. 24, 1881). In the same year he was made Governor of Minsk and became prominent as an ardent advocate of Pan-slavism. He died at Moscow, July 8, 1882.

SKO'DA, Joseph (1805–81). An Austrian physician, born at Pilsen, Bohemia. After studying in Vienna and practicing in Bohemia, he was detailed in 1833 to the Public Hospital in Vienna, where he became chief physician (1841) and professor in the clinic (1846). He was elected to the Academy of Sciences in 1848. In 1871 he retired. His *Abhandlung über die Auskultation und Perkussion* (1839; 6th ed., 1864) marked a new epoch in diagnostics, by demonstrating the principle that the physical symptoms observed in a patient only indicated certain physical conditions in his organism, whereupon it devolved upon the rational physician to draw his conclusions as to the real internal disease from his pathologic-anatomical experience. This was in opposition to the French doctrine, until then prevalent, which interpreted the physical symptoms immediately as the signs of a definite process of disease.

SKOKOMISH, skô-kŏ'mĭsh. A tribe of Salishan stock (q.v.) formerly occupying both sides of Hood's Canal on Puget Sound, Washington, and now gathered upon a small reservation near Union, within their own limits. In characteristics they resembled the neighboring Nisqualli and Puyallup (qq.v.), excepting in language. The women were expert in weaving hair cloth, mats, and baskets. The men usually went naked, the women wearing a skirt of twisted strands. In war the men had helmets of cedar bark with body armor of quilted elkskin or strips of wood. Scalping was not practiced. Head-flattening was universal. At death, slaves were sacrificed according to the rank and wealth of the deceased, these frequently being starved or tied to the corpse and left to perish. The great ceremonial was the potlatch (q.v.). The Skokomish have now decreased to 195.

SKOPLIE, skōp'lyĕ. See Uskup.

SKOPTSY, skŏp'tsĭ (Russ., eunuchs). A Russian religious sect practicing castration. Instances of this practice occur at an early period, but the movement increased at the middle of the eighteenth century. In 1772 Catharine II severely punished the leading heretics. This movement reached its height in 1871 under Lisin, "second Redeemer and Tsar Peter III"; he was sent to Siberia in 1876, and prosecutions have been continued since. The Skoptsy have emigrated in masses, chiefly into Rumania.

SKOWHEGAN, skou-hē'gan. A city and the county seat of Somerset Co., Me., 18 miles north of Waterville, on the Kennebec River, here spanned by two bridges (Map: Maine, C 4). It has a public library, a fine court house, Somerset Hospital, and Coburn Park. There are manufactures of woolen and worsted goods, shoes, sash and blinds, canned corn, foundry and machine-shop products, etc. It is important as a shipping point for dairy products. Pop., 1900, 5180; 1910, 5341. Skowhegan was incorporated as Milburn in 1823. It received its name, the old Indian name for the place, in 1836. Consult Hanson, *History of the Old Towns of Norridgewock and Canaan, comprising Skowhegan* (Boston, 1849).

SKRAM, skrăm, Peder (c.1500–1581). A Danish naval hero and Senator, whose popular nickname was "Denmark's Dare-devil." He was born near Horsens in Jutland. For his services in the war with Sweden (1518–20) he was given an estate in Norway, then under the Danish crown. During the "Count's War" he reorganized the Swedish fleet for Gustavus Vasa, then an ally of the Danish King Christian III, and with it operated successfully against the Hanseatic naval forces. In the political disturbances brought about by the reformation and other causes, Skram—now a senator—was one of the leaders who destroyed the German influence at the Danish court. He resigned his commission as admiral in 1555 on account of ill health, but in 1562 was induced to take command of a large fleet against the Swedish forces, which he defeated and drove behind the Skerries. Skram and Trolle made Denmark supreme on the northern seas.

SKREFSRUD, skrāfs'rōōd, Lars Olsen (1840–1910). A Norwegian missionary and philologist. He was born in Faaberg, Gudbrandsdal, and died in Santalia, India. He was early a mechanic. He taught himself English, French, German, Latin, and Greek, and went to Prochnow's Mission School in Berlin; then after learning Hindustani he was sent by the Goszner Mission in 1863 to the Kol people of India. With H. P. Börresen, from Denmark, he later founded Ebenezer Station among the Santals (1867). His lectures in London attracted wide attention, and Santal committees for his support were formed in England, Norway, and Denmark. He visited America in 1894–95. As a missionary he enjoyed unusual success. His genius for languages is shown by his *Grammar of the Santhal Language* (1873), his translation of the Bible into Santali, with Bodding, and his great *Santhali-English and English-Santhali Dictionary* (1904), on which he worked 35 years.

SKRIABINE, skryä'bēn, Alexander. See Scriabine.

SKRINE, skrēn, Nesta Higginson (Mrs. Walter Skrine; pen name Moira O'Neill) (?–). An Irish poet, whose work was a part of the so-called Irish Literary Revival. (See Irish Literature, *Irish Literature in English.*) Her poetry breathes the very spirit of the peasant life in Antrim, and is genuinely Irish in its mingled pathos, wit, and humor. Of an old Ulster family, Mrs. Skrine was born Nesta Higginson. She married Walter Skrine, and lived for a time with him on a ranch in Canada, but both of them subsequently settled in Ireland. Her poems, which originally appeared—most of them—in magazines, were collected in *Songs of the Glens of Antrim* (1900). In prose she wrote *An Easter Vacation* (1893) and *The Elf-Errant* (1895).

SKU'A (Norw. *skŭa*, Icel. *skūmr*, *skūfr*, skua), or Jaeger Gull. A gull (q.v.) of the subfamily Stercorariinæ, in which the nostrils open beneath the edge of a horny cere and other structural peculiarities exist, sufficient, in the opinion of some ornithologists, to entitle this group to family rank. These birds are rapacious, attacking and annoying terns and small gulls and compelling them to drop fish they have already taken. The Antarctic species strike down living birds as hawks do. They are about 20 inches long and about 4 feet in extent of wings, with plumage dusky above and usually white below. Consult Edmund Selous, *A Bird Watcher in the Shetlands* (New York, 1905).

SKULL (Icel. *skăl*, bowl, cup; connected with AS. *scale*, Eng. *scale*, bowl, balance, cup, and with AS. *scealu*, *sceale*, OHG. *scala*, Ger. *Schale*, husk, scale). The bony framework of the head, divided into two parts, the cranium and the face. In human anatomy it is customary to describe the former as consisting of eight and the latter of 14 bones; the eight cranial bones, which constitute the brain case, being the occipital, two parietal, frontal, two temporal, sphenoid, and ethmoid; while the 14 facial bones are the two nasal, two superior maxillary, two lacrymal, two malar, two palate, two inferior turbinated, vomer, and inferior maxillary. The ossicles of the ear, the teeth, and the Wormian bones are not included in this enumeration. At a very early period of fœtal existence the cerebrum is inclosed in a membranous capsule external to the dura mater and in close contact with it. This is the rudiment of the skull, its cerebral portion thus formed before any indication of a facial part. Soon four or five processes jut from it on each side of the mesial line, grow downward, incline towards each other, and unite to form a series of inverted arches, from which the face ultimately develops. Imperfect development or ossification of these rudimentary parts of the face gives rise to peculiarities known as harelip (q.v.), cleft palate, and in extreme cases to the form of monstrosity termed cyclops, in which, from absence of the frontal processes, the two orbits form a single cavity, and the eyes are more or less blended in the mesial line. See MONSTROSITY.

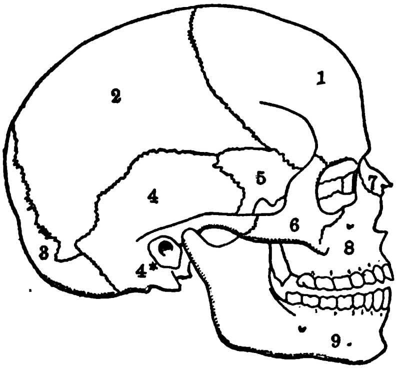


FIG. 1. SIDE VIEW OF HUMAN SKULL.

1, frontal bone; 2, parietal bone; 3, occipital bone; 4, temporal bone (squamous portion); 4*, same (mastoid portion); 5, sphenoid bone; 6, malar bone; 7, nasal bone; 8, superior maxillary or upper jawbone; 9, inferior maxillary or lower jawbone.

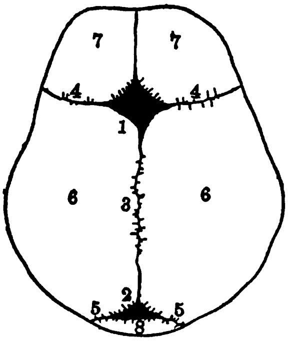


FIG. 2. TOP VIEW.

1, anterior fontanel; 2, posterior fontanel; 3, sagittal suture; 4, 4, coronal suture; 5, 5, lambdoid suture; 6, 6, parietal bones; 7, 7, two halves of the frontal bone, still ununited; 8, occipital bone.

The succession of events that occur in the normal development of the skull is as follows: cartilage is formed at the base of the membranous capsule, which has been already described as thrown round the brain and capable of enlarging with it. This is followed by the deposition of osseous matter at various points of the capsule, which soon becomes converted into flakes of bone, affording protection for the brain, while the intervening portions, which remain membranous, permit the skull to expand as its contents enlarge. The formation of these bony flakes on the convexity of the cranium is followed by the appearance of osseous nuclei in the cartilage at the base, corresponding to the future occipital and sphenoid bones. Lastly, the various bones, some originating in membrane and some in cartilage (see OSSIFICATION), approach one another by gradual enlargement and become united in various ways, forming a continuous and ultimately an unyielding bony case for the defense of the brain, for the accommodation of the organs of special sense, and for the attachment of the ligaments and muscles by which the skull is supported and moved on the spine. At birth most of the principal bones have grown into apposition with their neighbors, forming the sutures; but one large space remains at the meeting point of the parietal and frontal bones, which is termed the anterior fontanel, and which does not close till the second year after birth or even later. There are two fontanels in the mesial line, as shown in Fig. 2, and two lateral fontanels on each side.

After the sutures have been formed and the skull has acquired a certain thickness a process of resorption begins in the interior of the bones, and reduces the originally dense structure to a more or less cellular or cancellated state. The interior thus altered is called the *diploë*, and by this change the weight of the skull is much diminished, while its strength is scarcely affected.

The growth of the skull after the seventh year proceeds slowly, but slight increase goes on to about the age of 20. The skull bones are freely supplied with blood from arteries which pass from the dura mater internally and the pericranium externally through numerous foramina.

The base of the skull seen from within presents on each side three fossæ, corresponding to the anterior and middle lobes of the cerebrum and to the cerebellum. These fossæ are marked, as is the whole skullcap, by the cerebral convolutions, and they contain numerous foramina and fissures which give passage to nerves and blood vessels. The external or outer surface of the base of the skull, considered from before backward, is formed by the palate processes of the superior maxillary and palate bones; the vomer; the pterygoid and spinous processes of the sphenoid and part of its body; the under surface of the temporal bones; and the occipital bone. The hard palate is formed by the palate processes of the superior maxillary bone.

The anterior region of the skull, which forms the face, is of irregularly oval form, the bones so arranged as to inclose the cavities for the eyes, nose, and mouth, and to give strength to the apparatus for masticating food. The size of the face and the capacity of the cranial cavity stand in inverse ratio one to another, as may be seen by comparing vertical sections (through the mesial line) of human and other mammalian skulls; and if, in place of mammalian skulls, we take skulls of lower vertebrates (the crocodile, e.g.) this ratio is far more striking. In man the face is at its minimum as compared with the cranial cavity, chiefly in consequence of the facial bones being arranged in a nearly vertical manner beneath the cranium, instead of projecting in front of it. The human face is also remarkable for its relatively great breadth, which allows the orbits for the reception of the eyes to be placed in front instead of on the sides of the head, and renders their inner walls nearly parallel, thus contributing, through the parallelism of the optic axes, to that accurate vision which results from the ready convergence of the eyes upon every object. For description of the orbit, see ORBIT (of the eye); of the nasal cavities, see NOSE.

The different varieties of mankind present certain well-marked and characteristic peculiarities in the form of a skull. Three typical forms of the skull seem to be well established from comparison of a large number of crania—the prognathous, the pyramidal, and the oval or elliptical cranium. When the upper jaw slopes forward the insertion of the teeth, instead of being perpendicular, is oblique. A skull with this peculiarity is prognathous or prognathic, the opposite condition being termed orthognathous or orthognathic. The negro of the Guinea coast and the negrito of Australia present the prognathous character in its most marked form. The pyramidal shape is characterized by the breadth and flatness of the face, which, with the narrowness of the forehead, gives this appearance to the head. The Mongolian and Eskimo skulls belong to this type. The oval or elliptical type is that which is presented by the natives of western or southern Europe, and is not distinguished by any particular feature so much as by the absence of the longitudinal projection of the first type, or the lateral projection of the second, and by a general symmetry of the whole configuration. For the skull as a basis of classification in anthropology, see ANTHROPOMETRY.

The Morphology of the Skull is the highest and most difficult problem of comparative anatomy. Huxley destroyed the archetypal theory, previously held by Owen and others, and established the newer theory on sure grounds of actual observation. Taking first the unsegmented cranium of a skate or dogfish, with its appended jaws and arches, we find that in development, though the notochord extends into the region of the head, the vertebræ stop short of it; but that on each side of the cranium there arise a pair of cartilaginous bars, the *trabeculæ* or rafters of the future skull; three pairs of cartilaginous capsules, nasal, ocular, and auditory, form round the developing sense organs; the nasal capsules unite with the ends of the trabeculæ, which are meanwhile uniting below and growing up at the sides to form the brain case. The auditory capsules become united with the trabeculæ by the appearance of two new masses of cartilage, the parachordals. The first pair of a series of seven or more arches develops an ascending process, becoming the palatopterygoid arch or upper jaw. The second pair of arches, the hyoid, is modified to support the jaws, while the rest are modified to support the gills. In the bony skulls of higher vertebrates the chondrocranium and subjacent arches develop in the same way. The bones originate in two distinct ways: either by actual ossifications or by the ossification of overlying derma, known as cartilage bones and membrane bones respectively, the latter corresponding to the dermal bones and teeth of ganoid and elasmobranch fishes. In mammals the ends of the mandibular and hyoid arches lose their suspensory function, are taken into the interior of the ear capsule, and are metamorphosed into the auditory ossicles. See SKELETON.

Fracture of the Skull may take place either in the vault or at the base. In the vault the fracture is usually direct, the bone giving way at the point at which it was struck, and the result being either a simple fissure or a breaking of the bone into several fragments (a comminuted fracture). Although fractures may be limited to the outer or to the inner table of the skull, they most commonly extend through the whole thickness, and the broken bone is generally driven inward; and the most ordinary form of fracture with depression is that in which several fragments of a somewhat triangular form have their points driven down and wedged into each other, while their bases remain on a level with the surrounding bone. Fracture of the vault may be easily overlooked. Fissures involving the whole thickness of the bone occasionally exist without ever having been suspected during life, and even an extensive and comminuted fracture, with great depression of the fragments, may escape notice when hidden under the temporal muscle or under great extravasation of blood. When the fracture is accompanied by a wound leading down to the bone, it may, in general, be easily detected. With regard to treatment, it is now an established rule that simple fractures of the skull with depression and without symptoms are to be let alone. The depression may be so marked as to be easily detected; and yet so long as there are no symptoms operative interference is, as a rule, to be avoided. If, however, there be a wound leading down to the bone in a depressed fracture without symptoms, operative measures may be called for. When a depressed fracture is accompanied by primary brain symptoms an operation for the purpose of raising or removing the depressed fragments is usually necessary. Cases occasionally occur in which urgent symptoms of cerebral pressure, such as unconsciousness or convulsions, persist for a long time and are relieved at once on the pressure being removed.

Fractures of the Base may be direct or indirect, but in most cases are indirect, i.e., the bones give way at a point remote from the seat of the blow. At certain parts, however, the bones of the base are so thin that if direct pressure be brought to bear upon them they readily give way. Thus scissors, slate pencils, knitting needles, and other objects have often been thrust into the skull through the orbits or the nostrils and have given rise to wounds which are very serious because of the readiness with which the brain may be injured and bacteria introduced. The only symptoms that can be depended upon as indicating a fracture of the base of the skull are connected either with an escape of the substance of the brain, or blood, or watery fluid, or with an injury done to the nerves as they emerge at the base. Bleeding from the mouth or nose or from the ear occurs in about half the cases. A copious watery discharge from the ear was formerly regarded as a diagnostic sign of fracture of the base. Operative interference is very seldom required in these fractures. Consult: Harrison Allen, "Clinical Study of the Skull," in Smithsonian Institution, *Miscellaneous Collections*, vol. xxxiv (Washington, 1890); Heinrich von Eggeling, *Physiognomie und Schädel* (Jena, 1911), containing a bibliography; L. B. Rawling, *Surgery of the Skull and Brain* (Oxford, 1912); also general works on comparative anatomy and physiology.

SKUNK (from Abenaki *seganku*, Cree *seecawk*, skunk). A fur-bearing mammal of the genus *Mephitis* of the weasel family (Mustelidæ), approaching the badgers in the lengthened claws of the forefeet, in the plantigrade hind feet, in dentition, and in habits. Skunks are found only in America, distributed in many species from northern Canada to Patagonia. They are of moderate size, with long hair, bushy tails, and black and white markings. All have nocturnal habits and are noted for excessive development of the anal glands, common to most of the family (see BADGER; POLECAT; ETC.), from which an acrid fetid discharge may be projected to a considerable distance. The best-known species to which the name ordinarily refers are the common skunks of eastern North America (*Mephitis mephitis* and *putida*), which are numerous from New England and Canada, nearly as far to the north as timber grows, south to Virginia. The body is about 18 inches long and the tail about 9 inches, but considerable variation occurs, and females are always smaller. In the United States and Canada, as a whole, nine species, comprising 18 forms, are recognized.

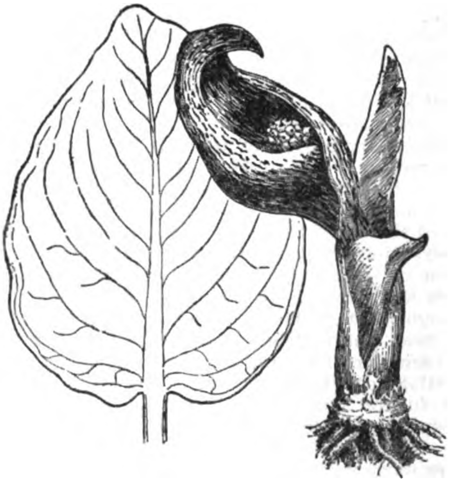
Skunks are wholly terrestrial and live in dens and burrows, usually of their own excavation. They are sluggish in movement and usually show little fear of human beings. Although chiefly nocturnal, they are often seen in the daytime. They hibernate only during the severest part of the winter. Five to seven young are born in May in the north. Their food consists largely of mice, reptiles, insects, and birds' eggs. In many parts of the United States they destroy the white grubs, a great pest in lawns and meadows. They occasionally rob the poultry yard, but this is offset by their destruction of noxious mammals and insects. Skunks have been trapped for furs ever since the settlement of the country by white men, and attempts have been made to breed them in confinement, meeting with some success. The fur is sometimes sold under the name "Alaska sable." Apparently there is but one molt in a year, occurring in late summer or in autumn.

That which particularly distinguishes skunks from other animals is their means of defense—the ejection of a malodorous fluid, speedily discouraging the boldest aggressor. The fluid is secreted by two anal glands like those possessed by other members of the Mustelidæ, but larger and more muscular. They lie one on each side of the rectum and are embedded in a dense, gizzard-like mass of muscle, which serves to compress them so forcibly that the contained fluid may be ejected to the distance of 15 feet. Each sac is furnished with a single duct that leads into a prominent, nipple-like papilla that is capable of being protruded from the anus and by means of which the direction of the jet is governed. This liquid causes acute distress when in contact with mucous membrane, as, e.g., the eyes.

The skunks west of the plains are divided into several species, that of the northwest being *Mephitis hudsonica*. In the southern and western United States and throughout Mexico occur also small striped skunks of another genus (*Spilogale*), marked with four narrow stripes breaking into spots and crossbars on the rump; these are called zorillos in the Spanish-speaking countries. Still another well-known form is the conepate, mapurito, or white-backed skunk (*Conepatus mapurito*), which is found from Arizona throughout Central and South America.

Bibliography. Elliott Coues, *Fur-Bearing Animals* (Washington, 1874), and the many authorities therein referred to; C. H. Merriam, "Mammals of the Adirondack Region," in *Transactions of the Linnæan Society of New York*, vol. i (New York, 1882); *North American Fauna, Nos. 4, 20, 26* (Washington, 1890–1906); E. T. Seton, *Life-Histories of Northern Animals* (New York, 1909); Stone and Cram, *American Animals* (new ed., ib., 1914); F. M. Holbrook, *Skunk Culture for Profit* (Chicago, 1915). See Plate of MINOR CARNIVORES with CARNIVORA.

SKUNK CABBAGE (so called because of the fetid odor), *Symplocarpus fœtidus*, or *Spathyema fœtida*. A plant of the family Araceæ, growing in bogs and moist ground from Nova Scotia to Florida and west to Missouri and Minnesota. The hooded, shell-shaped, rather fleshy, variegated purplish spathe appears in earliest spring before the smooth, radical, ovate, heart-shaped leaves. All parts of the plant, especially when bruised, emit a fetid skunkish odor. The fruit, which ripens in September, is a roughened globular mass 2 or 3 inches in diameter. In the northwestern United States, extending through Alaska to Japan and Siberia, is a related plant (*Lysichitum camtshatcense*), which from its resemblance to the above is also called skunk cabbage. The name given the skunk cabbage by Linnæus was *Dracontium fœtidum;* however, the name *Dracontium* is now given to a genus of about a dozen species of tropical aroids which have somewhat similar flowers, but a very different habit of growth.



SKUNK CABBAGE.
Leaf much reduced as compared with spathe.

SKUNK PORPOISE. The bay porpoise, so called on account of its variegated black and white markings. See PORPOISE, and accompanying illustration.

SKUNK TURTLE. The musk turtle, or musk tortoise (q.v.), so called in reference to its vile odor.

SKUPSHTINA, skụpsh-tē'nȧ (Serv., assembly). The name of the Servian national parliament. See SERVIA.

SKUTARI. See SCUTARI.

SKY. See ATMOSPHERE; CLOUD; DUST.

SKYE, skī. The second largest of the Scottish islands and the most northerly of the inner Hebrides (q.v.), forming part of the County of Inverness, from the mainland of which it is separated by a narrow channel (Map: Scotland, B 2). Area, 535 square miles. Skye has mountain and moor, but contains arable and pasture land. The Coolin Hills stretch irregularly from southwest to northeast, culminating in the peaks of Scoor-nan-Gillean (3167 feet) and Scoor

Dearg (3233 feet). The most famous scene in this region, immortalized by Sir Walter Scott in the *Lord of the Isles*, is Loch Coiruisg, a fresh-water lake near the end of the Bay of Scavaig. Glen Sligachan has fine Highland scenery. The coasts abound in extensive fisheries of herring and cod, and lobster catching is also carried on. Sheep raising engrosses almost exclusively the attention of the farmers. The island produces a well-known breed of pet dog. The principal exports are cattle and sheep, wool, fish, shell fish, and eggs. There are manufactures of tweed at Portree and of whisky at Carabost. The principal port of Skye is Portree, a picturesque village. Among the famous castles are those of Armadale and Dunvegan. Pop., 1901, 14,642; 1911, 14,278, chiefly Celtic, with a mixture of the Norse element. The common language is Gaelic. Consult: Smith, *A Summer in Skye* (Edinburgh, 1885); A. P. Abraham, *Rock-Climbing in Skye* (New York, 1908); James Boswell, *Tour in the Hebrides*, in Everyman's Library (ib., 1909).

SKYE TERRIER. See Terrier.

SKYLARK. A European lark (*Alauda arvensis*), the lark (q.v.) par excellence of Great Britain, which, notwithstanding the dullness of its brown plumage, is a universal favorite on account of the sweetness of its song, which it pours forth while flying. More rarely it sings on the ground. It is in great repute as a cage bird and sings well in confinement, fluttering its wings while singing, as if still desirous of liberty. It abounds in open but cultivated districts and is common in most parts of Europe, but from the north it migrates southward before winter. It is a native of Asia and a winter visitant to north Africa. It has been introduced into America and has become naturalized on Long Island. It makes its nest generally in an open field and often under shelter of a tuft of herbage or a clod of earth, lays four or five mottled eggs, and generally produces two broods in a season. It is not gregarious in summer, but in winter large flocks assemble, and at this season many are taken for food in the south of Europe by trapping. See Plate of Larks and Starlings.

The crested lark (*Alauda cristata*), very similar in size and plumage to the common lark, but having the feathers of the crown of the head more distinctly developed into a crest, although a very common bird in many parts of Europe, has very seldom been seen in Great Britain. The wood lark (*Alauda arborea*), a smaller species, not infrequent in England but rare in Scotland, is a bird of very delightful song and usually sings perched on the branch of a tree. It frequents wooded districts and is also a favorite cage bird. The nearest American representative of these birds is the shore lark (q.v.). Consult J. L. Bonbote, *Birds of Britain* (London, 1907).

SKYROCKETS. See Pyrotechny.

SKYROS. See Scyros.

SKYSCRAPER. A popular term to designate a tall office building, such as has become an American type since about 1891. At that time the modern system of steel-frame or skeleton construction began to be developed, first in Chicago, then in New York, making possible edifices of over 10 or 12 stories, the previous limit. The highest of modern skyscrapers is the Woolworth Building of New York, over 760 feet high, whose summit is at times actually lost in the low fog clouds that occasionally settle over the city. See Office Buildings; Steel Skeleton Construction.

SLA, slä. A seaport of Morocco. See Sallee.

SLABY, slä'bė, Adolf (1849–1914). A German engineer, born in Berlin and educated there. He was instructor at the Royal Industrial School in Potsdam (1873), at the Industrial Academy in Berlin (1876). In 1882 he became professor of the theory of machines and electricity at the Technical Institute in Charlottenburg and (1884) director of the electrotechnical laboratory there. In 1902 he was made professor in the University of Berlin. He wrote: *Versuche über Kleinmotoren* (1879); *Kalorimetrische Untersuchungen über den Kreisprozess der Gasmaschine* (1894); *Die neuesten Fortschritte auf dem Gebiete der Funkentelegraphie* (1901).

SLADE, släd, Felix (1790–1868). An English antiquary, born in Lambeth, then a suburb of London. On the death of his elder brother he inherited the family estate of his mother in Yorkshire, known as Halsteads. In 1866 he was elected a member of the Society of Antiquaries. Slade expended a large fortune in collecting books, bindings, engravings, manuscripts, carvings, glass, and pottery, which were bequeathed to the British Museum, and bequeathed £35,000 for art professorships at Oxford, Cambridge, and University College, London. John Ruskin was the first Slade professor at Oxford. Consult the *Guide to the Slade Collection of Prints in the British Museum* (1869) and the *Catalogue to the Slade Collection of Glass* (London, 1869).

SLA'DEN, Douglas (Brooke Wheelton) (1856–). An English author, born in London. He studied at Trinity College, Oxford, and went to Australia (1879), where he became the first professor of history in the University of Sydney. Subsequently he traveled much and settled in London as a writer. His work includes: *Frithjof and Ingebjorg* (1882); *Poetry of Exiles* (1883); *In Cornwall and Across the Sea* (1885); *Edward the Black Prince* (1886), an epic drama; *The Spanish Armada* (1888); *The Japs at Home* (1892); *A Japanese Marriage* (1895); *A Sicilian Marriage* (1905); *Egypt and the English* (1908); *The Unholy Estate* (1912); *Twenty Years of my Life* (1913); *Queer Things about Japan* (1913); *The Real "Truth about Germany"* (1914); *His German Wife* (1915).

SLAG (Swed. *slagg*, dross, slag; connected with Goth., OHG. *slahan*, Ger. *schlagen*, to strike, AS. *slēan*, Eng. *slay*), Scoria. Fused compounds resulting from the reduction of a metal from its ores. In fire metallurgy of ores sufficient quantities of materials are added to facilitate the fusing of the nonmetallic elements, which are thus separated from the metals. The fused earthy matter is called slag. It consists of compounds of silica in combination with lime, alumina, or other bases. Some metal usually remains in the slag, and in the early days of smelting so much metal was so lost that many ancient slag piles are being reworked now at a profit. Depending on the composition and rate of cooling slags are glassy, crystallized or stonelike, and earthy. Slags are now utilized in many ways. (See Iron and Steel; Cement.) Paving and building blocks are molded from it. Railroad ballast and road surfacing utilize much of the supply, while much is also used in making cements. Slags from basic steel processes contain much phosphorus and consequently are made use of in the production of fertilizers.

SLAN'DER (OF. *esclandre, escandele, scandele,* from Lat. *scandalum,* from Gk. *σκανδάληθρον, skandalēthron,* stumblingblock, offense, scandal; connected with Lat. *scandere,* to climb). Defamation committed by speech, either by vocal sounds or by the sign language of the deaf and dumb. English law distinguishes sharply between libel (q.v.) and slander. The latter is "actionable only when special damage can be proved to have been its proximate consequence, or when it conveys imputations of certain kinds." (For enumeration of these special imputations, as they existed at common law, see Defamation.) In England and in many of the United States the oral imputation of unchastity to a female has been declared actionable by statute without proof of special damage.

Although slander is one of the few torts in which malice (q.v.) is an essential element, that term in this connection means only that the defamation must have been uttered without just cause or excuse. Actual ill will on the part of the speaker towards the plaintiff is not necessary, unless the occasion of its utterance was conditionally privileged, as in the case of a statement by a master about the character of a servant made to one whose inquiries he may lawfully answer in good faith.

As slander consists in uttering words to the injury of another's reputation, it follows that they must have been uttered to, or in the hearing of, third persons who understood them. It is not essential, however, that the speaker knew of the presence of the others. Even though they were concealed from him, if they overheard his slanderous words, a case of "publication" by him is made out. Nor is it any defense to one who reports a slanderous statement that he gave the name of his informant and expressed no opinion as to its truth. Of course, the truth of the defamatory matter may be set up as a defense; for the law will not permit a man to recover damages in respect of an injury to a reputation which he ought not to possess. The plaintiff need not prove the falsity of the alleged slander, however, as that is presumed from its defamatory character. Hence, if the defendant does not prove truth as a defense, he may be liable.

It is sometimes difficult to determine whether particular language is slanderous or whether it is only "fair comment." This difficulty is generally one of fact, to be solved by the jury. The rule of law on this topic seems to be: Where a person has done or published anything which may fairly be said to have invited comment, every one has a right to make fair and proper comment thereon. He may freely criticize such acts or publications; but his criticism must be limited to their character and consequences and not directed against the personality of the actor. Consult: Sir Frederick Pollock, *The Law of Torts* (8th ed., London, 1908); W. B. Odgers, *Digest of the Law of Libel and Slander* (5th ed., ib., 1911); M. L. Newell, *Law of Slander and Libel in Civil and Criminal Cases* (3d ed., Chicago, 1914). See Defamation; Privileged Communication; Tort.

SLANDER OF TITLE. The disparagement of the property of another to his damage by false and malicious statements. This species of tort (q.v.) took its name from the fact that for a considerable period its only form was that of disparaging misrepresentations of a person's title to real property. At present it is extended to such statements concerning any property interest. Accordingly a disparaging publication about the quality of a public dinner served by a caterer, or about the age of a race horse, or about the right to use a particular trademark, if false and malicious and causing special damage to the plaintiff, is an actionable slander of title. It will be observed, therefore, that the name has ceased to be really descriptive of the tort. The wrong may be committed without slandering any one and without affecting title to any property, and it is immaterial whether the statement is oral or in writing, except that the damages are likely to be larger in the latter instance.

Not only must the malicious statement cause actual damage, but it must be a statement of fact and not one of opinion merely. Not being an action for injury to the person, slander of title is not subject to the common-law rule that a personal action dies with the person.

SLANG (origin uncertain; probably a cant use of the archaic preterite *slang,* regarded as a participle of *sling,* AS., OHG. *slingan,* Ger. *schlingen,* to fling, sling). Colloquial words and phrases originating chiefly in the lower classes of society or in professional jargon. The term may also include words and phrases formally in harmony with the standard usage, but which in meaning diverge from this norm so far as to be generally considered inelegant and vulgar. The importance of slang in the semasiological development of language (see Semasiology) is great, for it tends to enrich the language with new words and add new meanings to terms which it already contains. Condemnation of slang, therefore, finds little support from a linguistic point of view. Slang is the radical counterpart of conservative purism, and the two exercise a constant check on each other as a necessary condition to the development of language. It need hardly be added that vulgar slang is to be condemned unsparingly. Slang is furthermore the vocabularistic side of dialect and accordingly governed by the laws controlling dialectic growth. (See Dialect.) If therefore a given slang expression is found for any reason to supply a need on account of its shade of meaning or its superior convenience over a word in use, it may be adopted, though often on sufferance, into the standard language. The life of the average slang word is short. Such a term may, however, ultimately become recognized even by the most conservative purist and thus lose its character as a slang word, as "blizzard," "skyscraper," and "graft" which, originally slang, are now standard in America.

The basis of slang is metaphor (q.v.). In poker players cash their "chips" at the close of the game. Hence comes the phrase "to pass in his chips," as equivalent to death. Again, a girl, as being plump and of a peachlike complexion, is called a "peach"; or as being dignified and of exceptional beauty, a "queen"; while a clumsy, inept person is named a "lobster." Though such terms, drawn intentionally from slang unrecognized in literature, seem at first sight vulgar, equally violent transfers of meaning have been made in course of time in literary usage. The evolution of the French *tête,* head, from the Latin *testa,* jar (found also in the later Latin poets in the sense of "skull"), is in itself no better than the English "mug" for "face," yet *tête* is considered standard, while "mug" is regarded as slang. On the other hand, certain words and phrases formerly regarded as strictly literary are now slang, at least in certain collocations. As familiar examples of this may be cited "awful," "fierce," "keen," "wise," in such phrases as "an awful swell," "a fierce hat," "to be keen on something," or "to put a man wise." Not only does the inexact use of the word make it slang, but frequently it seems to be the brevity and commonness of the term which render it objectionable. Akin to this class is the slang of clipped words, as "enthuse" for "make enthusiastic," "beaut" for "beauty," "gent" for "gentleman," etc. The objection to such words seems justifiable on linguistic as well as on æsthetic grounds. A prolific source of slang is euphemism, especially that which is based on propriety. Akin to euphemistic slang are clipped oaths, now little used, though common in earlier English. Examples of these are "zounds," "od's life," "by cock and pie," and in modern usage the rustic oaths "dod rot," "gol darn," "I swan," and the low city form "hully Gee." Another class of slang comes from foreign languages. This enters, as a rule, among the higher circles of society and is therefore wider in vogue and more lasting in vitality. Here belong *fin de siècle,* "up to date," *bon-ton,* "high society," as well as translated expressions, as "to save one's face," i.e., "to preserve one's credit or self-respect in the eyes of others."

Every grade of society and almost every profession has its slang. These varieties are so different as to be almost unintelligible in other circles. The slang of the race course, prize ring, and barroom are distinct from one another and stand in marked contrast to the slang of the cultured classes. Here, again, there are separate slangs for the artist, the actor, the stockbroker, the club man, and the university man. It is in the colloquialisms of the two latter classes, indeed, that slang is found which is not so inconsistent with good taste. Intrinsically there is no reason why one slang should be preferred to another, and it is as proper to speak in low slang of "winning by a neck," or "putting to sleep," or "rushing the growler," as to use the high slang of "a slump in the market," "doing a turn," "skying a picture," or "boning up with a crib for an exam." The only criterion is the exact, intelligible expression of the idea.

Closely connected with professional slang is cant, and the two often overlap so as to be distinguishable only by some arbitrary rule. Cant differs from slang in that it is originally intentionally unintelligible to any but members of the profession, although it may of course spread even into the literary language. Cant, like slang, is of all grades. It ranges from thieves' cant, as "douse the glim" for "put out the light," or "pinch a cove's wad and ticker," for "steal a man's money and watch," through stage cant, such as "see the ghost walk," for "to get one's salary," "angel" for "patron," up to financial cant, as "a flyer in futures," and artists' jargon, as "to chic" for "to sketch from memory," or "to sky a picture" for "to hang it too high in an exhibition."

Among the many minor varieties of slang may be mentioned back, centre, and rhyming slang. Back slang is founded by roughly spelling words backward. Centre slang is more elaborate. The middle vowel of the word to be turned into slang is taken as the initial letter, followed by the latter part of the original word. To this the first part of the word is added. In rhyming slang a phrase which rhymes with the word to be disguised is substituted, as "apples and pears" for "stairs." The necessity of slang is shown by its universality. Not only is it current in all modern languages, but it is used by the most cultured society, despite puristic attempt to suppress it. It is not a characteristic of modern languages alone, for it abounds in the more popular literature of Greece and Rome, as in the comedies of Aristophanes and Plautus, or in the *Satyria* of Petronius.

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SLATE (OF. *esclat*, Fr. *éclat*, splinter, fragment, from OHG. *slizan*, Ger. *schleissen*, AS. *slitan*, Eng. *slit*). A hard fissile rock which has been produced from shale or clay, or more rarely igneous rocks, by metamorphism. This process by means of heat and pressure, aided also possibly by moisture, consolidates the original rock and obliterates the original stratification, developing new lines of parting or cleavage planes along which slate splits easily and in thin layers. Many fine-grained shales which split readily along the bedding planes are erroneously called slate, but true slate is a hard and compact rock, little likely to be acted on by the weathering agencies. Owing to its origin, slate is found only in regions of metamorphic rocks, and therefore its geographical distribution is somewhat restricted. Its geological range extends from the Cambrian to the Jurassic. Slate is commonly bluish black or gray black in color, but red, green, purple, and variegated varieties are known. In the United States the most important slate quarries are in Maine, Vermont, New York, Pennsylvania, Maryland, and Georgia. A small production is also made in California and Arkansas. The supply of slate in Europe is derived mostly from Wales and France.

Slate is usually quarried in open pits and less rarely by underground workings. The rock splits best when it is green or freshly taken from the quarry. Slate is extensively employed as a roofing material and for sinks, washtubs, billiard-table tops, electrical switchboards, flooring, mantels, blackboards, school slates, pencils, and in acid towers. The tests applied to slate are those of absorption, frost resistance, abrasive resistance, toughness, resistance to acids and electricity, and permanence of color.

Slate is classified as roofing slate and millstock. The latter is made into slabs 1 to 3 inches thick and sold at prices ranging from 4 to 50 cents per square foot.

Roofing slate is sold by the square (the number of pieces required to cover 100 square feet with 3-inch lap), and the price for ordinary No. 1 slate ranges from $3.50 to $10 per square.

The value of the slate produced in the United States in 1914 was: roofing slate, $4,160,832; millstock, $977,930; other uses, $568,025. The exports amounted to $139,125.

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See Building Stone; Metamorphism; Shale.

SLA'TER. A city in Saline Co., Mo., 12 miles northeast of Marshall, on the Chicago and Alton Railroad (Map: Missouri, C 2). It is in a rich grain and stock-raising region. Pop., 1900, 2502; 1910, 3238.

SLATER, John Fox (1815–84). An American manufacturer and philanthropist, the nephew of Samuel Slater, who introduced cotton spinning as an industry in America. John F. Slater was born at Slatersville, R. I., and after an academic training took charge of his father's woolen mill at Hopeville, Conn., and of a cotton mill near by, at Jewett City. In 1842 he removed to Norwich, Conn., and in 1872 became sole owner of the family's mills. He was a liberal benefactor of local institutions, and as his years advanced he determined to set apart $1,000,000 for the education of the freedmen. (See Slater Fund.) Congress voted him thanks and a gold medal for his benefaction. Consult the *Memorial*, privately printed in Norwich, Conn. (1885).

SLATER, Samuel (1768–1835). An American manufacturer, founder of the cotton-spinning industry in the United States. He was born in Derbyshire, England. He acquired a thorough knowledge of cotton spinning under Jedediah Strutt, the partner of Richard Arkwright, and in 1789 emigrated to the United States for the purpose of introducing the industry, leaving England secretly for fear attempts would be made to prevent departure. In January, 1790, at Pawtucket, R. I., he entered into a contract to build and equip a mill with spinning machinery like the Arkwright system. After several failures the machinery was completed and the spindles were set to work Dec. 21, 1790. In 1806, with his brother John, he constructed extensive cotton mills on the site of the present town of Slatersville, R. I., accumulating a large fortune there. By 1810 there were in the United States 100 mills in operation, all on the Arkwright system after the Slater models. In 1812 Slater constructed mills at Oxford, Mass., and in 1815–16 erected woolen mills. Consult White, *Memoir of Samuel Slater* (Philadelphia, 1836).

SLATER FUND. An endowment established by John F. Slater (q.v.) in 1882 for the encouragement of industrial education among the negroes in the South. In May, 1882, Mr. Slater transferred $1,000,000 to a board of trustees, incorporated by the State of New York, of which President R. B. Hayes was the original chairman. By good management this fund has almost doubled, and the annual income is at the disposal of the trustees for negro education in the Southern States. Bishop Haygood, Dr. J. L. M. Curry, Dr. Wallace Buttrick, and Dr. James H. Dillard have been general agents of this fund. The trustees have stood for the promotion of normal and industrial training and have given largely to Hampton and Tuskegee institutes and lesser amounts to several kindred and well-managed institutions. Consult L. P. Ayres, *Seven Great Foundations* (New York, 1911), and the annual *Reports of the United States Commissioner of Education* (Washington).

SLA'TINGTON. A borough in Lehigh Co., Pa., 17 miles northwest of Allentown, on the Central of New Jersey, the Lehigh and New England, the Lehigh Valley, and the Philadelphia and Reading railroads (Map: Pennsylvania, K 5). Structural iron, knit goods, and silk are manufactured, and there are fine slate quarries in the vicinity. Settled in 1738, the borough was incorporated in 1864. Pop., 1900, 3773; 1910, 4454.

SLATIN PASHA, slä'tên pȧ-shä', Baron Rudolf Carl (1857–). An Egyptian soldier, born near Vienna, Austria. He served for a time in the Austrian army, in 1878 entered the Egyptian service under General Gordon, and in 1881 became Governor-General of Darfur. Not long after his appointment to this post the Mahdi began his famous religious war, and in 1884, after the defeat of Hicks Pasha, Slatin was captured by the Mahdists. He became the servant of Abdullahi, who afterward succeeded to power on the death of the Mahdi. After a captivity of 11 years Slatin succeeded in 1895 in escaping to Lower Egypt. Upon reaching Cairo he was made a pasha by the Khedive. In 1900 he was appointed British Inspector General of the Sudan. He wrote *Fire and Sword in the Sudan* in 1896. In 1906 he was made Baron of the Austrian Empire. He was an honorary major general in the British army, but in the latter part of 1914 renounced this and other British honors.

SLAUGHTERHOUSE CASES. The term applied to some notable cases decided by the United States Supreme Court at the December term of 1872. The cases came from an attempt of the Legislature of Louisiana to place restrictions on the butchery industry in the interest of public health in New Orleans. The restrictions practically amounted to a denial of the right of the general public to engage in that business, and suits were brought on the ground that the statute was an infringement upon the Fourteenth Amendment to the Constitution. The cases were carried to the Supreme Court (q.v.), where it was held by a majority of 5 to 4 that it was not the purpose of the Fourteenth Amendment to deprive the States of their police power—this remained with them unimpaired; that there is a citizenship of the United States and a citizenship of a State, distinct from each other, and that the privileges and immunities belonging to the latter must rest for their security and protection where they had theretofore rested, viz., upon the States.

SLAUGHTERHOUSES. The first attempt to regulate the conduct of establishments where animals are slaughtered for food probably was made during the reign of Richard II, for in 1388 an Act of Parliament forbade the casting of offal and other refuse of slaughtered animals into rivers and other waters. During the nineteenth century a national system of municipal slaughterhouses was established in France and Germany and an agitation for a similar system of public ownership was under way in Great Britain and had been established in many towns. This great public improvement originated with Napoleon, who passed a decree in 1807 for the erection of public abattoirs.

In Germany each town council has authority to erect and maintain public slaughterhouses and to forbid the slaughtering of meat elsewhere. It may also provide regulations governing the inspection and sale of meat not slaughtered at public slaughterhouses and may prohibit the importation of prepared meats.

Inspection in England has not been made compulsory by parliamentary enactment, nor has the maintenance of municipal slaughterhouses been authorized. Abattoirs were opened in Edinburgh in 1851 and in Manchester in 1872. Throughout Europe municipal abattoirs are now considered necessary in order that not only the slaughtering of animals, but also the inspection of meat, may be concentrated and regulated.

In the United States the modern abattoir system dates from the middle of the last century, when concentration in meat packing began gradually to supersede the killing of animals on a small scale. This concentration reduced, but did not eliminate, the need for municipal control of abattoirs, whose conduct usually must conform with standards set by local health authorities. The largest packing centres of the country are Chicago, Kansas City, St. Louis, Omaha, etc., all in close proximity to the extensive cattle-feeding areas, because with the improved system of refrigerator cars it is advantageous to ship the dressed carcasses to Eastern markets rather than the live animals to be killed near the point of consumption. In these large abattoirs the division of labor is carried out to a remarkably fine degree, which renders each man extremely expert in his particular part of the work.

The United States since Oct. 1, 1906, when a meat-inspection law took effect, has had the broadest and most stringent Federal inspection of meat and meat products of all countries in the world. The inspectors are located in all abattoirs doing interstate or foreign business, and the regulations against diseased meats are very rigid. For further information and statistics, see PACKING INDUSTRY; ABATTOIR. Consult: F. W. Wilder, *Modern Packing House* (Chicago, 1905); J. P. Donovan (Westerner, pseud.), *Handling the Hog* (New York, 1910); O. Schwarz, *Public Abattoirs and Cattle Markets* (Chicago, 1912).

SLAVE COAST. A geographical name for a division of the coast of Upper Guinea. It owes its name to the active slave trade formerly carried on there. See DAHOMEY; BENIN.

SLAVE LAKE. See GREAT SLAVE LAKE.

SLA'VERY (from *slave*, from OF. Fr. *esclave*, Ger. *Sklave*, slave, Slav; originally referring to Slavs taken by Germans in war). Legally, that status of an individual or individuals characterized by perpetual and almost complete loss of personal and political liberty; socially, an institution defined by law and custom similar to *patria potestas*, *comitatus*, and to vassalage, serfdom, servitude, and apprenticeship in personal and economic subjection, but distinguished from them as the most absolute and involuntary form of human servitude.

The slave is the property, chattel or real, of his master and cannot participate in the civil right of personal freedom, though, except in strict Roman law, he may enjoy limited personal rights. Slavery represents a stage in social or industrial organization and development. It probably coincides with the beginnings of settled agricultural tribal life, but its ultimate origin is in dependence resulting from inequality of capacity or opportunity between individuals or sets of individuals brought into competitive relations. Whether recognized by common, statutory, or international law, slavery is a developing status varying its character in place and time as defined by local law and custom. It existed anciently among Babylonians, Assyrians, Egyptians, Hebrews, Persians, Phœnicians, Greeks, and Romans and in India, China, and Africa. It is interpreted in ancient monuments and literature and locally defined by law. Philosophic justification of slavery, ancient and modern, rests historically upon natural subjection and difference of race or creed, or both. But nationals as well as barbarians, heathen, and heretics have been enslaved by all races. Classical philosophy, Hebrew and other ancient religions, Brahmanism, Buddhism, Christianity, and Mohammedanism sanctioned the institution, but its essential sanction rested in law defining the status and its incidents. Of the chief sources of slavery (capture in war, man stealing, purchase, birth by a slave parent, and action of law), capture was early the most prevalent. Hebrew, Greek, and Roman slavery, recruited from all these sources, more often than modern slavery, applied to a subject the equal or superior of his master. An extensive slave trade with the Mediterranean islands, Asia Minor, Africa, or southern Europe aided to fill Athens, Corinth, Ægina, and Italy with vast numbers of slaves, numbering often thrice the free men. At Sparta conquered *helots*, owned by the state but let to individuals, numbered seven to one Spartan.

The incidents of Greek, Roman, and American slavery are strikingly similar. In each country the slave was sold, hired, seized for debt, and treated as his master's property, chattel or real. He was controlled by whipping, branding, fetters, exile, or by tie of affection to the family. He had customary limited rights of marriage, property, maintenance, contract, religion, and personal security and sanctuary (in Greece). Post-Homeric Greece, the later Roman Empire, and some American colonies of the eighteenth century legalized his right to life and limb. Previously Roman slaves were "things" in the master's *dominica potestas*, subject to life and death, torture, mutilation, gladiatorial combat, work in mines under drivers, but were, like American slaves, superior to Greek in having greater opportunity to obtain freedom. Greek and Roman freedmen gradually became free men. Classical and American slave labor was prædial, domestic, industrial, clerical, and public. Rome denied slaves civil or military service. Many Greek and Roman slaves entered learned professions. Italian latifundia worked by slaves destroyed freehold yeomanry and increased, with harshness, danger of servile insurrection. Serious revolts occurred in Greece and Rome and later in the West Indies, but North America suffered only minor local insurrections, such, e.g., as Gabriel's Insurrection (q.v.) and Nat Turner's Insurrection. (See TURNER, NAT.) The closing of Roman conquest, *jus naturale*, and Christianity modified the rigid chattel conception of *jus civile* and *jus gentium*, and law gave the slave personality and protection. Finally Justinian enlarged the *coloni*, men personally free but tied to the soil like serfs. Thereafter slavery, the chief labor system since the Punic Wars, though practiced by Rome's Teuton conquerors, was gradually replaced in mediæval Europe by feudal vassalage, villeinage, or serfdom, particularly where German and Roman life came in close contact. Serfdom persisted to modern times, surviving in Russia until 1861. See SERF.

Slavery and the slave trade, continued by mediæval Venice, the Saracens, Tatars, Turks, and African tribes, were freshly extended by Mohammedans in Africa and Asia, who made subject alike Christians, heathen, whites, and blacks. Negro slavery was a long-established African tribal custom with debtors, criminals, vagrants, and captives. The commercial expansion of Portugal began the African slave trade in modern Europe and America. Through kidnaping and from Moorish slavers Prince Henry of Portugal received negro slaves in 1442 and two years later began the European slave trade from the west coast of Africa. For a half century Portugal monopolized the traffic, which finally embraced the Spanish possessions in America, where Indian slavery established by Spain was exterminating the natives. Spain entered the slave trade in 1517, the English (under John Hawkins) in 1553, and France in 1624; they were followed by Holland, Denmark, and the American Colonies. The market was the West-European countries and their colonies in America, particularly the Spanish West Indies. England finally took the lead in the commerce, granting from the time of Elizabeth to 1670 five separate patents for its monopoly to favored merchants and companies. Between 1712 and 1749 the exclusive supply of the Spanish colonies was granted by Spain to the English South Sea Company. Thereafter all Englishmen could enter this field and continue their former trade to the English colonies.

Research has proved that the first negroes landed at Jamestown in 1619 and others brought by early privateers were not reduced to slavery, but to limited servitude, a legalized status of Indian, white, and negro servants preceding slavery in most, if not all, of the English mainland colonies. Statutory recognition of slavery occurred in Massachusetts in 1641, in Connecticut in 1650, in Virginia in 1661, and later in the other Colonies. Jews, Moors, and Turks were also subjects of Colonial slavery. Indian slavery was confined chiefly to the seventeenth century with the English, as their Indian captives were less profitable than those of the Spanish, who were subjected to more rigorous treatment. Slavery in the region now constituting the United States was patriarchal. Statutory law and court decisions added to such incidents of servitude as alienation, whipping, disfranchisement, limited marriage, trade, etc., first the incident of perpetual service and then a denial of civil and juridical capacity, as well as of marriage, property, and possession of children, thus creating slavery. The slave, contrary to the famous *obiter dicta* in the Dred Scott decision (see DRED SCOTT CASE), had some legal rights, such as limited personal agency, security (after 1788), support in age or sickness, a right to limited religious instruction, and suit and evidence in special cases. Custom gave numerous rights, such as private property, marriage, free time, contractual ability, and to females domestic or lighter prædial labor, which, however, the master was not bound to respect. Barbarities like mutilation, branding, chaining, and murder were regulated or prohibited by law, but instances of cruelty were not infrequent before the nineteenth century.

It was a mooted point in the courts of the former slaveholding States of the United States whether a slave had any rights under the common law which the master was bound to respect. There was very little precedent in the English law, and under the early Roman law a master had absolute power of life and death over his slaves, who were generally captives taken in war. In 1820 a Mississippi court held that under the common law the wanton killing of a slave was murder. In 1851 the Supreme Court of Georgia repudiated the reasoning advanced for the above conclusion, contending that a master had absolute dominion over a slave under the common law. The first legal provision in America on this subject seems to have been a Virginia statute of 1723, making the willful killing of a slave murder. In 1770 a Colonial Act prohibited the malicious and unnecessary killing of slaves by white men. However, in most of the Southern States statutes were enacted prohibiting the wanton killing or mutilation of a slave, thus finally disposing of the question. Slaves were liable under the criminal laws of the States in which they lived. Most of the slave States also passed statutes securing to slaves certain other rights, such as to be treated in a humane manner, to receive medical attention when ill, and to be provided with the necessaries of life when from old age or other causes they were unable to work.

With such humane provisions recognition of a slave as a person ceased, and for all other purposes he was regarded as a chattel, subject to the will of his master, and a thing to be bought and sold. The law of personal property was applied in governing his ownership. The children of a slave mother belonged to her owner, irrespective of who owned the father. In most of the Southern States the marriage of slaves was not recognized in law, though perhaps generally encouraged by slave-owners from religious or moral principles. The question of the legal status and effect of a slave marriage became important after the general emancipation of the slaves in determining the descent and distribution of property of former slaves. Generally, the States in which slavery flourished enacted statutes providing for legalizing such marriages by certain formalities, and in a few States continued cohabitation merely, after emancipation, was held sufficient.

A slave could not hold property, and anything acquired by him belonged to his master. The testimony of a slave would not be received in a civil action in which a white person was a party. However, slaves could testify in a criminal suit in which other slaves were defendants or in actions to secure their freedom. The right of an owner to give a slave his freedom was recognized, and a free negro could hold property.

Sentiment against the increase of the negro population and the slave trade early developed in America. English colonies by numerous statutes from 1695 imposed duties to discourage or prohibit slave traffic, but British merchants and commercial policy defeated these efforts. The enforced slave trade appears in State constitutions, and in the first draft of the Declaration of Independence as a justification of the American Revolution. Virginia by protest in 1772, Connecticut by statute in 1774, and Delaware by her constitution in 1776 attempted to stop the trade, and Virginia by an Act of 1778 was the first political community to prohibit it with efficient penalties. Similar action in nine other States during 1783–89; abolition of slavery in Massachusetts and Pennsylvania in 1780; the desire of John Jay to make prohibition a feature of the Treaty of Paris of 1783; the struggle for prohibition in the Federal Convention, resulting in the compromise limiting the duration of the trade to 20 years, at the end of which period the United States passed the Act of 1807 abolishing it, show the priority and force of American sentiment against the slave trade. Similar sentiment developed in Europe. Denmark by royal order prohibited the trade after 1802 in her possessions. France, following the doctrine of her Revolution, abolished her colonial slavery and slave trade in 1793, but Napoleon soon undid the work of the Convention. Napoleon's Decree of March 29, 1815, however, confirmed by the Treaty of Paris and a Law of 1818, made the trade illegal. In England Dellwyn, Sharpe, Clarkson, and Wilberforce began to organize antislave-trade opinion in 1787. In 1788 Dolben and Pitt moved bills for its regulation or suppression. But mercantile interests repressed the movement until 1806, when the Grenville-Fox ministry secured the passage of acts for the partial abolition of the slave trade, which were followed by an Act on March 25, 1807, for total abolition.

The Jay-Fox entente of 1783 paved the way for the joint pledge of England and the United States, in 1806, to strive for international abolition. This object appears in treaties of England with Denmark, Portugal, and Sweden during 1810–14. France then pledged aid to British advocacy of abolition in the Congress of Vienna. The Netherlands by royal decree in 1814 abolished the traffic. Spain restricted it, and Portugal in 1815 agreed to prohibit it in the Northern Hemisphere. In the Treaty of Ghent the United States and Great Britain again pledged their endeavors for suppression. The United States by supplementary acts in 1818 and 1819 endeavored to enforce her prohibition. From this time to 1840 England's chief efforts were bent on establishing an international right of search in time of peace to stop the illicit slave traffic, which increased from 40,000 a year in 1820 to 200,000 in 1837. In 1827 Portugal and Brazil promised to abolish the trade in 1829. A second time England interested a European congress, that of Verona in 1822, against the trade, now carried on with 352 ships. England urged a declaration in international law making the trade piracy, but secured, as at Vienna, only a general denunciation of the traffic. The United States and other Powers opposed right of search in time of peace as dishonor to the flag and a means of securing England's naval supremacy. (See SEARCH, RIGHT OF.) Though not a party at Verona, the United States promptly favored international declaration of the slave trade as piracy and prepared a treaty with England to this effect in 1824. But, as England was unwilling to yield her claim to search in American waters, the Senate rejected the treaty and the United States could only urge the international declaration. By 1833 Sweden, France, Denmark, the Hanse Towns, and some Italian states had agreed in part to England's contention for mutual search, but slavery had become such a delicate question in American politics at this time that the United States refused England's proposed concessions. In 1842 the United States and England agreed on joint naval cruising on the African coast to repress the trade. English statutes in 1824 and 1837 made the slave trade piracy punishable by death or life transportation. Conferees of England, France, Austria, and Prussia, in London, in 1838, proposed the Quintuple Treaty of Dec. 29, 1841, declaring the trade piracy and admitting mutual right of search. On account of this admission France refused to ratify, and Lewis Cass (q.v.), the American Minister at Paris, denied its application as international law to the United States. Belgium joined in 1845 in the Quintuple Treaty, and the United States, though refusing England's invitation to an international conference in 1860, completely changed attitude with the advent of Lincoln and Seward, admitted mutual right of search in 1862, and imposed the death penalty on smugglers of slaves. Suppression was organized, but until 1866 required a United States naval squadron on the African coast. The French, Spanish, Portuguese, and United States flags had protected slavers. Northerners sold to Southerners in Florida, Texas, and Cuba, but the Confederacy in 1861 declared against the trade. The Civil War and the Thirteenth Amendment practically and legally completed the extinction of slavery and the slave trade in the United States. The English, inspired by Livingstone, sought to put an end to the slave trade in the Sudan, but the efforts of Baker and Gordon proved ineffective in the face of the Mahdist convulsions. Tewfik, however, prohibited the Egyptian slave trade in 1884. The Powers in the Berlin Conference in 1884–85 promised their efforts for repression, and in 1890 an Act for this purpose resulted from the international conference, including Turkey, Persia, Zanzibar, and the United States, invited by Leopold of Belgium.

The antislavery sentiment and the movement aimed against the existence of the institution of slavery followed and in many cases coincided with or were affected by those against the slave trade from early colonial duties and taxes to steps for repression and emancipation. Promoted by the same, though a more limited and sometimes excitable public, including distinguished statesmen, authors, humanitarians, and sectarians, the movement originated and first rose to importance in North America and England. Eighteenth-century Christian sentiment, particularly among Friends, encouraged customary and legal manumission and the mitigation of slave codes. Justice Lord Mansfield's decision in 1772 freed slaves, like the negro Sommerset, brought to the soil of Great Britain. English emancipation societies arose in 1783 and French in 1788. Slaveholders like Washington, Jefferson, Henry, Mason, and Madison, and other statesmen, such as Franklin, Hamilton, and Adams, condemned slavery in principle, and emancipation was accomplished or in progress in every Northern State except New Jersey by 1799. Jefferson proposed in 1784 to prohibit slavery in the Northwest Territory, and he also advocated emancipation for Virginia in 1779. Tucker prepared another Virginia emancipation plan in 1796, New Jersey emancipated her slaves in 1804, and Congress limited the slave trade in Louisiana. The movement in its first stage rested chiefly on a moral or an economic basis, but soon became political. American antislavery organizations began from Pennsylvania's petitioning Congress for Federal interference with slavery. Congress denied its constitutional competency to regulate the domestic institution beyond the slave trade; but petitions continued, and the sentiment of the North and South, united in the Ordinance of 1787 (see NORTHWEST TERRITORY), but divided in the Constitutional Convention, was increasingly committed respectively to an antislavery and a proslavery programme. A movement towards united sentiment and national organization to solve the slavery and free negro questions by emancipation and colonization took tangible shape in the American Colonization Society (1816) and its affiliated State societies. (See COLONIZATION SOCIETY.) Though patronized by statesmen and divines, such as Madison, Harper, and Breckenridge, by many slaveholders, and by the Federal government, this movement, which resulted in the establishment of a negro colony in Liberia, was viewed by extreme antislavery men as a proslavery reaction.

From 1818 to 1820 political antislavery sentiment became more prominent, opposing particularly slavery extension. Dissatisfaction in the North with the Missouri Compromise (q.v.) laid the basis of abolitionism. William Goodell with his *Investigator* in Rhode Island, and Benjamin Lundy (q.v.) with his *Genius of Universal Emancipation*, established in 1821, began an antislavery press, while Lundy went on lecture tours and endeavored to found a slave asylum in Texas and Mexico. John Rankin formed an abolition society in Kentucky, and William Lloyd Garrison (q.v.), supported by Arthur and Lewis Tappan, established the *Liberator* at Boston in 1831. The era of expansion and reformation, mechanical, moral, and political, then beginning, favored the increasing antislavery societies and press, such as Griswold and Leavitt's *New York Evangelist* and Goodell's *Genius of Temperance* (1830) and *Emancipator* (1833), the New England Antislavery Society, founded in 1832, and the New York City and the American antislavery societies, founded in 1833. The last resulted from a National Antislavery Convention in Philadelphia representing every Northern State. These agencies distributed broadcast tracts, books, pamphlets, and business labels denouncing slavery. The abolitionists denounced slavery and slaveholding as crimes, demanded immediate and unconditional abolition without compensation, encouraged breach of slave laws and unconstitutional measures, and affirmed natural equality of persons. Garrison, Lovejoy, Phillips, Gerrit Smith, John Brown, Hutchinson, Storrs, and Birney became their leaders. Channing, Emerson, Bryant, Whittier, Lowell, and Longfellow gave literary and moral support to reasonable antislavery methods, but less conservative men in border free States manipulated an "underground railway" to Canada for fugitive slaves. (See UNDERGROUND RAILWAY.) John Quincy Adams and others fought for the right of petition concerning slavery and constitutional abolition. Southern apologists, such as Dew, Dabney, Smith, and Fitzhugh, answered the polemics culminating in Mrs. Stowe's *Uncle Tom's Cabin* (1852), a protest against the Fugitive Slave Law; and the paper war raged till Lincoln's election assured the antislavery victory and made actual war inevitable. President Lincoln issued his famous emancipation proclamations on Sept. 22, 1862, and Jan. 1, 1863, and the Thirteenth Amendment (1865) practically and legally secured the success of the Abolitionists by Federal abolition.

Great Britain, where Clarkson and Wilberforce had been the most prominent leaders in the antislavery movement, pursued a less radical method of abolition, providing by law in 1833 for future and progressive emancipation in her West Indian colonies and compensating slaveholders by purchase and an apprenticeship subsequently limited to 1839. In 1843 she abolished slavery in India. Sweden followed with colonial abolition in 1846, France in 1848, Holland in 1859, Brazil with progressive emancipation in 1871 and total emancipation in 1888, Spain in Porto Rico in 1873 and in Cuba in 1880, Great Britain and Germany in their African protectorates in 1897 and 1901, the United States in the Philippines in 1902, and Egypt in the Sudan. The South American republics abolished slavery when they emancipated themselves from the yoke of Spain.

Mohammedan countries have been the last to feel this influence, and household slavery exists in Turkey, Persia, Egypt, Zanzibar, Pemba, Tripoli, and Morocco, though everywhere officially prohibited. A considerable traffic still exists in the Congo and Portuguese West Africa, and Nieboer's extensive inquiries disclosed 210 savage tribes in North, Central, and South America, Oceania, Malay Archipelago, and Africa, where slavery exists.

Slavery was chiefly a moral and economic question in the American Colonies, but it appeared as a political one during the Confederation, particularly in the debates of the constitutional and ratifying conventions, when the question of submitting it and other States' rights to Federal initiative arose. The dictum of natural equality and inalienable rights in the Declaration of Independence, even when reappearing in bills of rights, could not be practically applied except in limited cases, as by George Wythe in

Virginia, to the liberation of slaves. But Northern emancipation provisions showed that the economic and social basis in the North was to be increasingly laid in free labor and a farm system contrasting with the slavery and plantation system of the South. Economic and social sectionalism in the Colonial period rapidly became political in the Federal. From 1787 Mason and Dixon's line (q.v.) had political significance; slavery as one of the basal elements of the difference of sectional interests and sentiment rose from a local State question into the most important and permanent in national politics. Controlling conditions were: (1) increasing sectionalism from localization of industrialism in the North; (2) constitutional compromise provisions granting Federal legislation in regard to the slave trade and fugitive slaves, and representation for slaves on the three-fifths basis; (3) a Federal domain increasing by cession, purchase, treaty, and conquest and subject to Federal organization and representation in Congress; (4) the growth of political parties opposed as to constitutional construction; (5) sectionalized antislavery sentiment; and (6) development and expansion of Southern staples adapted to slave labor, especially cotton after the invention of the cotton gin in 1793. The Constitution purposely avoided the use of the terms "slave" and "slavery," yet the bargain of South Carolina and Georgia with commercial New England riveted upon it recognition of the institution. Slavery had thus two connected phases: (1) as to its existence in the States, a State right, a local question, involved in national politics in the general States' rights struggle; (2) as to its existence and extension in Federal territory, a national question, constitutionally subject to Federal legislation. National expansion necessarily brought it into politics. Support of members from the slave States in Congress secured the ordinances of 1784 and 1787, prohibiting slavery in the Northwest Territory and preparing the way for new free States. In 1793 Congress passed almost unanimously a fugitive slave law to secure owners in their property. (See Fugitive Slave Law.) The bill abolishing the slave trade renewed sectional debate and showed predominant antislavery sentiment in the North. Between 1803 and 1817 four States, two free (Ohio and Indiana) and two slave (Louisiana and Mississippi), were admitted into the Union, and the theory of balance of power between slave and free States was established. But the further organization of the Louisiana territory in 1818–20 drew the issue sharply on slavery extension. Only temporary political adjustment of slavery followed the Missouri Compromise (q.v.) prohibiting slavery north of lat. 36° 30′ N., except in Missouri. From 1820 to 1830 tariff and public land policy were, together with slavery, the issues conditioning the life and expansion of the Southern and Northern economic systems. Nonextension was interpreted as eventual extinction of slavery. Discussion of tariff bills in 1824 and 1828, dogmas of nullification, State rights, and abolition, and the Hayne-Webster debate of 1830 greatly increased the importance of slavery in sectional politics and made it the leading question after the Tariff Compromise of 1833. Antislavery men who believed in attaining their ends through constitutional methods and Abolitionists organized the Liberty party (q.v.), and twice (in 1840 and 1844), nominated J. G. Birney (q.v.) for President. The annexation of Texas in 1845 and the Mexican War in 1846–48 were proslavery victories, the latter adding territory from which the unsuccessful Wilmot Proviso (q.v.) failed to exclude slavery. There now arose over the question of slavery a controversy destined to split both Whigs and Democrats, to bring about new party alignments, and eventually to hasten, if not cause, a great civil conflict between the North and the South. By 1848 Oregon (q.v.) was organized without slavery, and the Free-Soilers, who strove for the exclusion of slavery from the Territories (see Free-Soil Party; Territories), had taken the place of the Liberty party. The antislavery cause won in the Compromise of 1850 in free California and slave-trade prohibition in the District of Columbia, but lost in a fugitive-slave law federally executed. (See Compromise Measures of 1850.) Douglas's mistake in the repeal of the Missouri Compromise and his substitution for the arrangement then effected of "squatter sovereignty" by the Kansas-Nebraska Bill (q.v.) in 1854, precipitated a sectional struggle for possession of Territories by colonization and border warfare. (See Kansas.) The free-State settlers practically won in 1857, and the Republican party, absorbing Anti-Nebraskans, Free-Soilers, Abolitionists, and Antislavery Whigs and Democrats, completed the victory, though the Dred Scott decision opened the Territories to slavery. Cuban annexation, which had been a proslavery policy since 1841, was defeated in 1859, and Lincoln's election following the John Brown raid of 1859 was the signal for the secession (1860–61) of a South jealous of her State rights and resentful of interference in slavery. Congressional acts in 1862 and Lincoln's Emancipation Proclamation in 1863 (a war measure), and the Thirteenth Amendment in 1865 legally destroyed the institution of slavery, while the Fourteenth and Fifteenth Amendments gave freedmen full civil rights.

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Industrial System (2d ed., The Hague, 1910); Morel, *Great Britain and the Congo* (London, 1909); Worcester, *Slavery and Peonage in the Philippine Islands* (Manila, 1913); Brawley, *A Short History of the American Negro* (New York, 1913); Woodson, *The Education of the Negro Prior to 1861* (ib., 1915); J. Z. George, *Political History of Slavery in the United States* (ib., 1915).

SLAVERY, or SLAVES. A name applied to certain tribes of Déné (q.v.) Indians in northwestern Canada, the Etchaotine, Thlingchadinne, Kauchodinne, and part of the Nahane. In the first half of the last century the name was often used by fur traders to signify all the Athapascan-speaking tribes west of the Mackenzie River. Consult Emile Petitot, *Dictionnaire de la langue Déné-Dindjie* (Paris, 1876).

SLAV'IC LANGUAGES. A branch of the Indo-European or Indo-Germanic languages (q.v.). Among these languages Slavic is most closely connected with the Baltic group (Old Prussian, Lettic, and Lithuanian). The principal characteristics of the Slavic languages are: (1) Disappearance of closed syllables, entailing the loss of final consonants, as OChurch Slav. *domŭ*, house; Russ., Serb., Bulg., Slov., *dom;* Pol. Czech., *dum;* Skt., *damas;* Gk. *δόμος*; Lat. *domus*. (2) Monophthongization of primitive diphthongs, as Common Slav. *zima*, winter; Gk. *χεῖμα*; Common Slav. *ucho*, ear; Lat. *auris*. (3) Change of short *i* and *u* into indistinct sounds, *ĭ*, *ŭ*, in OSlav., as OChurch Slav. *vĭdova*, widow; Skt. *vidhávā;* Lat. *vidua*. (4) Development of nasal vowels, as OChurch Slav. *pętŭ*, five; Pol. *pięć;* Skt. *páñca;* Gk. *πέντε*; Lat. *quinque;* Lith. *penki*. (5) Development of the peculiar sound *y* from the primitive *ū*, as OChurch Slav. *dymŭ*, smoke; Russ., Pol. Czech., *dym;* Skt. *dhūmás;* Gk. *θυμός*; Lat. *fūmus;* Lith. *dúmai*. (6) Change of primitive intervocalic *s* into *ch* (*kh*), as Common Slav. *ucho*, ear; Lith. *ausis;* Lat. *auris;* Goth. *ausō*. (7) Change of the palatal *kh* into *s*, *g*, *gh*, into *z*, as (a) *k;* Common Slav. *slovo*, word; Gk. *κλυτός*; Lat. *inclutus;* OIr. *cloth;* Skt. *śrutas;* (b) *g*, OChurch Slav. *znati*, to know; Russ. *znat'*, Pol. *znac;* Gk. *γιγνώσκειν*; Lat. *gnoscere;* Skt. *jñā;* Goth., *kann;* OHG. *knāen;* OIr. *gnāth;* Lith. *zinóti;* (c) *ĝh*, OChurch Slav. *azŭ*, I; Skt. *ahám;* Gk. *ἐγώ*; Lat. *ego;* Goth. *ik*. (8) Palatalization of the gutturals *g*, *k*, *kh*, into *ž*, *č*, *š* before palatal vowels *e*, *i*, *ĭ*, *ē* (*ě*), and *j;* later into *z*, *c*, *s*, before *ě* and *i* resulting from primitive *ei*, *oi*, as (a) *ž*, OChurch Slav. *živŭ*, alive; Lat. *vivus;* Gk. *βίος*; OIr. *beo;* Goth. *qius;* Skt. *jīvás;* Lith. *gývas;* *č*, OChurch Slav. *očese*, gen. sing. of *ok-o*, eye; Common Slav. *oko;* Lith. *akis;* Lat. *oculus;* Ger. *auge;* OChurch Slav. *ušesa*, nom. pl. of *ucho*, ear; Common Slav. *uši;* OChurch Slav. *bozě*, loc. sing., and *bozi*, nom. pl. of *bogŭ*, God; OChurch Slav. *člověcě*, loc. sing., and *člověci*, nom. pl. of *člověkŭ*, man; OChurch Slav. *dusě*, loc. sing., and *dusi*, nom. pl. of *duchŭ*, soul. (9) The preservation, to a large extent, of the primitive free accentuation.

The first attempt at a scientific classification of the Slavic languages was made by Dobrovsky (1822), who divided them into a Western and an Eastern group. A later somewhat conventional division is into Eastern, Southern, and Western. At present the following divisions are distinguished in the Slavic group: (1) Russian, with Great Russian, Little Russian, and White Russian branches (see RUSSIAN LANGUAGE; UKRAINIANS); (2) Bulgarian, with Eastern and Western dialects, and (2a) the Macedonian Slavic, which agrees with it in such important peculiarities as the postpositive article, the preservation of nasal sounds, and the loss of declension; (3) Serbo-Croatian; (4) Slovenian; (5) Czecho-Moravian, with its (6) Slovak dialect; (7) Serbo-Lusatian or Sorbian (with the Upper Lusatian and Lower Lusatian dialects); (8) Polish, with (9) Kashubian and Slovintsian, and the extinct (10) Polabian (these three languages constitute the Liach group); (11) Old Church Slavic (Old Bulgarian), the oldest and in many respects nearest to the Primitive Slavic. It agrees with the Modern Bulgarian in its treatment of *tj* and *dj*.

That the linguistic affinity of the Slavic languages closely corresponds with their geographic relationship there is no doubt in view of such phenomena as the following: (1) *tj* (also *ktj*, *gtj*) becomes *č* in Eastern Slavic, as *svěča*, candle, for **svět-ja;* *št* in Bulgarian, as *svěšta;* *k'* in Macedonian, *svek'a;* *ć* in Serb, as *svěća;* Slov. *svéča;* *c* (= *ts*) in Western Slavic, as Czech. *svíce;* Pol. *świeca;* *dj* becomes *ž* in Russian, as *meža*, boundary line, for **medja*, cf. Lat. *medius* (= English *j*) in Serb, *meda;* Slov. *méja*, *žd* in Bulg. *mežda;* in Western: *z* in Czech. *mieze;* *dz* in Pol. *miedza*. (2) *pj*, *bj*, *vj*, *mj*, become *plj*, *blj*, *vlj*, *mlj* in Russian, as *toplju*, heat, infinitive *topit';* *ljublju*, I love, infinitive *ljubit';* *lovlju*, I seize, infinitive *lovit';* *zemlja*, earth, for **zemja;* the epenthetic *l* also appears in Serb, Bulgarian, and East Slovenian, while in the Western Slavic the sound *l* is absent. (3) Before *l* and *n*, *t* and *d* fall out in Russian and Southern Slavic, as Russian *plel*, I led, *vel*, I wove, from *pletu*, I lead, *vedu*, I weave; *t* and *d* are retained, however, in certain Slovenian dialects and in Western Slavic. (4) *ar*, *al*, *er*, *el*, become *oro*, *olo*, *ere*, *ele* in Russian, as *boroda*, beard, *golova*, head, *bereg*, shore, *peleva*, membrane; *re*, *la*, *rě*, *lě* in Southern Slavic, as *brada*, *glava*, *breg*, *pleva* (*brěg*, *plěva*); in Western Slavic *ra*, *la*, *re*, *le*, as in Czechic, *brada*, *hlava*, *břeh*, *pleva;* *ro*, *lo*, *rze*, *le* in Polish, *broda*, *glowa*, *brzeg*, *plewa*. (5) *gv* and *kv* become *zv*, *sv* in Russian and Southern Slavic, as Russ., Bulg., *zvězda*, star; Slov. *zvézda;* *cvět*, color, flower, Russ., Serb, Bulg., Slov., but remain in Western Slavic, as Czech. *hvězda*, *květ;* Pol. *gwiazda*, *kwiat*. Other illustrations of geographical and linguistic parallelism occur in the treatment of the semivowels *ĭ* and *ŭ*, which sometimes reappear as *e* in the West, *a* in Serbo-Croatian, *o* and *e* in Russian, with other Slavic languages holding intermediate positions; the softening (palatalization) of consonants, especially dental, when followed by *e*, *ě*, *i*, and *ĭ* (less intense from North to South); the treatment of nasals; vocal quantity (long vowels appear in Little Russian, Slovak, Polish, Czech, Slovenian, and Serbo-Croatian); the degree of freedom of the accent; etc. The division of the Slavic languages into Eastern, Western, and Southern is based on the conjunction of several of the peculiarities enumerated above. The Slovak comes very near being the connecting link of all the Slavic languages in spite of the fact that it has lost actual contact with most of them. Also Little Russian, though separated by the Rumanian (see RUMANIAN LANGUAGE) wedge from the South Slavic, agrees with the latter as against Great Russian by confusing *i* and *y* and by showing diminished palatalization before *e*.

In morphology we may note the retention of three genders, and in certain languages (as Serb and Slovenian) the presence of the dual and seven cases (loss of the ablative). The Modern Slavic languages, however, show a tendency to simplify the declension by reducing the number of stems and leveling the case endings. Bulgarian has completely lost its declension.

The relation of Slavic declension to the Indo-European may be illustrated by the example of a masculine *o*-stem, *vranŭ*, raven. Singular: nominative: *vran-ŭ*, Skt. *vṛka-s*, wolf, Lat. *lup-us*, Gk. λύκ-ος; ablative (coinciding with the genitive in Slavic): *vran-a*, *vṛk-āt*, *lup-ō*(*d*); accusative: *vran-ŭ*, *vṛk-am*, *lup-um*, λύκ-ον; vocative: *vran-e*, *vṛk-a*, *lup-e*, λύκ-ε; locative: *vran-ĕ*, *vṛk-ē*, *Corinth-oi* (-ī), at Corinth, οἴκ-οι, at home. Dual: nominative, accusative, vocative: *vran-a*, *vṛk-ā*(-*āu*), *du-o*, two, λύκ-ω; genitive, locative: *vran-u* (for *ous), Russ. *vo-očiju*, with one's two eyes, Serb *ušiju*, with one's two ears, *vṛkay-ōṣ*. Plural: nominative, vocative: *vran-i*, *lup-i*, λύκ-οι; genitive: *vran-ŭ*, *vṛk-ām* (-*āṇāṃ*), *div-ōm*, λύκ-ων; locative: *vran-ĕchŭ*, *vṛk-ēṣu*, λύκ-οισι; accusative: *vran-u*, λύκους, Goth. *sununs*, sons; instrumental: *vran-y* (for *oīs), λύκοις, *vṛkaiṣ*, Lith. *vil-kais*. The instrumental (all numbers) in -*m*- is also found in the Baltic group of languages. Peculiar to the Slavic is the dative singular *vran-u* (instead of *vran-ĕ*), which shows the influence of the *u*-stems.

In conjugation the Slavic verb is well exemplified in the Old Church Slavic. (See Old Church Slavic Language and Literature.) In the syntax perhaps the most striking feature is the use of double negatives: OChurch Slav. *ničitože ne bysti*, nothing happened; Russ. *nikto ne znayet*, no one knows; Pol. *nic nie widzem*, I see nothing. Other peculiarities are the substitution of the genitive for the accusative in nouns denoting animate beings in the singular and plural masculine and in the plural feminine, and the use of the instrumental (instead of the nominative) as a predicate. The possessive pronoun of the third person has usurped the functions of the other two when referring to the subject, in Russian invariably, in Old Church Slavic usually: OChurch Slav. *idi vŭ domŭ svojĭ*, go unto thine house; Russ. *Ya* (*ty*) *vidĕlŭ svoyego brata*, I saw (thou sawest) my (thy) brother.

Those Slavic nationalities which adopted Roman Catholicism use in writing the Roman alphabet with some modifications (see Serbo-Croatian Language); the Greek Catholic Slavs, however, employ the Cyrillic (q.v.).

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SLAVIC MYTHOLOGY. The earliest reliable information concerning the mythology and religion of the Slavs before their adoption of Christianity does not reach further back than the eleventh century of our era and is confined to the Baltic Slavs and Russians. From German and Scandinavian sources we learn that the Slavonic dwellers of the lower Elbe and Oder basins worshiped a number of divinities of a military character. Thus, Suarasiz (i.e., Svarozič) was the god of the Lutitians; Svantovit, "the mighty," was worshiped at Arcona, and Triglav, "the three-headed," at Stettin. These divinities had their statues, temples, and attendants and received part of the spoils of battle. The old Russian chronicles state that the Varangian Russ princes took oath by the gods Perun and Volos. When St. Vladimir "began to reign in Kiev, he put on a hill outside his palace yard the wooden Perun with the silver head and golden mustaches, and Khors, Dazhbog, Stribog, Semargl, and Mokosh, and the people brought them sacrifices." Perun may have been a god of thunder like the Scandinavian Thor. Volos, "the beast god," may have been a god of cattle and patron of merchants. In the song of Igor (see Igor's Band, Song of) he is said to be the grandfather of bards (*boiany*). Of the other Russian divinities nothing is known with certainty, for the view that they were personifications of natural phenomena is not sufficiently supported by early evidence. It is interesting to note, however, that in an old Russian source Hephæstus is glossed with Svarog and the fire, moreover, is called Svarozič (son of Svarog), recalling the Suarasiz of the Lutitian Slavs. This seems to point to the identification of fire and sun worship. With the advent of Christianity the old gods were regarded as devils. The pagan Russians had medicine men (*vlsvi*) and cremated their dead.

On the whole the survival of old rites and ritualistic customs are the most fruitful source of information on early religion. Ancestor worship, e.g., clearly survives in the *dziady* festivals of the White Russians, while various solstitial and equinoctial rites point to an early Slavonic religion of agricultural magic. Popular belief knows of numerous sprites (*domovye*, *lĕsye*, the fairy-like *vilas* of the Southern Slavs), fate and birth divinities (ORuss. *rožanica; rodjenice* and *sudjenice* of the Southern Slavs), were wolves (*vlkodlaci*), etc. Nevertheless, many beliefs and practices have been borrowed from the neighboring nations, not a few being introduced along with Christianity. To Christian influence are due the burial ceremony (*marzana*) of the Poles, most of the Christmas ceremonies and practices of the Southern Slavs, belief in devils, witchcraft, relics, etc.

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SLAVO'NIA. The northeastern part of the autonomous Province of Croatia and Slavonia in Austria-Hungary. See Croatia and Slavonia.

SLAVONIC ENOCH. The common designation of one of the Enoch books, extant only in a Slavonic version under the title *The Book of the Secrets of Enoch*. The book contains a description of all the seven heavens, and its ethical teachings approach in many respects those of Christianity. See Enoch, Books of.

SLAVONIC MUSIC. Just as the hymns of the Church of Rome exerted a powerful influence upon the music of western Europe, so a similar influence was exerted upon the music of eastern Europe through the hymns of the Greek church. Although both the Greek and Roman hymns can be traced to a common origin, a differentiation took place in the earliest centuries of the Christian era and thenceforward the music of the East and the West developed separate characteristics. In the East the folk music became strongly tinged with characteristics of the music of the Greek liturgy, and these characteristics have found their way through the folk music into the art music of the modern Slavonic composers. All the emotions of the Slav peasant find expression either in songs or primitive dance tunes, and every season of the year has its particular songs. The real folk songs of Russia are always metrical, although the poetry does not rhyme. The words are most frequently sung without any instrumental accompaniment. The lively melodies, mostly of gypsy origin, are generally dance tunes in the major keys. They are sung in unison, the rhythm being marked by the feet; whereas the slow melodies—and these are the best and most popular—are in minor keys and are sung in harmony. The national music of the Poles is more fiery and passionate. The melodies, which for the greater part are not remarkable in themselves, are rendered effective by means of skillful ornamentation and piquant rhythms. Difficult and unusual intervals occur with great frequency, imparting to the Polish folk songs something of an instrumental character. The folk music of Bohemia is especially rich in popular dance tunes, some of which, like the polka, have also found great favor in other countries. The influence of Church music is pronounced in many of the folk songs, especially in those dating from the fifteenth and sixteenth centuries, where we find entire chorales introduced as middle sections. The later songs are distinguished by a broad melodic outline, showing to some extent Italian influences, and by a spirit of humor. Consult: A. Soubies, *Précis de l'histoire de la musique russe* (Paris, 1893); A. Pougin, *Essai historique sur la musique en Russie* (ib., 1904); A. Bruneau, *La musique russe* (ib., 1905); R. Batka, *Geschichte der böhmischen Musik* (Berlin, 1906); M. Montagu-Nathan, *A History of Russian Music* (New York, 1914). See Folk Music; Music, History of, *XXXIII, XXXIV, XXXVII;* Opera, *Modern Tendencies*, Russia, Bohemia, Poland.

SLAV'OPHILS. See Panslavism; Russian Literature.

SLAVS. A branch of the Aryan or Indo-Germanic family, constituting the great bulk of the population of Europe east of the meridian of 15° E. as well as of Siberia. Their number in 1910 was estimated at 159,000,000 by Niederle; according to Professor Florinski of Kiev that should be increased by some 25,000,000 for 1915. They are broad-headed (brachycephalic), below the average Aryan in height, with skin pale white, swarthy, or light brown, and eyes brown, gray, and black.

The Slavs comprise the following groups and nationalities: *Eastern Group*—Great Russians, Little Russians or Malo-Russians (Ukrainians and Ruthenians), White Russians; *Western Group*—Poles, Wends, Czechs (Bohemians, Moravians), Slovaks; *Southern Group*—Slovenians, Serbo-Croats, (i.e., Croats, Servians, including those formerly known as Morlaks and Uskoks, Herzegovinians, Bosniaks, Montenegrins), Slavic inhabitants of Macedonia, Bulgarians.

It has long been recognized that in this vast complex resulting from racial mixtures there can be found no "Slav type." Investigations among Slav peoples show an interblending of a great variety of races, and that the Ukrainians (Little Russians) probably deviate least from the primitive types.

The country occupied by Slavs before the great migration of nations appears to have been between the rivers Oder and Dnieper. From this seat in the period from the third or fourth century to the seventh century they spread in all directions, towards the Baltic beyond the Elbe, towards the Danube and the lower Dnieper, and into the Balkan Peninsula. From the tenth century on the Germans pressed back the Slavs, and in the course of centuries many regions occupied by Slavic tribes again became German. The Bulgarian invaders of the Balkan Peninsula were a Turkish people, soon assimilated by the Balkan Slavs. After their settlement in Bulgaria they became Slavicized. The Polabians, a Slavic people who dwelt about the lower Elbe and the southwestern corner of the Baltic Sea, have become extinct.

Consult: Lubor Niederle, *La race slave* (trans. by L. Léger, Paris, 1911), containing a full bibliography; also id., *Man in Prehistoric Time* (Russ. ed., St. Petersburg, 1898), and *Slavic Antiquities* (in Czech, Prague, 1902); Florinski, *The Slavic Race* (in Russian, Kiev, 1907). See Colored Plate of White Races of Europe, under Europe, Peoples of.

SLAVYANSK, slàv-yänsk'. A town in the Government of Kharkov, Russia, about 100 miles southeast of Kharkov (Map: Russia, E 5). It is noted for its large output and export of salt, obtained from the adjacent lakes. Pop., 1911, 24,274.

SLEDGE DOG. A dog used for hauling sledges, especially in the Arctic regions; at first little more than a half-domesticated wolf. The typical Eskimo dog is broad-chested, with powerful shoulders, a short thick neck, sharp wolflike muzzle, slanting eyes, short and generally erect ears. He has a coat of warm and thick hair, normally gray, though black, black and white, and pure white occur. The "native dogs" endure a surprising amount of cold and work so long as they are fairly fed. Harnessed to a toboggan or a sledge, a team of five will drag a heavy load 60 miles a day, day after day.

There are two other kinds of sledge dogs, the Ostiaks and Samoyeds. The Ostiaks vary much in appearance, some being stout, weighing 50 to 70 pounds, others leggy and wolflike. In color they range from gray to dark brown, are thick-coated, prick-eared, and more or less wolf-like in disposition. The Samoyed dogs are entirely white, with the exception of the nose; the tail is bushy and turned over the back, and the ears are pricked. They weigh from 40 to 60 pounds and much resemble large Pomeranians.

SLEEK, Aminadab. A hypocrite in Morris Barnett's comedy *The Serious Family.*

SLEEP (AS. *slæp*, Ger. *Schlaf*, sleep, from AS. *slæpen*, Goth. *slēpan*, OHG. *slāfan*, Ger. *schlafen*, to sleep). A condition of the body in which the normal activity of the nervous system is so far reduced that self-consciousness and consciousness of surroundings are entirely wanting or at an extremely low ebb. (On dreamless sleep and consciousness of conditions, see Dreaming; Somnambulism.) It is, furthermore, a normal and rhythmic process and as such differentiated from stupor, unconsciousness under drugs, and other cases of abnormal loss of consciousness. Its most conspicuous physiological features are relaxation of muscular tone, slower and deeper breathing, slower and weaker pulse, and lessened arterial pressure. As regards the volume of the brain during sleep experiments are not conclusive: it was formerly believed that the cortex, if not the entire cerebrum, is anæmic; but recent experiments seem to show an increase in volume, accompanied by an increase in the height of arterial pulse in the brain. (Shepard.)

There are three main types of sleep theory, the circulatory, the chemical, and the histological. The first circulatory theory was that of congestion. Sleep was the result of pressure upon the brain due to venous congestion. The evidence for this view came from the analogy of sleep to the condition produced by apoplexy, opiates, and the lethargy caused by pressure on the brain in cases of fractured skull. The second theory turns to anæmia, the exact opposite of congestion. A large number of well-attested facts seem to prove the existence of a cortical anæmia during sleep. Pressure upon the carotid arteries will produce a dreamlike state of consciousness. This theory, however, has been challenged by Shepard on the basis of experiments noted above. He has substituted therefor an activity theory, in the belief that certain nervous centres are active during sleep. Psychologically regarded, sleep is a conscious process characterized by attention of high degree and narrow span, the focal elements consisting of "fatigue sensations." Further work is demanded before a decision can be reached.

The chemical theories are of two types, according as they are based on combustion or auto-intoxication. The combustion theories, all of which are concerned with the use of oxygen or carbonic-acid gas, may be represented by Pflüger's idea that the stored-up intramolecular oxygen is exhausted by activity of the nerve cells, which finally become saturated with carbonic acid. The explosions of the cells grow less frequent, and the condition of relative cerebral inactivity, sleep, thus results. This theory is not buttressed by sufficient experimental evidence, nor does our recent knowledge of the function of oxygen in the body warrant us in attributing sleep to its lack. In the auto-intoxication theories it is asserted that certain products of the decomposition of living substance influence the continuance of cell activity: in the older form of this theory the products mentioned were chiefly lactic acid and creatine; in the recent theories the influence of modern bacteriology has led to the substitution of certain poisons, such as the ptomaines and the leucomaines, which are formed more rapidly than they can be oxidized during active labor of the day. During sleep these poisons are gradually oxidized and removed from the blood. In excessive quantity they produce insomnia, which, as we all know, is often characteristic of extreme fatigue.

The rapid advance in histological technique within the last few years has led to certain discoveries concerning the nature of the nerve cell and its processes, or the neurone, which shed some light upon the conditions of sleep. Of special interest are the results of investigations upon the connection of neurone to neurone. We know that the nerve elements are structurally independent, but functionally interdependent. Microscopic examination has shown that the nerve cell possesses different chemical properties in a waking and in a sleeping or fatigued condition, and that the disposition of the "contact granules" or "gemmules," which some authorities deem the structural means for the interconnection of functioning neurones, varies according to the condition of activity or rest in the nervous system. Upon these facts various theories have been advanced, which find the cause of sleep in dissociations of the neurones. These theories have taken three principal forms: dissociation through amœboid movements of cell processes, dissociation through interposition of neuroglia (nonnervous) cells, and profuse connection through torpor of processes.

But no single theory, whether vasomotor, chemical, or histological, is adequate to a complete explanation of sleep. Recent observations of the daily life of protozoa and other simple forms show that such organisms never sleep and, of course, never exhibit phenomena of fatigue. Somewhere in the line of evolution the phenomena of fatigue and sleep must make their appearance. It seems likely, therefore, that profitable work upon the problem of sleep is to be expected in the future from the side of comparative physiology and psychology.

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SLEEPERS, The Seven. See Seven Sleepers, The.

SLEEPER SHARK, or Nurse Shark. One of the large Arctic sharks of the family Scymnidæ, closely allied to the dogfishes (Squalidæ), especially *Somniosis microcephalus,* which reaches a length of 25 feet and is an enemy of whales.

SLEEPING BEAUTY, The. The fairy tale of a princess who falls into an enchanted sleep for 100 years and is awakened by a prince who penetrates the dense wood which grew up about her castle. It is told by Charles Perrault in "La Belle au Bois Dormant," in *Contes du temps passé* (1697), translated by Grimm as *Dornröschen* and versified by Tennyson in "The Day Dream." The legend in varying forms is very old, found even in some early Egyptian and Hindu tales, and paralleled in the magic sleep of Brunhilda.

SLEEPING CARS. See Railways.

SLEEPING SICKNESS, Human Trypanosomiasis, or Negro Lethargy. An endemic disease confined to equatorial Africa and characterized in its terminal stages by sleepiness, torpor, and coma. Sleeping sickness was known as far back as about 1800. It was then endemic in a few localities, but of late years it has become widespread, owing to the opening up of the country to trade and travel. The disease is caused by a blood parasite, the *Trypanosoma gambiense,* which is conveyed by two varieties of the tsetse fly, *Glossina palpalis* and *Glossina morsitans.* Wild and domestic animals act as reservoirs for the sickness, the disease in the animal being known as *nagana,* the tsetse fly disease of cattle.

Two types of sleeping sickness are recognized. The Uganda type, carried by *Glossina palpalis* and confined to the watercourses and lake shores, was first identified in 1901. It is violently epidemic and is credited with 200,000 deaths between 1898 and 1906. The variety occurring in Nyassaland and Rhodesia has been known as a distinct form only since 1908. It is highly fatal but not epidemic. The fly that is the conveyer in this case is *Glossina morsitans,* which is irregular in its distribution and is independent of water.

Both whites and negroes are liable to contract sleeping sickness. The parasite is described by Castellani as from 16 to 24 micra long and from 2 to 5 micra broad. It is undulating, almost wormlike in shape and ends in a flagellum. The parasite at first gains entrance to the peripheral blood and lymph glands, from which it is distributed through all the fluids of the body, being found in the later stages of the disease in the cerebrospinal fluid. The symptoms in the early stage are irregular fever, irritability, headache, sleeplessness, and loss of strength. The eyelids become puffy; an erythematous eruption appears on the skin. After a variable period of apparent improvement the victim becomes more and more lethargic, is aroused with difficulty, takes little food, and becomes emaciated. The anæmia is more pronounced, tremors of the hand and tongue are noted, and areas of anæsthesia and hyperæsthesia are seen in some patients. In the final stage the tremors become convulsions, apathy and somnolence merge into torpor and coma. Death takes place in coma or from some intercurrent disease such as pneumonia or dysentery. The duration of sleeping sickness is variable. The first stage may last from a few months to a few years, and life may be prolonged by careful nursing and medication. In Europeans the duration is given as from one and a half to several years. Consult: Thomas, *Report on Trypanosomes* (London, 1905); Sir Patrick Manson, *Tropical Diseases* (5th ed., ib., 1914); C. W. Daniels, *Tropical Medicine and Hygiene* (New York, 1914).

SLEEPLESSNESS. See Insomnia.

SLEEP MOVEMENTS. See Movement (in plants).

SLEEP OF PLANTS. A popular name for the phenomenon of leaf movement in certain plants, especially of the Oxalideæ and Leguminosæ, whose leaves have a nocturnal position distinct from the diurnal. Usually the petioles rise or fall and sometimes the leaf blades become folded. The phenomenon is due to the sensitiveness of certain parts to variations in the intensity of the light reaching them. See Motor Organ; Movement.

SLEEPY HOLLOW. A picturesque valley near Tarrytown, N. Y., traversed by a small stream called the Pocantico River, famous as the scene of Washington Irving's *Legend of Sleepy Hollow.* It contains an old Dutch church, dating from 1699 and built of bricks brought from Holland.

SLEEVE DOG. A Japanese breed of tiny spaniels. See Spaniel.

SLEEVE INSIGNIA. See Chevrons; Military Insignia.

SLEIDAN, slī′dȧn, or **SLEIDA′NUS,** Johann (c.1506–56). An early German historian whose real name was Philippson. He was born at Schleiden, near Cologne, studied law at Liége, Paris, and Orleans, and entering the service of Francis I of France in 1537 acted as intermediary between him and the Schmalkaldic League. In 1544 he made his home at Strassburg and thenceforth was active as diplomat, pamphleteer, and apologist in the cause of the Reformation. In 1551 he represented the city of Strassburg at the Council of Trent. His chief work is *De Statu Religionis et Republicæ Carolo Quinto Cæsare Commentarii* (Strassburg, 1555; ed. by Am Ende, Frankfort, 1785–86), the best contemporary account of the Reformation. He also wrote *Summa Doctrinæ Platonis de Republica et de Legibus* (1548). Consult Baumgarten, *Ueber Sleidans Leben und Briefwechsel* (Strassburg, 1876), and Hasenclever, *Sleidan-Studien* (Bonn, 1905).

SLEIGHT OF HAND. See Legerdemain and Magic.

SLEM′MER, Adam J. (1828–68). An American soldier, born in Montgomery Co., Pa. He graduated at West Point in 1850, served against the Seminoles in Florida, and then was stationed in garrisons along the Pacific. From 1855 to 1859 he taught at West Point. In January, 1861, he was in command of a body of regular troops in Fort Barrancas, Pensacola Harbor, Fla. On the 10th, after the surrender of the Pensacola navy yard, he transferred his force to the Fort Pickens position in the same harbor. This fort he held against Confederate attack until reënforced. Promoted to be major, he was attached to General Buell's command and took part in the Corinth campaign and the relief of Nashville, became brigadier-general of volunteers (Nov. 29, 1862), and participated in the battle of Stone River (Dec. 31, 1862), receiving a wound that incapacitated him for the rest of the war. In 1865 he was brevetted colonel and brigadier-general in the regular service for meritorious conduct and was commissioned lieutenant-colonel of the Fourth Infantry. He died while in command of Fort Laramie.

SLES'WICK. See SCHLESWIG.

SLEUTH'HOUND'. See HOUND, *Bloodhound.*

SLEZAK, slä'zäk, LEO (1876-). An Austrian dramatic tenor, born at Mährisch-Schönberg. He began his musical studies at a very early age and when only 17 made his début as Lohengrin in Brünn. In 1898 he sang as guest at the Royal Opera in Berlin with such success that several managers offered him tempting contracts. He accepted the offer of Mahler, and for seven years was a member of the Vienna Opera, whence his fame soon spread over Europe. At the expiration of his time, in 1908, he went to Paris, studying with Jean de Reszke and changing his method completely. His sensational success at Covent Garden in the spring of 1909 led to his engagement at the Metropolitan Opera House in New York, where he immediately became a favorite. With a voice of great beauty and quite unusual power he combined fine histrionic ability and a remarkable stage presence. He came to be regarded as the most impressive Otello (in Verdi's opera of that name) since the famous Tamagno, and in addition gained a name as a liedersinger of the first rank.

SLICK, SAM. See HALIBURTON, THOMAS CHANDLER.

SLICK'ENSIDES'. The name given to the polished surfaces found along the joints and fault planes of rocks. They are caused by the rubbing together of the rocks during faulting or differential movement along the planes of fracture.

SLIDELL', JOHN (1793-1871). An American politician, born in New York City. He graduated at Columbia College in 1810. In 1819 he removed to New Orleans and was United States District Attorney for Louisiana (1829-33). In 1853 he became United States Senator but resigned when Louisiana left the Union. In September, 1861, he was appointed commissioner of the Confederate States to France and ran the blockade from Charleston, S. C. At Havana, with James M. Mason, commissioner to England, he embarked on the British mail steamer *Trent,* which was overhauled on November 8 by Capt. Charles Wilkes in the United States sloop *San Jacinto,* and the envoys and their secretaries were arrested and confined for a time in Fort Warren, Boston. At England's demand the act of Wilkes was disavowed and the commissioners sailed for England, Jan. 1, 1862. (See TRENT AFFAIR.) Slidell failed in securing the assent of France to the convention giving that nation control of Southern cotton if the blockade should be broken, but was permitted to begin negotiations for the £15,000,000 Confederate loan. At the close of the war Slidell settled in London, where he died.

SLIDE RULE. An instrument composed of various scales, the positions of which in relation to each other may be altered, used for the rapid performance of certain arithmetical operations. The scales may be engraved on straight rods, disks, or on the surface of a cylinder. See CALCULATING MACHINES.

SLI'GO. A maritime county of the Province of Connaught, Ireland, bounded on the north by the Atlantic and the Bay of Donegal (Map: Ireland, C 2). Area, 707 square miles. Pop., 1851, 128,600; 1901, 84,083; 1911, 78,850. The coast line is indented with numerous bays dangerous for navigation except in the Bay of Sligo. The navigable streams are the Moy, the Owenmore, and the Garrogue. The picturesque loughs Arrow and Gill are in this county. The mineral products consist of copper, lead, iron, and manganese. The chief occupation is cattle rearing. The sea and salmon fisheries are important, and there are manufactures of woolens, linens, and leather. Capital, Sligo. Consult Wood-Martin, *History of Sligo, County and Town* (Dublin, 1890-93).

SLIGO. The capital of County Sligo, Ireland, on the Garrogue, 131 miles northwest of Dublin (Map: Ireland, C 2). It is well built, and contains several handsome public edifices. There are a town hall, including an assembly room, exchange, free library, etc., the Roman Catholic Cathedral of Elphin, and the ruins of an old abbey. Steamers ply regularly between Sligo and Glasgow, Liverpool, and Londonderry. Brewing and milling are the chief industries and flour and pork are exported. Sligo had its origin in the erection of a Dominican abbey and a castle in the thirteenth century by Maurice Fitzgerald, Earl of Kildare. In the reign of James I it received a charter. Pop., 1901, 10,862; 1911, 11,163.

SLIME EEL. See HAGFISH, and Plate of LAMPREYS AND DOGFISH.

SLIMEHEAD. One of the beautiful, red, richly ornamented berycoid fishes of the genus *Beryx,* called by the French alfonsines. They are found in the deep seas of all warm latitudes, and one species (*Beryx splendens*) is taken in the Gulf Stream. See Plate of MULLETS AND ALLIES.

SLIME MOLD. The common name of the Myxomycetes (q.v.).

SLINGELANDT, sling'e-länt, PIETER CORNELISZ VAN (1640-91). A Dutch portrait, genre, and still-life painter. He was born at Leyden, where he studied under Gerard Dou, entered the painters' guild in 1661, and became its dean in 1691. Although he never achieved the luminosity and naturalness of his master's best work, he successfully imitated his smooth, careful brushwork. His best works are scenes with children, examples of which are in the Uffizi and Dulwich galleries. Other well-known paintings are the "Meerman Family" (Louvre); "Interrupted Music Lesson" (1672) and "Poultry Vender" (1673), in the Dresden Museum; and "Musical Party in a Kitchen," in the Rijks Museum, Amsterdam.

SLIP. A semifluid form of clay with or without other ingredients, used by clay-product manufacturers to coat different wares, such as some kinds of pottery, terra cotta, etc. It is applied for decorative purposes, or also for coating the ware with a more or less impervious skin. See POTTERY.

SLIP METER. See STROBOSCOPE.

SLIPPED. In heraldry (q.v.), a term applied to a leaf, branch, or flower which is represented with a stalk and torn from the parent stem.

SLIVEN, slē'ven, **SLIVNO,** or **SELIMNIA.** A town in the Kingdom of Bulgaria, situated at the important pass in the Balkan Mountains known as the Iron Gate, 65 miles north of Adrianople (Map: Balkan Peninsula, F 3). Sliven is noted for its black wine and has an important government cloth factory. Pop., 1910, 50,598.

SLIVINSKI, slê-vĭn'skê, Joseph (1865–). A Russian pianist, born at Warsaw. He studied there at the conservatory with Strobl and later took a four years' course with Leschetizky at Vienna, completing his studies with Anton Rubinstein at St. Petersburg. He made his début in 1890, but his reputation was not established until his London appearance three years later. His first American recital took place in 1893. He became well known for his technique, for his mastery of intricate phrasing, and especially for his poetic interpretation.

SLOANE, slōn, Sir Hans (1660–1753). A British physician and naturalist. He was born in Ireland of Scottish parents and was educated in London and in France. He was elected a member of the Royal Society in 1685 and of the Royal College of Physicians in 1687. He was physician to Christ's Hospital (1694–1724), president of the College of Physicians (1719–1735), secretary to the Royal Society (1693), in the presidency of which he succeeded Sir Isaac Newton in 1727. He had been created a baronet and physician-general to the army in 1716, and in 1727 received the further honor of being appointed royal physician. He gave a strong impulse to the practice of inoculation by performing that operation on several of the royal family. He formed a museum of natural history, antiquities, coins, etc., and a library of 50,000 volumes and 3560 manuscripts, which he directed to be offered at his death to the nation for £20,000, and which formed the commencement of the British Museum (q.v.). He contributed numerous memoirs to the *Philosophical Transactions,* whose publication he superintended for a number of years, and published in 1745 a treatise on medicine for the eyes.

SLOANE, Thomas O'Conor (1851–). An American writer on science, born in New York City. He graduated at St. Francis Xavier College in 1869 and at the School of Mines of Columbia University in 1872. For many years he served as a gas engineer, inventing a self-recording photometer and devising an accurate method for determining sulphur in illuminating gas. In 1888–89 he was professor of natural sciences in Seton Hall College (New Jersey). He wrote the *Electrician's Handy Book* (1905), *Elementary Electrical Calculations* (1909), and many other books on popular science.

SLOANE, William Milligan (1850–). An American educator and historian, born at Richmond, Ohio. He graduated at Columbia in 1868, and from then till 1872 was instructor in classics at the Newell School in Pittsburgh. Afterward, while in Germany as private secretary to George Bancroft, then United States Minister at Berlin, he studied history under Mommsen and Droysen. In 1883 he was made professor of history in the College of New Jersey (Princeton), a position which he resigned in 1896 to become professor of history at Columbia. From 1886 to 1889 he edited the *Princeton Review.* A member of the American Academy of Arts and Letters, and in 1911 president of the American Historical Association, Sloane became also Chevalier of the French Legion of Honor and of the Swedish North Star. He published: *Life and Work of James Renwick Wilson Sloane* (1888); *The French War and the Revolution* (1893); *The Life of Napoleon Bonaparte* (4 vols., 1896; rev. and enlarged ed., 1911); *Life of James McCosh* (1896); *The French Revolution and Religious Reform* (1901); *Party Government in the United States of America* (1914); *The Balkans* (1914).

SLOAT, slōt, John Drake (1780–1867). An American naval officer, born in New York City. He was a midshipman in 1800, but after a year's service was honorably discharged. In 1812, however, he reëntered the navy as a sailing master, and in the war with England was attached to the frigate *United States,* which in 1812 captured the British frigate *Macedonia.* In 1813 he was promoted to be lieutenant, and in 1823–25 commanded the *Grampus,* one of the squadron engaged in suppressing piracy in the West Indies. From 1844 to 1846 he was in command of the Pacific Squadron, and took possession of Monterey and San Francisco early in the Mexican War. He was retired in 1861, but was subsequently promoted to the rank of commodore in 1862 and rear admiral in 1866.

SLO'CUM, Henry Warner (1827–94). An American soldier, born at Delphi, N. Y., and graduated at West Point in 1852. In 1856 he resigned from military service and became a counselor at law in Syracuse, N. Y. In the Civil War he became colonel of the Twenty-seventh New York Volunteers, which he led at the first battle of Bull Run, where he was severely wounded. He returned to active service in September, 1861, as brigadier general of volunteers. He rendered conspicuous service at the battle of Gaines's Mill (q.v.). After Malvern Hill (July 1, 1862) he rose to be major general of volunteers. He was in the second battle of Bull Run and at South Mountain, Antietam, Chancellorsville, and Gettysburg. He later took part in the capture and occupation of Atlanta. In Sherman's march to the sea Slocum was given the left wing, a command which he held until after Johnston's surrender at Durham Station. In 1865 he resigned from the service. He was elected to Congress in 1868 and 1870.

SLOCUM DISASTER. One of the greatest marine catastrophes of modern times. The large steamboat, *General Slocum,* carrying about 1800 passengers, was discovered to be on fire while sailing up the East River on June 15, 1904. Before the boat could be grounded a panic seized those on board, and many hundreds leaped overboard to escape the flames, which spread with great rapidity. The vessel was finally beached near North Brother Island, but in spite of the heroic efforts of those who hastened to the rescue, about 1000 persons were drowned or burned to death.

SLOE, slō (AS. *slā, slāhæ,* OHG. *slēha,* Ger. *Schlehe,* sloe), Blackthorn or Sloe Thorn (*Prunus spinosa*). A shrub of the family Rosaceæ, by some botanists supposed to be the original species of some of the cultivated plums. It is generally a much branched spiny shrub of 4 to 10 feet high, or sometimes a small tree of 15 to 20 feet, with small snow-white flowers, which appear before the leaves. The fruit, generally about the size of large peas, is used for making preserves, brandy, and gin. The juice is much used in the manufacture of spurious port wine and to impart roughness to the genuine.

SLOKE, or Laver. See Carrageen.

SLONIM, slŏ'nyêm. The capital of a district in the Government of Grodno, Russia, situated on the Shara, a navigable tributary of the Niemen, 110 miles southeast of Grodno. It has manufactures of cloth, tobacco, and spirits. Pop., 1911, 21,440, mostly Jews.

SLONIMSKY, Chaim Selig (1810–1904). A

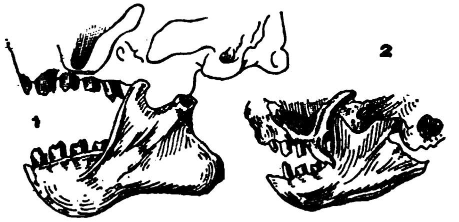
Russian Jewish physicist, astronomer, and mathematician, born at Byelostok. Slonimsky was a pioneer as a popularizer of science among the Jews. The Hebrew weekly he founded for this purpose in 1862, *Ha-Zefirah*, was the first of its kind. The Russian government made him official censor of Hebrew books (1862–74), a function he performed while acting as dean of the Zhitomir rabbinical seminary. Slonimsky invented a device for transmitting quadruple telegrams (1856), a forerunner of the device perfected by Sir William Thomson (Lord Kelvin) in 1858. Some of his magazine articles were collected and published under the title *Ma'amare Hokmah* in 1891.

SLOOP (Dutch *sloep*, Ger. *Schlupe*, sloop; probably from OF. *chaloupe*, from Sp. *chalupa*, Eng. *shallop*). A small vessel having a single mast and fixed bowsprit. A sloop's sails are mainsail, gaff topsail, jib, and staysail; spinnaker, club topsail, jib topsail, balloon jib, and flying jib are carried by large racing sloops. Formerly sloops and cutters differed in shape, the cutter usually being much narrower and deeper, but at present the difference in form is very slight. In the days of sailing ships, and of steamers before sails were removed from steam men-of-war, a sloop of war was a ship-rigged vessel, but smaller than a frigate. See Yacht and Yachting.

SLOS'SON, Edwin Emery (1865–). An American editor and author; also a chemist. He was born at Albany, Kans., and was educated at the University of Kansas (B.S., 1890; M.S., 1892) and at the University of Chicago (Ph.D., 1902). From 1891 to 1903 he was professor of chemistry at the University of Wyoming, and chemist at the Wyoming Agricultural Experiment Station. Thereafter he was connected with the ***Independent*** as literary or managing editor. From 1912 he was associate on the faculty of the school of journalism, Columbia University. He published: *Great American Universities* (1910), *Major Prophets of To-Day* (1914), and many magazine articles on matters scientific and literary.

SLOTH (from AS. *slāw*, OHG. *slēo*, *slēw*, dialectic Ger. *schlēw*, *schlō*, Eng. *slow*). An edentate mammal of the family Bradypodidæ, remarkably adapted to arboreal life, and represented by many species, all residents of tropical America. They vary in size from that of a small bear to that of a cat. They feed on the leaves, buds, and young shoots of trees, among the branches of which they live, rarely descending to the ground. They do not walk upon the branches, but cling beneath them, with back downward, progressing with agility. They are chiefly nocturnal, resting sleepily during the day, from which, and from a misunderstanding of their habits, the misnomer of "sloth" arose.

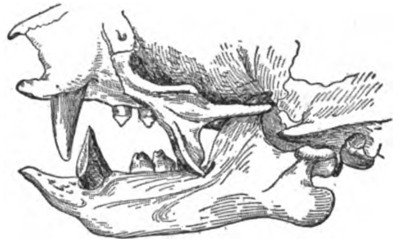
The forelegs are much longer than the hind ones, and the feet are furnished with long sharp claws, curved into hooks by which sloths hang beneath the branches even in sleep. A peculiarity of the group is the extraordinary number of dorsal vertebræ. The head is round and the muzzle so short that the face is monkey-like. Although members of the order Edentata, sloths are by no means toothless. There are no incisor teeth, but sharp canine teeth, and eight molars in the upper, six in the lower jaw. The molars are cylindrical and are adapted merely for crushing, not for grinding, the food. For this, however, there is compensation in the stomach—somewhat imperfectly divided, by transverse ligatures, into four compartments, for retention and thorough digestion of the food. The hair is coarse and shaggy, affords excellent protection from insects, and gives sloths such a gray appearance that they are not readily observed except when in motion.



JAWS AND TEETH OF SLOTHS.

1, three-toed sloth (*Bradypus tridactylus*); 2, collared sloth (*Bradypus infuscatus*).

The sloth produces only one young one at a birth, which clings to its mother till it becomes able to provide for itself. The voice of the animal is a low plaintive cry. Less than a dozen species of sloth are known, grouped in two subfamilies, according to the number of toes on the forefeet. All have three toes on the hind feet, but the Cholœpodinæ have only two toes on the front feet, the Bradypodinæ three. The latter have nine cervical vertebræ and 20 abdominal, and of the latter 15–17 bear ribs; while the former have only six or seven cervical vertebræ, and 27 abdominal, of which 23–24 bear ribs. Of the Cholœpodinæ, or "unaus," there are only two species, the two-toed (*Cholœpus didactylus*), common in Brazil, and a Central American species (*Cholœpus hoffmanni*), which is lighter colored. They are about 2 feet long. Of the Bradypodinæ conspicuous species are the three-toed sloth (*Bradypus tridactylus*) and the collared sloth (*Bradypus infuscatus*). The latter is the largest of the family and has a collar of long black hair around the neck, behind which is a patch of pale orange. Consult: Alston, "Mammals," in *Biologia Centrali-Americana* (London, 1879–82); Richard Lydekker, *Royal Natural History*, vol. iii (ib., 1895); F. E. Beddard, "Mammalia," in *Cambridge Natural History*, vol. x (New York, 1902), and the memoirs there cited relating to anatomy and classification; H. W. Bates, *Naturalist on the River Amazons* (new ed., London, 1910). For fossil forms of the sloth, see Ganodonta; Mammalia, Fossil; Megatherium; Mylodon.



JAWS AND TEETH OF TWO-TOED SLOTH.

SLOTH BEAR. See Bear, and Plate of Bears.

SLOUGH, slou. A market town and railway junction in Buckinghamshire, England, 18 miles west of London and 2 miles north of Windsor Castle (Map: London, D 1). Here the elder Herschel erected his observatory and great telescope and made many of his important astronomical discoveries. Pop., 1901, 11,461; 1911, 14,982.

SLOUGH. See Necrosis.

SLOUGH OF DESPOND. A bog encountered by Christian, in *Pilgrim's Progress*, at the outset of his journey. It typifies the discouragement and apprehension caused by a sense of sin.

SLOVAKS, slŏ′văks. A Slavic people of northwestern Hungary and southern Moravia, closely akin to the Czechs. According to Niederle they number more than 2,500,000, not counting those in the United States. Most of them are Roman Catholics. Consult: J. Čapek, *The Slovaks* (New York, 1906); R. Šeton-Watson, *Racial Problems in Hungary: A History of the Slovaks* (London, 1909); L. Niederle, *La race slave* (Fr. trans., Paris, 1911).

SLOVENIANS, slō-vē′nĭ-*anz*. A South Slavic people of Austria-Hungary, inhabiting Carniola (where they constitute the great bulk of the population), the southern part of Carinthia and Styria, the environs of Udine in Friuli, Gorizia (Gorica, Görz), and other districts. About the sixth century they migrated from their home in the Carpathians to the south of the Danube, where they remain. The Slovenians number over 1,500,000 people, including some 100,000 who have settled in the United States. (Niederle.) Consult L. Niederle, *La race slave* (Fr. trans., Paris, 1911). See Slavs.

SLOWACKI, slō-väts′kē, Juliusz (1809–49). A famous Polish Romantic poet. He was born at Kremenez in Volhynia, and was educated at the University of Vilna. In 1831 he left his country, never to return. Among his works are the poems "Jan Bielecki," "Arab," "Lambro," "Anheli," "Beniowski," an epic in five cantos from the time of the Bar Confederacy, containing satirical allusions to his contemporaries, "Waclaw," "King Spirit," the dramatic poem "Kordjan," and the dramas *Maria Stuart*, *Mazeppa*, *Balladyna*, and *Lilla Weneda*. Some of these were translated into several languages. His collected works were published at Leipzig (4 vols., 1860) and at Lemberg (4 vols., 1880); his posthumous works were issued in 1866 and 1885. Consult the biographies by Malecki (Lemberg, 1881) and Hoenck (Warsaw, 1897); also Sarrazin, *Les grands poètes romantiques; Mickiewicz, Slowacki, Krasinski* (Paris, 1906).

SLOW LEMUR. A lemur of the genus *Nycticebus* or *Loris*, noted for its slow movements, especially the common Asiatic loris, also called sloth monkey (*Nycticebus tardigradus*). See Loris, and Plate of Lemurs.

SLOW MATCH. A rope or cord which has been saturated or steeped in a solution of saltpetre, so that it will burn slowly and regularly. Fuses or electric sparks now replace this in ignition of gunpowder or explosives. (See Blasting.) For igniting fireworks quick match, which burns more rapidly, is used. See Pyrotechny.

SLOWWORM (AS. *slāwyrm*, *slāwerm*, slowworm, from *slēan*, Goth., OHG. *slahan*, Ger. *schlagen*, to strike + *wyrm*, *werm*, worm; influenced by popular etymology with Eng. *slow*). A burrowing elongated lizard of the family Anguidæ. One of the slowworm species (*Ophisaurus ventralis*) occurs in the United States south of the Ohio River and is sometimes called joint snake because, on account of a loose articulation of the vertebræ, the tail easily separates from the body. See Blindworm, 1.

SLUBBER. See Spinning.

SLUDGE. See Cottonseed.

SLUG (from ME. *sluggen*, Norw., Swed. *slōka*, to go draggingly, to droop, Icel. *slōkr*, slouching fellow). A terrestrial pulmonate gastropod or snail, in which the shell is represented by an internal horny plate overlying the respiratory cavity. The slugs are chiefly of two families, Limacidæ and Arionidæ, and most commonly are of the genus *Limax*. They are vegetable eaters and often ascend trees in search of food and then let themselves down by means of a mucous thread spun from a gland opening on the anterior edge of the foot. In Europe they ravage garden and field crops, but do little damage in the United States. Their general economy is that of the snails (q.v.). The great gray slug, sometimes 4 inches long, is a European species, introduced into and now become common in eastern North America. A native American slug, which is very common in the United States, is *Lima campestris*, a small species of slug less than 1 inch long.

SLUTER, slụ′tẽr, Claux (?–c.1405). The principal Dutch sculptor of the later Middle Ages. The earliest record of his life is that in 1389 he became statuary in ordinary at Dijon to Philip the Bold of Bungundy, whose service he had entered a few years before. In charge of the sculptures for the Carthusian monastery, the Chartreuse de Champmol, which Duke Philip had founded in 1383, he surpassed in ability all his predecessors. His works are noble and original in conception and characterized by a powerful, trenchant, and yet pictorial realism. In 1398 Sluter, aged and infirm, called to his aid his nephew and pupil, Claux de Werne, of Hattem, to whom must be attributed a more or less important part in the execution of his uncle's latest productions. The earliest of Sluter's works that still remain on the site of the former Chartreuse, now occupied by a lunatic asylum, are the figures on the portal of the chapel (c.1390–94), to wit, "Duke Philip in Prayer," "Saint John," "Duchess Marguerite," and "St. Catherine," the first and last remarkable for the freshness of their realism. Next comes the famous "Moses Fountain" (1395–1404) in the courtyard, a hexagonal base with the life-size figures of the "Six Prophets," admirable specimens of psychological individualization, polychrome, according to mediæval usage. A reproduction of this is in the Dijon Museum which also contains Sluter's masterpiece, the "Tomb of Philip the Bold" (1404–11), in black and white marble, the mighty sarcophagus surrounded with arcading, through which passes a procession of 40 small alabaster figures of mourners, exquisite in finish. The recumbent figure of the Duke is of striking realism. Claux de Werne undoubtedly completed this monument. Consult Alfred Gonse, *L'Art gothique* (Paris, 1890), and id., *La sculpture française depuis le XIVme siècle* (ib., 1894).

SLUTSK, slụtsk. The capital of a district in the Government of Minsk, Russia, situated 123 miles south of Minsk. Pop., 1910, 16,190. Slutsk passed to Lithuania in the thirteenth century and attained great importance as the capital of the Principality of Slutsk. It came into the possession of Russia in 1795.

SLY, CHRISTOPHER. A tinker and bear keeper who, in the induction to Shakespeare's *Taming of the Shrew,* is found drunk, taken to a lord's house and made to believe he is master, while the comedy is performed before him.

SMALCALD, smäl′kȧld. A town of Prussia. See SCHMALKALDEN.

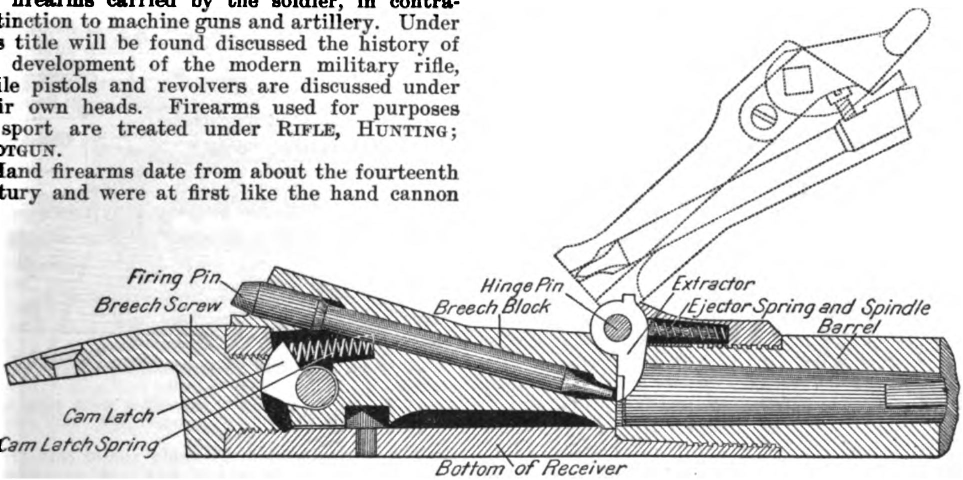
SMALCALDIC (smȧl-kăl′dĭk) **LEAGUE.** See SCHMALKALDIC LEAGUE.

SMALL, JOHN KUNKEL (1869–). An American botanist. He was born at Harrisburg, Pa., and graduated from Franklin and Marshall College in 1892 and from Columbia (Ph.D.) in 1895. After serving as curator of the Columbia herbarium in 1895–99 he was curator from 1899 to 1906 and head curator after 1907 of the New York Botanical Garden. His papers deal largely with the flora of North America and of Patagonia. He published: *Shrubs of Florida* (1913); *Florida Trees* (1913); *Flora of Miami* (1913); *Flora of Lancaster County* (1913); *Flora of the Florida Keys* (1913); *Flora of the Southeastern United States* (2d ed., 1913).

SMALL ARMS. A military term denoting the firearms carried by the soldier, in contradistinction to machine guns and artillery. Under this title will be found discussed the history of the development of the modern military rifle, while pistols and revolvers are discussed under their own heads. Firearms used for purposes of sport are treated under RIFLE, HUNTING; SHOTGUN.

Hand firearms date from about the fourteenth century and were at first like the hand cannon or bombardello—a small bombard, fired from the shoulder by means of a match applied to a touchhole. The bombard was welded on to an iron rod, which was carried suspended from the neck of the soldier. The powder chamber was smaller in its internal diameter than the bore of the gun, but externally larger. These weapons are also known as *bâtons-à-feu* (fire sticks). The hand culverin was a small cannon secured to a stock by iron bands and had a bore of little more than half an inch, but was in general use throughout Europe. The Swiss army at the battle of Morat (1476) included about 6000 culveriners. The hand culverin was fired from a forked rest usually and required two men to work it—one aimed and held the weapon; the other discharged, loaded, and assisted in carrying it. Improvements included an enlarged bore, a bent stock, and finally the side touchhole. The barrels were octagonal or hexagonal. Small culverins were used for horseback fighting and larger ones for foot soldiers. The first real approach to the modern small arm was the early matchlock, the ordinary gun of the period with the addition of a serpentine or cock for holding the match. The serpentine was hung upon a pivot which, passing through the stock, formed a lever for the hand. Before the weapon could be discharged it was necessary to bring the serpentine in contact with the burning match on the barrel, until the former was ignited, after which the lever was raised and the serpentine brought to the priming of the touchhole and the gun discharged. The next improvement was to reverse the position of the serpentine and provide a spring to hold the match away from the touchhole, after which a pressure brought to bear upon the lever caused the serpentine with lighted match to fall into the flash pan.

Many strange varieties of firearms came into use—combinations of club and pistol, of pistol and battle ax, and particularly the "holy-water sprinkler," a strong mace formed by four or more barrels arranged as is the chamber of the modern revolver. An improved invention in the form of the wheel lock was made in 1515. It consisted of a grooved steel wheel, having a serrated edge connected to the lock plate by means of a chain and spring. The spring power was obtained by winding the wheel so that when the gun was charged the wheel would be wound up, the cover of the flashpan withdrawn, and the pyrite which was held in the cock permitted to come in contact with the wheel. When the trigger was pressed the check on the wheel was released, and sparks produced by the friction of the wheel against the pyrite and the priming ignited the charge. Owing to its expense, the wheel-lock gun was used almost entirely for sporting purposes, and soon after this the use of firearms in the chase became general.

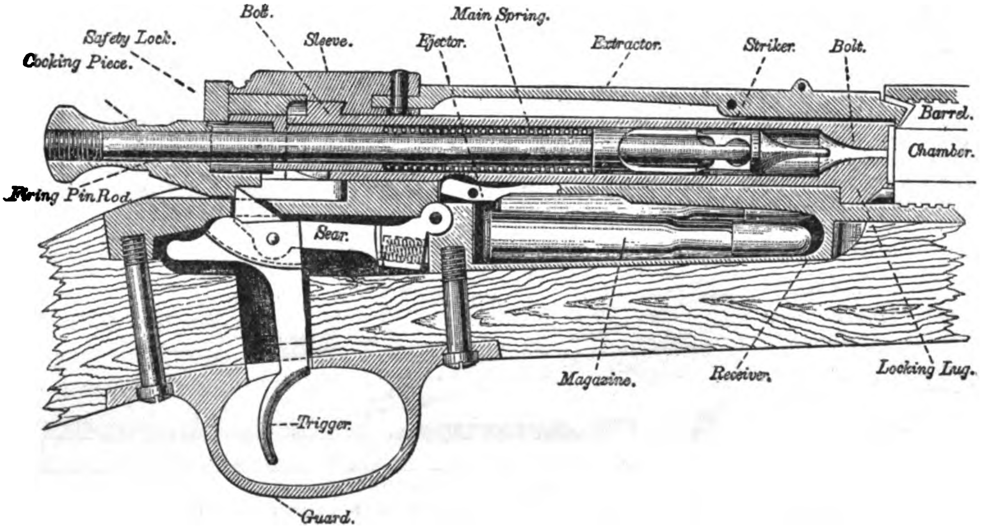


BREECH MECHANISM OF UNITED STATES SPRINGFIELD RIFLE, CALIBRE 0.45 INCH.

The flintlock, which followed the wheel lock, seems to have been of Spanish origin and to date from early in the seventeenth century; in it the process of igniting the charge was considerably simplified. The hammer or cover plate was forced backward by the bolt so that the flint, which was screwed in the jaw of the cock, and the priming in the flashpan were exposed to the sparks caused by the contact of the flint and the hammer, and thus the charge was ignited. The flintlock was a long time coming into favor, owing to the fact that in its original form the sparks frequently escaped without firing the charge. Flintlock muskets were first introduced into England during the reign of William III and in one form or another remained in use in the British army up to as late as 1840.

In the improved methods of ignition which Forsyth made possible the next important step in the evolution of small arms was accomplished. His invention dates from 1807 and is described as "a detonating principle for exploding gunpowder in firearms, etc." Many subsequent improvements in the system were made by the manufacturers whom the patentee engaged to make the guns. The percussion principle was applied first to muzzle-loading and afterward to breechloading guns, but did not at first appeal to the various governments of Europe as suitable for weapons for military purposes.

Modern Military Rifles. Although the principle of rifling small arms dates from the beginning of the sixteenth century, it was not till towards the close of the seventeenth that the principle was employed for military weapons. Owing to the fact that the rifle could not be loaded after a few rounds had been fired, some method had to be found to obviate this; nothing proving satisfactory until an English gunmaker in 1836 devised an egg-shaped bullet with a cavity at one end to receive a conical plug which under pressure of the gas generated by the discharge expanded the bullet into the grooves. The Minié rifle of the French was the next improvement on this; in that an iron cup was utilized to expand the cone when forced home by the gas. In the three-grooved Enfield rifle (English) of 1855 a wooden plug was used instead of the iron cup. Next followed the Whitworth hexagonal rifling, which made possible the use of an elongated bullet and which lowered the trajectory of the bullet by offering a smaller front to air resistance.

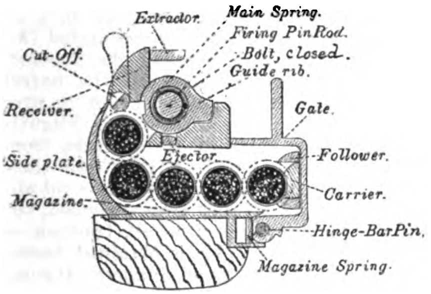


UNITED STATES MAGAZINE (KRAG-JÖRGENSEN) RIFLE, CALIBRE 0.30 INCH.

The first breechloading small arm of consequence was Hall's rifle, invented in 1811 and manufactured in small quantities about 1818 for the United States army; its chamber rose on a hinge at the rear end for loading. About 1812 Pauly, an officer under Napoleon, evolved a breechloader which is the progenitor of all later guns with swinging block. Dreyse, working under him, developed a discarded model of Pauly's into a successful breechloading needle gun, the forerunner of all bolt-action guns. In 1841 the Prussians adopted their famous needle gun, which brought many victories from 1848 to 1866.

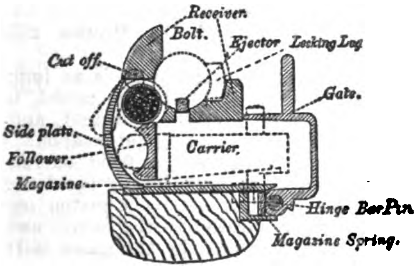
This weapon marked a great advance in military rifles. The bullet was conical in shape and together with the powder was inclosed in strong paper. In the centre of the outer surface of the wad (immediately behind which was the powder) was a detonator, to explode which the needle fixed in the breech would upon pulling the trigger be released and penetrate the cartridge. The French adopted the Chassepôt (q.v.), an improved needle gun. This gun, as well as other weapons employed by European armies, had the action now generally used, a bolt containing firing pin and spiral spring and sliding axially with the bore in a metal receiver behind, and fastened to, the barrel. A handle fastened to one side of the bolt engages in front of a lug when the bolt is run forward and rotated to the right, thus locking the breech.

England converted her Enfield rifles, of the three-grooved expanding-bullet muzzle-loader type, into Snider breechloaders by alterations at the breech end of the barrel. A chamber was made by which the cartridge could be inserted in the barrel, after which the block (worked on a hinge) was closed and the space filled. A needle or striker passed through the breech block, struck the cap in the base of the cartridge, and thus ignited the charge. In 1869 the Martini-Henry rifle was adopted for the British army. It consisted of a combination of the Martini breech action with the Henry barrel. The Italians and Swiss adopted the Vetterli gun, which was of the repeater or magazine type, having a tube under the barrel in which were contained 11 cartridges, which were in turn forced into the breech by the same action which discharged the empty cartridge. Russia adopted the Gorloff gun with a block hinged in front and rising to open. This is the principle of the Springfield breechloading rifle (calibre 0.45) adopted for the United States army in 1873, and retained until 1892 (see illustration), when it was succeeded by the United States magazine rifle, developed from the Krag-Jörgensen.



UNITED STATES MAGAZINE RIFLE AND CARBINE, CALIBRE 0.30 INCH.

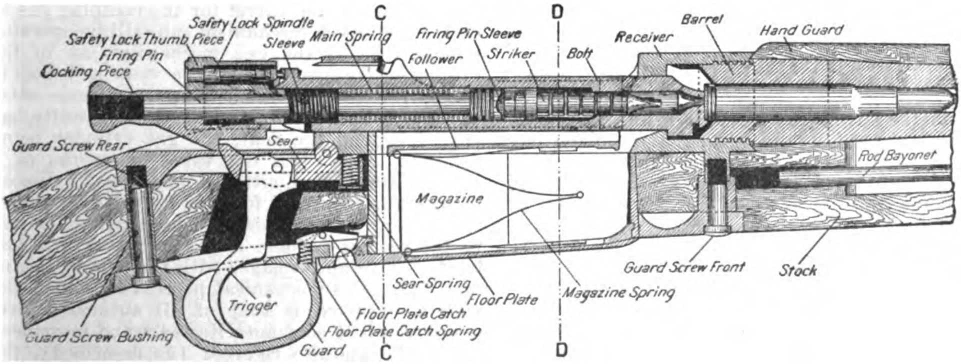
Transverse section through magazine.



UNITED STATES MAGAZINE RIFLE AND CARBINE, CALIBRE 0.30 INCH.

The same cross section when all but the last cartridge has been fired; the magazine is "on" and the bolt opened.

The question of magazine arms was considered (1891–92) in the United States by a board which tested 53 different designs, among which they found two general classes—repeaters, which could not be used as singleloaders while the magazine was charged, and magazine guns proper, in which the magazine could be charged and held in reserve for an emergency while loading is done shot by shot. The gun selected was one of the latter class—a bolt-action gun with magazine under and rising to the left of the chamber. It had a clasp containing five cartridges placed under and to the left of the receiver; the calibre of the barrel was 0.30 inch. It was sighted up to 1900 yards and had a firing capacity (single-loading) of 42 shots to the minute. It was the weapon used by the United States regular troops in the war with Spain (1898) and was found to be all that was claimed for it. The Krag-Jörgensen bullet had a weight of 220 grains and a velocity of 2200 feet per second. It had an inside of tin and lead composition and an outer jacket of cupronickel steel. Its weight without bayonet was 9.187 pounds, and its total length without bayonet 48.9 inches. The cartridges are put in on the right through a gate, lie side by side, and are pushed sideways across and up into the chamber by a follower. Partly entering the magazine, they are caught by the bolt coming forward, forced on an inclined path into the bore, and supported behind by the bolt, which is locked by lugs and the handle engaging in recesses when rotated.



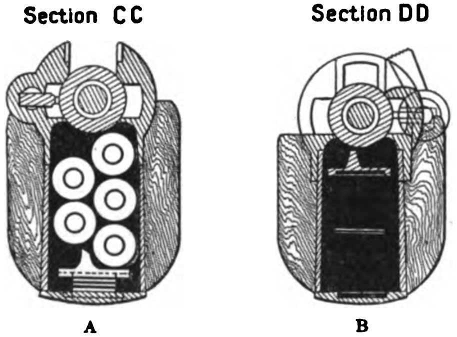
UNITED STATES SPRINGFIELD MAGAZINE RIFLE, MODEL 1902. LONGITUDINAL SECTION.

An example of the repeater is the Austrian Mannlicher, a bolt gun, into which is introduced from above, through the receiver, a metal packet holding five cartridges. The packet forms an essential part of the mechanism until all its cartridges have been used, when it falls out. There is no cut-off, as in the Krag-Jörgensen, by which the magazine can be held in reserve; all five cartridges must be fired before any more can be put in.

The Mauser rifle was a modification of the French Chassepôt, constructed for the use of the military gas-check cartridge. It was first adopted by the Prussian government as the successor of the needle gun, but it has been so frequently improved that even in 1916 it still remained one of the most effective of modern military weapons. The Spanish troops were armed with the Mauser magazine rifle during the Spanish-American War and derived from it a great advantage in effective rifle fire over the American volunteer regiments, who were for the most part armed with the Springfield 0.45. The bore of the original Mauser as adopted for the Prussian military service was 11 millimeters (0.433 inch) diameter and was rifled with four flat grooves. The length of the barrel was 33.65 inches, and the total length 53.15 inches.

During the last half of the nineteenth century the muzzle-loader was superseded by a single-shot breechloader, and this in turn by a magazine rifle, this latter now replaced in some armies by automatic rifles ejecting and loading by the energy of discharge. During this time there was a constant decrease in the calibre until 1895, when some reaction was felt. The average is now about 0.30 inch. that of the United States gun. The wisdom of arming the soldier with an automatic magazine rifle is a subject of debate among military authorities. It is argued on the one hand that the percentage of hits with repeating fire weapons indicates wasteful and badly directed fire, and such an arm is subversive to good fire discipline, besides adding to the already complex problem of ammunition supply. On behalf of the automatic and magazine systems it is urged that the soldier is in a constant state of readiness, and that, notwithstanding a tendency to wastefulness, its faults are more than compensated for in critical moments when rapid-fire action is of importance. In 1903 the tendency was to reduce the length of the barrel and increase the strength of the charge, to increase the magazine capacity, and, where such was not already employed, to replace the detachable magazine with a clip, and from that time to the outbreak of the Great War there was but little change.

The Springfield magazine rifle, model 1902, was next adopted as the military weapon of the United States. It differs from the weapon that is displaced in that it is centrally fed by clips and the bolt has two lugs instead of one. The barrel has four grooves and a calibre of 0.30. The bullet weighs 220 grains and is fired by a powder charge of a little over 44.5 grains, giving a pressure of 4200 pounds per square inch and an initial velocity of 2300 feet, a velocity at 1000 yards of 958 feet, and a muzzle energy of 2581.6 foot pounds. The rifling in the barrel makes one turn in 8 inches. The magazine is charged from a clip, the cartridges being forced from it directly into the magazine by pressure of the thumb on the top of the cartridge. The clip is ejected by the forward motion of the bolt. The gun may be used as a single loader with the magazine empty, and it may be filled by the insertion of a single cartridge. There is a knife bayonet, which is about 16 inches long and weighs one pound. In connection with the preliminary tests of this weapon before the examining board it was noted that it exceeded by 9.3 per cent in rapidity and 18.6 per cent in hits the results obtained by the same marksman with the regular service weapon. Later tests gave more favorable results.



UNITED STATES SPRINGFIELD MAGAZINE RIFLE, MODEL 1902. TRANSVERSE SECTIONS.

A, transverse section at *CC*; *B*, transverse section at *DD*.

The weapon with which the British army was equipped in 1903 was a modification of the Lee-Metford weapon. Notwithstanding all that had been promised for the Lee-Metford magazine rifle, with which the troops were armed during the South African War, it was found to be deficient in all the qualities that make a good service weapon. The new weapon was 5 inches shorter than the old one, thus securing appreciable reduction in weight. In the old weapon there was a small wooden grip to protect the hand from the heat of the barrel; in the new one the barrel is inclosed in a wooden casing throughout its entire length, to within an inch of the muzzle. This, of course, necessitated a new method of fixing and securing the bayonet. A separate nose cap is fitted to the barrel, to which the bayonet is attached. A greater velocity of the projectile is secured by slightly enlarging the bore from about 10 inches from the muzzle, on the principle that where the bore begins to increase the force of the explosion of the cartridge has already been expended, so that by enlarging the bore a small fraction of an inch an increased velocity is obtained, because if the bore were of the same diameter throughout its entire length the tight barrel would cause friction and a consequent reduction of velocity. The disadvantage of the shortened barrel is that the back and fore sights are brought closer together, thus demanding greater care in taking aim, since the possible angle of error is greatly increased. To obviate this the backsight has been made so as to be capable of adjustment up to a considerable range without raising the leaf. The magazine is concealed within the stock and carries 10 cartridges, as did the former rifle, but instead of loading the magazine by hand a clip similar to that of the Mauser rifle is employed.

The Mannlicher automatic rifle is an improvement on the ordinary Mannlicher model, is 0.7 kilogram (1.54 pounds) less in weight, and has a shorter barrel than the original weapon. It is an automatic firearm with a fixed barrel, the bolt mechanism being operated by powder gases from the barrel, which act on a piston moving in a gas cylinder parallel to the barrel and the bolt. The energy created by the gases is transmitted from the piston to the breech mechanism. The gas piston is driven back a short stroke by the gas, upon which it unlocks the bolt and starts it towards the rear. The gas piston does not accompany it the entire length of its movements in either direction, its function being confined to impelling it rearward. The advantage of this is that it enables the breech mechanism to be operated with a short and light brass cylinder and piston, at the same time leaving the greater part of the movement to the barrel, independent of the gas mechanism, so that should the opening in the barrel for the escaping gas be closed the breech mechanism can still be operated independent of the gas mechanism, as in the ordinary repeating rifle. The vent is bored in the barrel through which the powder gases enter the gas cylinder the moment the projectile has passed beyond the vent, the gas cylinder being fastened underneath the valve by means of a screw. The piston, situated in the gas cylinder, is constantly pressed forward by a spiral spring and is forged in one piece with an arm extending to the rear and side. This arm moves in a slit in the sleeve and engages with the bolt by means of a lug. The mechanical process by which the rifle is operated is that of all automatic firearms; the bolt continues its rearward movement under the impulse received (as described), the hammer is cocked, and the empty shell is disengaged from the extractor by a blow against the ejector, after which the bolt spring drives the bolt forward again. Several important advantages are claimed for this weapon, one being that the vent in the barrel leading to the gas cylinder

COUNTRY	Name of gun	Year of introduction	Calibre	Length		Weight		Cartridge			Rifling			Maximum sight setting	Bullet			Powder		Muzzle velocity
				Without bayonet	With bayonet	Without bayonet	With bayonet	Length	Weight	No. in magazine	No. of grooves	Direction of twist	No. inches to one turn		Jacket	Length	Weight	Kind	Weight of charge	
			inches	feet	feet	lbs.	lbs.	inches	grains					yards		inches	grains		grains	ft. secs.
Argentina	Mauser	1909	.301	4.10	5.40	8.92	10.05		371		4	right	9.84	2187			154	smokeless powd. centralito base	47.5	2788
Austria-Hungary	Mannlicher	1895	.315	4.16	4.95	8.05	9.89	3.00	454	5	4	right	9.84	2132	lubricated steel	1.24	244	nitrocellulose	42	2840
Belgium	Mauser	1889	.301	4.19	4.98	8.60	9.59	3.055	432	5	4	right	9.84	2187	maillechort (zinc, copper, and nickel)	1.20	219	nitrocellulose	37	1968
Bolivia																				
Brazil	Mauser	1911	.275												steel	1.173	138.89	nitrocellulose	48.61	2906.8
Bulgaria	Mannlicher	1888 1895	.315	4.166	4.9	8.03	8.656	3.00	437	5	4	right	9.84	1968 2120	nickel-plated steel	1.253	244	nitrocellulose	42.5	2034
Chile	Mauser	1895	.275	4.05	4.86	8.60	9.50	3.07	386	5	4	right	8.65	2187	cupro-nickel	1.121	170	nitrocellulose	38	1910
China																				
Colombia	Deutsche waffen und Berlin		.275	4.10	5.01	8	9	3.04	354.9	5				3280.8		1.181	138.89	smokeless in rectangular cakes	46.30	2952.7
Costa Rica																				
Denmark	Corrected Krag-Jörgensen	1889	.315	4.363	5.216	9.369	9.920	2.992	450.6	5	6	right	11.8	2187.2	steel	1.240	196	nitrocellulose	49.38	2460.6
Ecuador	Improved Mannlicher	1906	.311	4.08	4.90	8.377	9.259	3.248	416.7	5	4	right	9.84	2241.9	nickel steel	1.20	216.05	troisdorf	30.86	2034.1
France	Lebel	1886–1893	.315	4.30	6.00	9.22	10.10	2.95	424.4	8	4	left	9.45	2620	no jacket, bullet of brass	1.54	197.5	nitrocellulose	46	2263.4
Germany special armor amm.	Mauser	1898	.311	4.10	5.81	9.03	10.04	3.16	368 411.5	5	4	right	9.45	2187	nickel copper-plated milled sheet steel	1.105	154 197.2	lamellar	49.3 49.7	2952 2641
Great Britain	C. L. Lee Enfield Mark III	1907	.303	4.12 3.70	5.12 5.14	9.25 8.65	10.22 9.69	3.05	415	10	5	left	10.0	2800	cupro-nickel (for Mark VII cal. .30, s. a. amm.)	1.25 1.28	215 174	cordite	31.5	2060 2440
Greece																				
Guatemala																				
Holland	Mannlicher	1895	.256	4.20	5.50	9.05	10.0	3.05	346	5	4	right	7.85	2187	steel, coated with cupro-nickel	1.24	171	nitrocellulose	36	2870
Honduras	Remington single shot		.430 .275			10.0	11.0			1				1093.6 2187.2	no jacket, bullet of lead		395 175	black smokeless	77	
Italy	Paravicino	1891	.256	4.24	5.22	8.38	9.25	2.98	340	6	4	right	7.85	2187	cupro-nickel	1.20	162	ballistite	35	2296
Japan	Arisake	1905	.264	4.20	5.48	8.75	9.75	2.98	325	5	6	right	7.85	2187	cupro-nickel	1.25	138	nitrocellulose	33	2425
Mexico	Mauser	1902	.275	4.04	4.86	9.04			336		4	right	8.60	2187	cupro-nickel	1.21	162	nitrocellulose	31	2295
Montenegro																1.26	171.3	nitroglycerine	36.44	2460.6
Nicaragua	Spanish Mauser	1902	.433	4.25	6.10	10.0	12.0			10	4	left	20	1749.78	lead	1.06	55	black	40	
Norway	Corrected Krag-Jörgensen	1894	.256	4.14	5.00	8.818	9.534	3.169	361.8	5	4	left	10.12	2405	nickel-plated steel	1.26	171.3	nitroglycerine	36.44	2460.6
Paraguay	Paraguayan Mauser	1908	.314	4.13	5.84	9.369	10.803	3.15		5	4	right		2187.2	steel	.933		smokeless rectangular flakes		2690.28
Peru	Mauser	1910	.301	4.10	5.81	9.149	10.097	2.913	370.3	5	4		8.84		cupro-nickel	1.102	154.32	Karlsruhe		2788
Portugal	Mauser Vergueiro	1904	.256	3.64	4.46	8.16	9.92	3.26	372	5	4	right	7.78	1968	steel, coated with cupro-nickel	1.26	155	nitrocellulose	32	2347
Rumania	Mannlicher	1893	.256	4.02	4.825	9.13	9.944	3.05	350.12	5	4	right	7.87	2270.3	steel, coated with German silver	1.228	159	nitrocellulose	36.5	2296.6
Russia	inf. Three line rifle cav.	1891	.30	4.23 3.94	5.69 5.40	8.80 8.35	9.48 9.03	3.10	349	5	4	right	3 turns in length of barrel	2666.6 (3200 paces)	nickel German silver	1.19	148	pyroxylin	50.7	2886
Salvador																				
Servia	Mauser	1899	.275	3.75		8.82	9.90	3.00	373	5	3	right	8.65	2186	cupro-nickel	1.20	172	nitrocellulose	34	2290
Spain	Mauser	1893	.275	4.05	4.86	8.80	9.70	3.07	380	5	4	right	8.65	2187	cupro-nickel	1.214	173		38	2330
Sweden	Correc. Mauser	1896	.256	4.14	4.82	8.644	9.239	3.11	339.5	5	4	right	7.874	2187.2	copper nickel	1.22	155.86	nitrocellulose	35.49	2395
Switzerland	Repeating rifle	1897	.2955	4.27	5.25	9.92	10.87	3.03	432	12	3	right	10.63	2187	nickel-plated steel	1.142	212.9	Scheisswollpulver p. c. 88	20.86	1968
Turkey	Mauser		.301	4.04	5.55	8.59	10.46	3.07	416.6	5	4	right	7.85	2187	nickel-plated steel	1.18	213	nitrocellulose	41	2140
United States	Springfield	1903	.30	3.60	4.93	8.69	9.69	3.34	392	5	4	right	10.0	2850	cupro-nickel	1.095	150	pyrocellulose	50	2700
Uruguay	Mauser	1908	.275	4.10	4.20	8.81	9 797	3.063	362.7	5	4	right	8.66	30° clev. range 4374.44	nickeled copper	1.177	141.96	smokeless in flakes	47.07	2740
Venezuela	Mauser old mod.																			

can be sealed by the screw, making the weapon to all intents and purposes a nonautomatic repeating rifle. Again, should it be operated automatically and the bolt spring become useless or break, the breech mechanism may be locked by hand and the rifle still remain available as a repeater.

The construction of the Mauser automatic repeating rifle is closely similar to the automatic pistol of that name in that the energy required for its operation is supplied through the recoil. (See PISTOL.) After firing the barrel is moved backward by the breech. The same movement readjusts the spring and cocks the hammer, after which the barrel is disconnected from the breech action. The breech, however, continues its recoil movement by virtue of the velocity acquired, and besides extracting from the barrel and ejecting the shell from the breech causes the compression of a second recuperating spring. The first spring then expands and reloads the chamber; the breech is closed, and the second spring expanding in its turn brings the barrel into a firing position. Thus, all that is necessary is to press the trigger and the weapon continues to fire to the full extent of the magazine capacity.

The carbine employed by all the nations of the world is the cavalry firearm, which uses the same cartridge as the infantry rifle and with most nations is constructed on the same principle as the rifle.

A change which affected all rifles previously constructed occurred at the beginning of this century. A much desired requirement of a rifle is that the trajectory of the bullet should be so flat as to make the space vertically under it so small that it would pass through a man or horse for the greater part of its range. The importance of this is apparent, since any object between the target aimed at and the rifle would be in the path of the projectile unless the trajectory is so curved that the projectile would pass over it. To obtain a flat trajectory it is evidently necessary to increase the power of the rifle—in other words, give a greater velocity to the bullet. This, however, for the same weight gives a greater kick of the rifle, which would quickly tire the man firing and interfere with the accuracy of his aim. The change that greatly improved this condition was first adopted by Germany and consisted in the use of a pointed bullet instead of the more blunt form previously used. With this pointed bullet the air resistance was reduced to such an extent that for the same range the weight of the bullet could be reduced while its velocity was increased, without increasing the kick of the rifle. This resulted in greatly increasing the effective range for the same elevation of the rifle, or in permitting a less elevation for the same range, which of course greatly increased the dangerous space.

This change required rechambering of all rifles and was naturally not adopted by most countries until they were practically forced to do it by rival countries. France quickly followed the lead of Germany, while England delayed with the result that at the beginning of the Great War she was equipped with an inferior rifle to that of her enemy. The United States adopted the pointed bullet in 1906. The modified rifle, which is the one adopted for both cavalry and infantry, is designated "United States Rifle Model of 1903." Its action is the same as that described for the 1902 Springfield. This rifle is generally conceded to be the best military rifle in the world. It possesses wonderful accuracy and is simple and reliable. The following data pertain to the rifle and ammunition: 23 aimed shots have been fired in one minute with this rifle, used as a single-loader, and 25 shots in the same time, using magazine fire. Firing from the hip without aim, 30 shots have been fired in one minute, using the rifle as a single-loader, and 40 shots in one minute, using magazine fire.

MAXIMUM RANGE	Elevation	Time of flight
4891.6 yards	45 degrees	38.058 seconds

The powder pressure in the chamber of this rifle is about 51,000 pounds per square inch.

DANGEROUS SPACES

(The dangerous spaces were calculated under the assumption that the gun, when fired, is 12 inches above the ground, that the height of a man is 68 inches above the ground, and that the gun is aimed at the middle point of the target.)

RIFLE AGAINST INFANTRY

DISTANCE TO TARGET (yards)	Rising branch of trajectory	Falling branch of trajectory In front of target
	Yards	*Yards*
100	All	All
200	All	All
300	All	All
400	All	All
500	All	All
600	All	All
700	232.7	113.2
800	174.5	73.4
900	138.2	52.6
1000	112.4	39.7
1100	93.1	32.4
1200	78.3	25.5
1300	66.7	21.2
1400	57.4	18.0
1500	49.8	15.3
1600	43.7	13.3
1700	38.5	11.5
1800	34.2	10.4
1900	30.5	9.2
2000	27.4	8.2
2100	24.7	7.8
2200	22.4	7.0
2300	20.3	6.3
2400	18.5	5.7
2500	16.9	5.2
2600	15.5	4.7
2700	14.2	4.3
2800	13.0	3.9

Initial velocity	2700 feet per second.
Powder pressure in chamber	about 51,000 pounds per sq. in.
Weight of ball cartridge	about 395.5 grains.
Weight of bullet	150 grains.
Weight of powder charge	about 50 grains.

The data shown in the table on page 183 pertains to rifles as used in various countries at the beginning of the Great War.

Consult: Great Britain War Office, *Text Book of Small Arms* (London, 1909); O. M. Lissak, *Ordnance and Gunnery* (New York, 1914); Ommundsen and Robinson, *Rifles and Ammunition and Rifle Shooting* (ib., 1915). See SMOKELESS POWDER.

SMALLEY, smạl'ĭ, GEORGE WASHBURN (1833–1916). An American journalist and author, born at Franklin, Mass. He graduated at Yale (1853), studied law at Harvard, and practiced in Boston. From 1861, when he went to the front in the Civil War as correspondent, he was for many years connected with the New York *Tribune*. He was on the editorial staff of this paper (1862–67) and, after organizing its European bureau in London (1867), was in charge of its European correspondence during the Franco-Prussian War and until 1895. From that year till 1906 he was again in America as correspondent of the London *Times*. He published *London Letters and Some Others* (1891); *Studies of Men* (1895); *Anglo-American Memories* (1911; 2d series, 1912).

SMALLPOX, or Variola. An acute, infectious, febrile disease, characterized by an eruption showing papular, vesicular, and pustular stages, followed by crusting. The first accurate description of variola was given by Rhazes, an Arabian physician of the ninth century. After the Crusades it prevailed in many southern countries of Europe and spread into England and the more northern countries by the thirteenth century. The Spaniards brought it to America early in the sixteenth century. It appeared first in Santo Domingo, three years later in Mexico, when it destroyed 3,000,000 people, and thence spread with frightful severity over the New World. In 1707 it reached Iceland, when more than a quarter of the inhabitants fell victims, and in 1733 it almost depopulated Greenland. In the seventeenth century a study was made of the disease by Sydenham, who devised a better treatment, but no means of preventing its spread were known until Jenner discovered vaccination (q.v.) in 1796. An attempt to mitigate the severity of smallpox was made by reviving the practice of inoculation (q.v.), and this was introduced into England by Lady Mary Wortley Montagu in 1718.

Smallpox is one of the most contagious of diseases, and few who are exposed, unless protected by vaccination, escape infection. Even the unborn child may be attacked through the medium of the mother and may be born with the characteristic rash or pitted. The malady is particularly fatal in young children and among aboriginal races; negroes are especially susceptible. One attack usually, but not invariably, protects against another. No specific microörganism has been identified with the disease, although eagerly sought. It is probably an intracellular protozoön, appearing in the epithelial cells of the lesions. Guanieri first described these bodies clearly in 1892, giving them the name *Cytorytes vaccinæ*. Guanieri's findings have been confirmed by others, notably by Councilman and his followers. The *contagium* exists in the pustules, in the fluids of the body, and apparently in the exhalations from the lungs and skin. The dried crusts thrown off during desquamation are the most important element in disseminating the malady, which travels long distances and with great rapidity, through the medium of clothes, furniture, or other articles in contact with a patient.

The first symptoms make their appearance after an incubation period of about 12 days. The onset is abrupt, with a severe chill, pains in the back and limbs, intense headache, and vomiting. The temperature rises rapidly to 103° F. or 104° F. On the third day the typical rash appears. This may be preceded by a preliminary eruption assuming various characters in different cases. These initial rashes commonly appear on the second day, if at all, and fade away before full development of the typical eruption. The latter begins as a collection of small red papules on the face, spreading rapidly downward over the whole body. It also occurs upon the mucous membranes. On the third day after their appearance they develop into vesicles filled at first with a clear transparent fluid, which becomes purulent in the three days following, this change being preceded by a process known as umbilication. Each vesicle becomes depressed in the centre, the circumference forming a prominent ring. This change often causes great swelling of the face. The suppurative stage lasts two or three days, after which the pustules gradually dry, leaving in their place depressed white scars, popularly known as pits. After the initial rise of temperature, coincident with the primary rash, the temperature falls nearly or quite to the normal, remaining low until the vesicles begin to mature, when the secondary or suppurative fever begins. This lasts for six or eight days and is accompanied by sleeplessness, headache, perhaps delirium. The fever subsides with the drying up of the eruption, and convalescence begins.

Several varieties of smallpox are described. To the ordinary or discrete the description given above applies. In this the pustules remain distinct and scattered. Confluent smallpox is a severe form in which the rash is very abundant and the pustules exhibit a tendency to coalesce and form blebs. The mortality in this variety is very high. Malignant or hemorrhagic variola is characterized by small hemorrhages beneath the skin and is often fatal. Modified smallpox, often called varioloid, occurs in persons who have been vaccinated, but whose protection is incomplete on account of the lapse of time or because vaccination was inefficient. This variety is of short duration, and recovery is the rule. In the form of smallpox produced by artificial inoculation a pimple arises at the seat of the operation on the second day. This develops into a vesicle or pustule and is followed by modified symptoms of the disease. About the eleventh day the typical eruption of variola appears and passes through its various stages. The attack is generally mild and confers immunity, but it is, on the other hand, sometimes fatal and always contagious. Inoculation is no longer practiced. Variola may be complicated or followed by destruction of the eyes, chronic discharge from the ears, bronchitis, pneumonia, and pleurisy.

The preventive treatment of smallpox at the present time consists almost solely in vaccination and isolation. That vaccination confers complete immunity not only to individuals but to communities has been abundantly proved. A patient with the disease should be placed in bed in a well-ventilated room and should have an abundance of milk and other easily digested liquid foods, with cooling drinks for thirst. Fever is kept within the limits of safety by cold sponging. Many attempts have been made to prevent the occurrence of disfiguring scars or pits. Painting the face with iodine or silver nitrate, washing it with various antiseptic lotions, anointing it with carbolized oil, have all been tried with indifferent success. The best plan is to protect the face from the light and keep it covered with a mask of lint saturated with antiseptic solution. Light rays passed through red glass are reported to prevent pitting, in harmony with the old belief that red curtains and hangings had this effect. But if the inflammatory process goes below the true skin a pit will result. The eyes should be sponged frequently and kept free from secretion. Beyond these measures the treatment is purely symptomatic, no specific having been discovered for the disease. Consult: J. J. Clarke, *Protozoa and Disease*, part ii (New York, 1908); T. F. Ricketts, *Diagnosis of Smallpox* (ib., 1910); William Hanna, *Studies in Small-Pox and Vaccination* (ib., 1913); W. M. Wanklyn, *How to Diagnose Smallpox* (ib., 1914); C. P. Wertenbaker, *Plan of Organization for Suppression of Smallpox* (2d ed., Washington, 1914). See COWPOX; JENNER, EDWARD; MEASLES; VACCINATION.

SMALLWOOD, CHARLES (1812–73). A Canadian physician and meteorologist. He was born at Birmingham, England, studied medicine, went to Canada in 1853, and settled in practice at St. Martin, Isle Jesus, in 1854. He established a meteorological and electrical observatory which was afterward described in the reports of the Smithsonian Institution. He discovered the action of electricity in forming snow crystals, made researches on ozone in connection with light and on the effect of electricity in the germination of seeds. In 1858 he was appointed professor of meteorology in McGill University. The Canadian government having made him a grant in 1860 for the purchase of magnetic instruments, he began observations in 1861. Upon the establishment of a signal service by the United States, Smallwood connected it with stations in Montreal and other Canadian cities. He contributed frequently to scientific journals in the United States, Canada, and Europe.

SMALLWOOD, WILLIAM (1732–92). An American soldier, born in Kent Co., Md. He was colonel of a Maryland regiment in 1776 and served with great gallantry at Long Island, White Plains, Fort Washington, Germantown, and Camden, becoming a brigadier general in 1776 and a major general in 1780. He refused to serve under Baron Steuben in the South, but remained in the army until November, 1783. He was elected to Congress (1785) and was Governor of Maryland (1785–88).

SMALTITE, smạl'tīt (from *smalt*, from It. *smalto*, enamel, from OHG. *smalzjan*, *smelzan*, Ger. *schmelzen*, to melt; connected with Gk. *μέλδειν*, *meldein*, to melt, OHG. *malz*, Ger. *Malz*, AS. *mealt*, Eng. *malt*). A mineral cobalt diarsenide crystallized in the isometric system. It has a metallic lustre and is white to steel gray in color. It occurs associated with other metallic arsenides and sulphides, and with cobaltite in veins. It is one of the commercial sources of the cobalt oxide which is used as a blue coloring matter for glass and pottery. It is sometimes called tin white cobalt, or speisskobalt.

SMART, CHRISTOPHER (1722–71). An English poet. He was born at Shipbourne, Kent, and was educated at Cambridge (B.A. 1742), where he took the Seatonian prize for poetry five years in succession. In 1753 he went to London and endeavored to make a living by his pen. He translated the Psalms, Horace, and Phædrus into English verse and made a prose translation of Horace. His works were published in collected form (London, 1791). He became insane through dissipation and privation and died in a debtor's prison in London. His "Song to David," the one poem by which he is remembered, was excluded from the first edition of his works because it was supposed to have been written while he was insane. It appears in part in T. H. Ward, *English Poets*, vol. iii, and was reprinted in 1895 and with introduction by R. A. Streatfield in 1901.

SMART, HENRY (1813–79). An English organist and composer, born in London. He held the position of organist at several churches in London and finally (1864) at St. Pancras. That year he lost his sight and in 1879 received a government pension. Among his works are an opera, *Bertha, or the Gnome of Hartzburg* (1855); the cantatas, *The Bride of Dunkerron* (1864), *King René's Daughter* (1871), *The Fisher Maidens* (1871), and *Jacob* (1873). In addition he wrote considerable church music, songs, and part songs. Consult William Spark, *Henry Smart* (London, 1881).

SMART, JOHN (1741–1811). An English miniature painter. He was born near Norwich and studied under Daniel Dodd and at Shipley's Academy. He was the friend and perhaps a pupil of Cosway and ranks highest among English miniaturists of the late eighteenth and early nineteenth centuries. Though quiet and gray in color, his miniatures have never been excelled in precision, modeling, and delicacy of finish. About 1788 he went to India, returning to London in 1797. He is excellently represented in the Morgan collection, New York, and in private collections in England, Hyderabad, and Delhi.

SMART, WILLIAM (1853–1915). A British political economist. He was born in Renfrewshire, Scotland, was educated at the University of Glasgow, and until 1884 was a manufacturer. Between 1886 and 1896 he was lecturer on political economy in University College, Dundee, in Queen Margaret College, Glasgow, and in Glasgow University. At the last-named institution he was Adam Smith professor of political economy from 1896 till his death. He was elected president of the economic section of the British Association in 1904 and in 1905 was appointed a member of the Royal Commission on the Poor Laws. His publications include: *An Introduction to the Theory of Value* (1891); *Studies in Economics* (1895); *Taxation of Land Values and the Single Tax* (1900); *The Return to Protection* (1904); *Economic Annals of the Nineteenth Century, 1801–20* (1910), besides contributions to economic periodicals.

SMEATON, smē'ton, JOHN (1724–92). A British engineer, born at Ansthorpe, near Leeds. He was educated for the bar, but followed his mechanical tastes and became an instrument maker, pursuing in the meantime scientific study and investigation. In 1754 he studied the canals and other great engineering works in Holland and a few months after his return was called to replace the second Eddystone lighthouse. The new structure erected from his plans (1756–59) was considered a model of engineering. After it had been standing about 120 years it was found necessary to replace it by a new lighthouse. (See LIGHTHOUSE.) Afterward he built bridges at Perth, Banff, and Coldstream, the North Bridge at Edinburgh, and the Hexham Bridge. The Forth and Clyde Canal was the most important of his canal work. He also made harbor improvements at Ramsgate. In 1769, after considerable experimental work, he began the construction of steam engines of greater size and length of stroke than had previously been built, in which numerous improvements were introduced. Smeaton's improvements on Newcomen's engine did much to increase its range of usefulness, and engines designed by him were exported to the continent of Europe. He also engaged in astronomical researches. A small club of engineers, founded by him in 1771, afterward became the Institution of Civil Engineers. His engineering work is described in three volumes of *Reports*, published in 1812. Consult Samuel Smiles, *Lives of the Engineers—Smeaton and Rennie* (London, 1861; new ed., 1904).

SMED′LEY, Francis Edward (1818–64). An English novelist. Unable to attend public school and university because of a malformation of the feet, he was educated by private tutors and for a long time lived at Chesterton, near Cambridge, with his uncle, Edward Arthur Smedley, chaplain of Trinity College. There he saw much of student life and subsequently he turned his experiences to good use. He edited *Sharpe's London Magazine* two years, and wrote *Frank Fairleigh* (1850), *Lewis Arundel* (1852), and *Harry Coverdale's Courtship* (1855); with Edmund Yates, *Mirth and Metre* (1855).

SMEDLEY, William Thomas (1858–). An American landscape and portrait painter and illustrator. He was born in Chester Co., Pa., and studied at the Pennsylvania Academy and under Laurens in Paris. In 1880 he opened a studio in New York. In his suave and typical illustrations of modern life, especially of the wealthier classes, contributed to *Harper's Magazine* and other periodicals, he displayed the same subtle psychological analysis which later distinguished his painted portraits. In 1882 he traveled with the Marquis of Lorne and illustrated his *Picturesque Canada*. He became a National Academician in 1905, received various prizes, and is represented in the National Gallery, Washington.

SMEERENBERG, smā′ren-bĕrк. A former Dutch settlement on the extreme west coast of Spitzbergen, founded in 1623. It was a busy and important whaling station, but declined in about 20 years.

SMELL. The sensations set up through the stimulation of the end organs of the olfactory nerve by odorous particles in the current of inspired air. The ultimate number of smell qualities is difficult to determine. Like tastes, odors come to us highly fused with affective qualities, with other sensations, pressure, temperature, tickling, or pain, and with secondary effects—drowsiness, sneezing, weeping. (Cf. the effects of carbon disulphide, chlorine, acetic acid.) In 1896 Aronsohn suggested a method of classification by exhaustion. A given substance is smelled until entire fatigue (perhaps better, adaptation) ensues; other substances are then applied with the result that some remain at their normal intensity, others possess a lessened intensity, and others are entirely imperceptible. Thus, after exhaustion by iodine, cajeput is strong, mace weak, pine imperceptible; after exhaustion by camphor, cajeput is very faint; mace strong, pine faint. Certain smells are compensatory; if given simultaneously, they cancel one another. Compensation, it should be noted, is not the mere swamping of one odor by the sheer intensity of a second, often observed in actual life, e.g., in the operating room; it is a complete nullification of olfactory sensation, comparable to producing neutral gray by the mixture of complementary colors. There are also smell contrasts. See Chemical Sense in Animals; Intensity of Sensation; Nose.

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SMEL′LIE, William (1740–95). A Scottish printer and antiquary, born in Edinburgh. From the grammar school he passed to an Edinburgh printing house, performing his duties with efficiency and attending lectures at the university. In 1765 he began business as printer in conjunction with a fellow apprentice. The firm brought out the first edition of the *Encyclopædia Britannica* (1771). Of Smellie's works, which include several biographies, the most popular was *The Philosophy of Natural History* (completed by his son in 1799).

SMELLING SALTS. See Salt; Spring.

SMELT (AS. *smelt;* perhaps connected with *smeolt*, *smylt*, smooth). One of a genus (*Osmerus*) of fishes of the family Argentinidæ, sometimes included under the Salmonidæ. They are merely reduced salmon, from which they differ principally in the form of the stomach and in their smaller size. They are slender, delicate fishes, inhabiting the coasts of Europe and North America; some enter rivers to spawn. Their flesh is most delicate, and they are highly valued as food. There are only a few species. The common European smelt is *Osmerus eperlanus*, called spirling or sparling in Scotland and éperlan in France. It grows to be about 8 inches long and is abundant. The American smelt (*Osmerus mordax*) is very closely related to the European species, attains a length of about 12 inches, and is abundant along the Atlantic coast of the United States from Virginia to the Gulf of St. Lawrence. It ascends streams to spawn and has become landlocked in lakes in New England, where it thrives and is important not only for the markets, but especially as food for salmon and trout. On the California coast and northward to Alaska occurs an important species (*Osmerus thaleichthys*), and a common species of the Far East is *Osmerus japonicus*.

See Fisheries, and Colored Plate of Philippine Fishes; Plate of Whitefish, Smelts, etc.; also Plate of Mullets and Allies for California smelt.

SMELTING. See *Metallurgy* in the articles on Copper; Gold; Iron and Steel; Silver; and other metals.

SMENDES, smĕn′dēz. See Her Hor.

SMER′DIS (Lat., from Gk. Σμέρδις, *Smerdis*). A son of Cyrus. At his father's death the young prince controlled several provinces in eastern Iran, but he was soon put to death by his elder brother, Cambyses II (q.v.). During the absence of Cambyses in Egypt a Magian named Gaumata, who closely resembled Smerdis, impersonated the dead man, since the murder was not generally known. The rebellion begun by this pseudo-Smerdis in 522 became so dangerous that, if the inscription of Darius Hystaspis (see Darius), the earliest record of these events, may be trusted, the entire Persian Empire was in commotion. He was finally slain by conspirators after having reigned seven months. Consult Wilhelm Hutecker, *Ueber den falschen*

Smerdis (Königsberg, 1885); H. C. Tolman, *The Behistun Inscription of King Darius* (Nashville, 1908).

SMET, Peter John de (1801–73). A Roman Catholic missionary to the Indians. He was born in Termonde, Belgium, was educated at the episcopal seminary at Mechlin, and in 1821 embarked for the United States. He was received into the Jesuit Order at Whitmarsh, Md., and in 1828 went to Saint Louis, participated in the establishment of the University of Saint Louis, and became one of its professors. In 1838 he entered upon the work that occupied him the remainder of his life, first among the Potawatamie Indians and later among the Flatheads of the Rocky Mountains, in whose behalf he made several visits to Europe, collecting money and enlisting recruits as missionaries and teachers. He wrote: *Letters and Sketches and Residence in the Rocky Mountains* (1843; also in *Early Western Travels*, ed. by R. G. Thwaites, vol. xxvii, Cleveland, 1906); *Oregon Missions and Travels Over the Rocky Mountains in 1845–46* (1847); *Western Missions and Missionaries* (1863); *New Indian Sketches* (1865). Consult his *Life, Letters, and Addresses*, edited by Chittenden and Richardson (4 vols., New York, 1904); E. Lavelle, *The Life of Father De Smet* (ib., 1915).

SMETANA, smä′tä-nä, **Friedrich** (1824–84). A Bohemian composer and pianist, born in Leitomischl. He studied music under Proksch of Prague, and later with Liszt. He founded a music school in Prague, but in 1856 went to Sweden, where he became conductor of the Philharmonic concerts at Gothenburg. Returning to Prague in 1866, he became kapellmeister at the National Bohemian Theatre. A gradual loss of the sense of hearing, resulting in complete deafness, compelled him to resign his post in 1874. Smetana's works are thoroughly Bohemian, and as a national composer he is of the greatest importance. But his instrumental works have won a lasting place in the repertoire of the best orchestras throughout the world. His works include the following operas: *The Bartered Bride* (1866); *Dalibor* (1868); *Two Widows* (1874); *The Kiss* (1876); *The Secret* (1878); *Libussa* (1881), and *The Devil's Wall* (1882); the symphonic poems, *Richard III.* (1858); *Wallensteins Lager* (1859); *Hakon Jarl* (1861); *My Country*, comprising six independent works (1874–79); and other symphonies, string quartets, and smaller compositions. He died in the Prague lunatic asylum. Consult F. V. Krejči, *Friedrich Smetana* (Berlin, 1907); W. Ritter, *Smetana* (Paris, 1907).

SMET DE NAEYER, nä′yer, Paul, Count de (1843–   ). A Belgium statesman, born at Ghent. He was elected in 1886 to the chamber of deputies, where he became the leader of the conservative-clerical party. He became minister of finance in 1894 and premier in 1896, continuing to hold that office until 1907, with the exception of the first six months in 1899. In 1900 he was created a count. In 1910 he declined renomination to the chamber, but became a member of the senate.

SMETHWICK, smĕтн′ĭk. A municipal borough in Staffordshire, England, 3 miles northwest of Birmingham (Map: England, E 4). It is an important manufacturing centre with iron, machine, glass, chemical, and other works. The municipality owns gas and electric lighting plants and garden allotments and maintains a free library and reading rooms, a park, public baths, and an isolation hospital. Pop., 1901, 54,539; 1911, 70,681.

SMEW (probably a variant of *smee*, *smeath*, perhaps from MDutch *smeente*, Dutch *smient*, widgeon). A small merganser (*Merganser albellus*), which abounds from Lapland to Kamchatka, but not east of Bering Strait, and visits Europe in winter. It is a very handsome bird, the plumage of the male being chiefly white, marked with black and gray, and on the head with green.

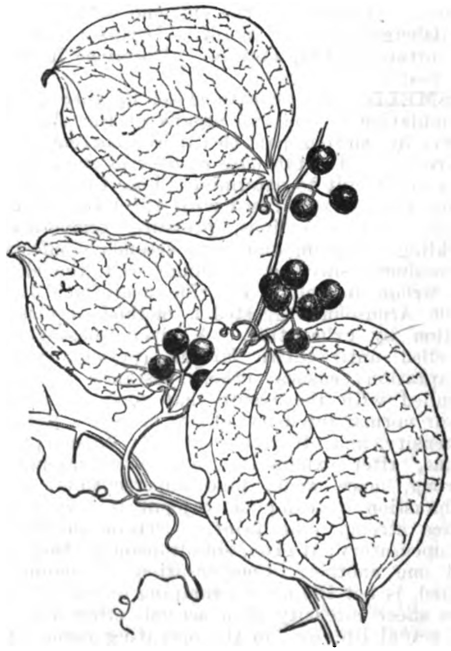
SMIBERT, John. See Smybert, John.

SMICHOW, smĕ′kôf. A town of Bohemia, Austria, on the river Moldau, opposite Prague, of which city it is an important suburb and with which it is connected by the Palaky Bridge. The town contains a municipal building and a botanical garden. There are a large wagon factory, rattan-furniture factories, chocolate and confectionery establishments, and flour mills. Pop., 1900, 47,135; 1910, 47,857, mostly Czechs.

SMIKE. A miserable, half-witted drudge at Squeer's school, in Dickens's *Nicholas Nickleby*.

SMILACEÆ, smĭ-lā′sē-ē. A group of monocotyledonous, generally climbing herbs and subshrubs, regarded by some botanists as a distinct family and by others as a tribe of the family Liliaceæ. It includes three genera and about 250 species, natives of warm and temperate regions. Most of the species belong to *Smilax* (q.v.), the only genus represented in North America.

SMILAX (Lat., from Gk. σμῖλαξ, yew). A genus of about 225 species, mostly herbs and woody climbing or trailing plants, best represented in the temperate and tropical parts of Asia and America. (For family relationship, see Smilaceæ.) In some species (the greenbriers) the stems are often very prickly. The roots or rootstocks of a number of species, particularly



GREENBRIER (*Smilax rotundifolia*).

Smilax officinalis, *Smilax medica*, and *Smilax papyracea* of Central and South America, yield sarsaparilla. The fleshy, starchy rhizomes of others (*Smilax china* of eastern Asia and *Smilax pseudo-china* of the southern United States) have similar properties and are sometimes used—the former as food, the latter as medicine. There are a dozen American species, the best known being *Smilax herbacea*, carrion flower, with herbaceous stems, and *Smilax rotundifolia*, the greenbrier or horse brier. The smilax used for decorative purposes is *Asparagus medeoloides*, or *Asparagus asparagoides*, a native of South Africa.

SMILES, Samuel (1812–1904). An English writer, born at Haddington, Scotland. He studied medicine at the University of Edinburgh. At 20 he began practice at Haddington and later at Leeds. He subsequently gave up his profession to assume the editorship of the radical *Leeds Times*. In recognition of his services to letters, the University of Edinburgh honored him with the degree LL.D. (1878). As early as 1827 Smiles published, at his own expense, *Physical Education*, and in 1857 a *Life of George Stephenson*. His *Lives of the Engineers* appeared in 1861–62 (new ed., 5 vols., 1904). There followed biographies of James Brindley, Boulton and Watt, Thomas Telford, Robert Dick, George Moore, Josiah Wedgwood, James Nasmyth, and others. He gained immense success with *Self Help* (1859), practical talks to young men. It has been translated into seventeen languages. Among his many works, similar books are *Character* (1871), *Thrift* (1875), *Duty* (1880), and *Life and Labor* (1887). Consult his *Autobiography*, ed. by T. Mackay (New York, 1905).

SMILEY, smī′lĭ, Albert Keith (1828–1912). An American humanitarian, born at Vassalboro, Me., of Quaker stock. In 1849 he graduated from Haverford College, where he was an instructor until 1853. With his twin brother, Alfred H. Smiley, he founded and was principal of the English and Classical Academy, Philadelphia, in 1853–57. He then served as principal of schools in his native town in 1858–59, and at Providence, R. I., in 1860–79. His name is known in connection with the remarkable summer resort which he was instrumental in building up at Mohonk Lake (q.v.) and the conferences which he initiated (see Lake Mohonk Conference). In 1889, with his brother Alfred, who was also associated with him at Mohonk, he purchased a large tract of land at Redlands, Cal., part of which he made into a park, and here he spent his winters. See also Smiley, Daniel.

SMILEY, Daniel (1855–). An American humanitarian. He was born at Vassalboro, Me., and graduated at Haverford College in 1878. He was instructor in Greek and Latin at the William Penn Charter School, Philadelphia, 1878–81; with his brother, Albert K. Smiley (q.v.), managed the noted resort at Lake Mohonk, N. Y., and became in 1912, on his brother's death, owner of the Lake Mohonk estate and of Cañon Crest Park, Redlands, Cal. In 1882 he became associated in the management of the Lake Mohonk Conferences. In 1912 he was appointed a member of the United States Board of Indian Commissioners.

SMILLIE, smĭl′ĭ, George Henry (1840–). An American landscape painter, brother of James D. Smillie. He was born in New York and was a pupil of his father, James Smillie, an engraver, and of James Hart. He became a member of the National Academy of Design in 1882. His landscapes, modern in style and skillfully executed, are distinguished by brightness and gaiety. Examples are in the Metropolitan Museum, New York; the Corcoran Gallery, Washington; the Union League Club, Philadelphia; and the Lotos Club, New York.

SMILLIE, James David (1833–1909). An American engraver, etcher, and landscape painter, brother of George H. Smillie. Born in New York, he studied at the National Academy of Design and under his father James Smillie, an engraver, with whom he collaborated until 1862, working chiefly at bank-note vignettes. He also did illustrations, notably a series for Cooper's novels. From 1862 to 1864 he traveled in Europe and upon his return took up landscape painting. He became a member of the National Academy of Design in 1876 and was one of the founders and president of the American Water-Color Society and of the New York Etching Club. His landscapes in oil and water color, including many of American mountain scenery, are skillfully executed and modern in conception. He possessed extraordinary mastery of the technique of etching, dry point, aquatint, and mezzotint, excelling particularly in flower pieces drawn from nature.

SMIRKE, Sir Robert (1781–1867). An English architect, born in London. He studied under Sir John Soane and in the schools of the Royal Academy, winning the gold medal for design in 1799. After visiting Greece and Sicily he began to practice his profession as an architect in London in 1805. Among his works in the classic style are the College of Physicians, the Post Office, the Mint, and the British Museum, the main façade of which is his best-known work. In the Gothic style are his extension of the Inner Temple and restoration of York Minster. He published *Specimens of Continental Architecture* (1806). His brother, Sidney Smirke (1799–1877), also an architect, designed the great circular reading room of the British Museum.

SMITH, Adam (1723–90). A British political economist, regarded as the founder of economics as a separate branch of human knowledge. He was born at Kirkcaldy in Fifeshire, Scotland, June 5, 1723. He studied at the University of Glasgow and won there an exhibition on the Snell foundation, which took him to Balliol College, Oxford. There he remained seven years. In 1748 he was in Edinburgh, where he delivered a course of lectures upon rhetoric and belles-lettres. These seem to have given him a reputation as a scholar and to have introduced him to learned and accomplished men, of whom the most famous was David Hume. The friendship thus begun was an important one for Smith, who remained friendly with Hume during his life. In 1751 Adam Smith was appointed professor of logic at the University of Glasgow and a year afterward was transferred to the chair of moral philosophy.

In 1759 he published his first work, *The Theory of Moral Sentiments*, still well-known in the history of ethics. In 1763 he became tutor to the young Duke of Buccleuch and accompanied him in France. He spent a year or more in Paris and met the more important men of letters of France. He was particularly attracted by the group who termed themselves Economistes and who are better known as Physiocrats. Quesnay, the leader of the school, and several of his followers were in the circle of Smith's acquaintance. He became familiar with the theories of the Physiocrats, which exercised a great influence upon him. In 1766 he returned to Kirkcaldy. He was now engaged in the preparation of his great work, *An Inquiry into the Nature and Causes of the Wealth of Nations*, which first appeared in 1776. The work made a great impression. Five editions were printed during the lifetime of the author, and before the close of the century it had been translated into the principal European languages. (For its place in economic thought, see Political Economy.) In 1778 Smith was appointed a Commissioner of Customs for Scotland, and he took up his official residence in Edinburgh. In 1787 he was elected Lord Rector of the University of Glasgow. He died in Edinburgh, July 17, 1790.

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SMITH, Sir Albert James (1824–83). A Canadian statesman. He was born at Shediac, New Brunswick, and was called to the bar in 1847. He was a Liberal member of the New Brunswick Legislative Assembly in 1851–67 and in 1856 a member of the executive council without portfolio. He became Attorney-General of the province in 1862, led the party opposed to Confederation and went to England in that behalf in 1865. In 1864–66 he was Premier of New Brunswick. After Confederation he was elected to the House of Commons, was Minister of Marine and Fisheries in the Mackenzie administration (1873–78), and in 1877 was chief counsel of the Canadian government before the Halifax Fisheries Commission. In 1878 he was knighted (K.C.M.G.).

SMITH, Albert Richard (1816–60). An English author and lecturer, born at Chertsey, Surrey. For a short time he practiced medicine. Primarily a humorist, he was a contributor to *Punch* in its early years and to *Bentley's Miscellany*, where his book, *The Adventures of Mr. Ledbury* (1842), first appeared serially. He also wrote extravaganzas and adapted certain of Dickens's stories for stage presentation. His ascent of Mont Blanc in 1851 provided him with the material for one of several popular lectures, or entertainments, at Egyptian Hall, London. He wrote several novels: *Christopher Tadpole* (1848); *Pottleton's Legacy* (1849); *Wild Oats and Dead Leaves* (1860), and books of satiric essays and sketches, illustrated by favorite artists of the day.

SMITH, Albert William (1856–). An American mechanical engineer, born at Westmoreland, N. Y. He graduated from Cornell University in 1878 and in 1887–91 was assistant professor of mechanical engineering at Sibley College (Cornell), of which he became director in 1904. In the meantime he had been professor of machine design at the University of Wisconsin in 1891–92 and professor of mechanical engineering at Leland Stanford Junior University from 1892 to 1904. He published: *Elementary Machine Design* (1895); *Material of Machines* (1902; 2d ed., 1914); *Machine Design* (1905; 4th ed., 1915), with G. H. Marx; *The Giant and Other Nonsense Verse* (1910).

SMITH, Alexander. See Adams, John (1760–1829).

SMITH, Alexander (1830–67). A Scottish poet, born at Kilmarnock. His *Life Drama* (1853) created a sensation. Its richness and originality of imagery may perhaps atone for its many sins against taste and knowledge. In 1855, with Sidney Dobell, he published a volume of *Sonnets on the Crimean War*. He also wrote *City Poems* (1857), *Edwin of Deira* (1861), and several prose works, as *Dreamthorp* (1863), notable essays; *A Summer in Skye* (1865); *Alfred Hagart's Household*, a story of Scottish life (1866), and its sequel, *Miss Dona M'Quarrie* (1867). After his death appeared *Last Leaves* (London, 1868). Smith was classed with Philip James Bailey, Sydney Dobell, and Gerald Massey (qq.v.) as a member of the Spasmodic school. The epithet was first used in *Blackwood's Magazine* for May, 1854. Consult Brisbane, *Early Years of A. Smith* (London, 1869).

SMITH, Alexander (1865–). An American chemist, born in Edinburgh, Scotland. He graduated from the university of his native city in 1886 and received the degree of Ph.D. at Munich in 1889. After coming to the United States he was professor of chemistry and mineralogy in Wabash College (1890–94) and then till 1911 was a member of the faculty of the University of Chicago. In 1911 he was called to Columbia University to be professor and head of the department of chemistry, and in the same year he held the presidency of the American Chemical Society. He was elected to the National Academy of Sciences in 1915. His publications include: *Laboratory Outline of General Chemistry* (1899); *The Teaching of Chemistry and Physics* (1902), with E. H. Hall; *Introduction to General Inorganic Chemistry* (1906; 2d ed., 1912); *General Chemistry for Colleges* (1908; rev. ed., 1916); *A Text-Book of Elementary Chemistry* (1914).

SMITH, Alfred H(olland) (1864–). An American railroad president. He entered the service of the Lake Shore and Michigan Southern Railway as a messenger boy in 1879, served afterward in various minor capacities, and was superintendent of various divisions from 1890 to 1901, assistant general superintendent and, in 1901–02, general superintendent. Thereafter he was with the New York Central and Hudson River Railroad as general superintendent (1902–03), general manager (1903–12), vice president (1906–13), and president of the system and its subsidiary lines after 1914.

SMITH, Andrew Jackson (1815–97). An American soldier, born in Berks Co., Pa. He graduated at West Point in 1838, served on the southwest frontier and in the Mexican War, and afterward against the Indians in Oregon and Washington Territory. In the Civil War he was commissioned colonel of the Second California Cavalry. He served as chief of cavalry in the departments of the Missouri and the Mississippi up to 1862 and was then commissioned brigadier general of United States volunteers. He was at the siege of Corinth in the Yazoo River expedition (1862), in the attack on Arkansas Post (1863), and in the Vicksburg campaign. Subsequently he commanded a division in the Sixteenth Army Corps, took part in Banks's Red River expedition, and for services at the battle of Pleasant Hill, La., April 9, 1864, he received the brevet of colonel in the regular army. He became major general of volunteers, May 12, 1864; later he participated in the battle of Nashville (1864), receiving for services in that struggle the brevet rank of major general in the regular army. He took command of the Sixteenth Army Corps in February, 1865, and was with it in the Mobile campaign and in operations against Montgomery. In January, 1866, he was appointed colonel of the Seventh Cavalry. In May, 1869, he resigned from the army and was appointed postmaster at St. Louis, Mo.

SMITH, Archibald Carey (1837-1911). An American naval architect, born in New York City. He learned boatbuilding under Robert Fish and in 1860 built the sloop *Comet*, which held the American championship for several years. Later he built the *Vindex*, the first iron vessel built in the United States. He designed the *Mischief*, which successfully defended the *America's* Cup against the *Atalanta* in 1881, and superintended the construction of the *Priscilla*, which was defeated by the *Puritan* and the *Mayflower* in 1885. In 1911 he designed and built the schooner *Enchantress*, the winner of the King's Cup. Other vessels designed by him were the *Iroquois*, the *Meteor* for the German Emperor, the motor boats *Ailsa Craig* and *Eronel*, and several steamboats.

SMITH, Benjamin Bosworth (1794-1884). An American Protestant Episcopal bishop. He was born at Bristol, R. I., and graduated at Brown University in 1816. The following year he was ordained, beginning his ministry at Marblehead, Mass. He held several pastoral charges and was for a time editor of the *Episcopal Recorder* of Philadelphia. His last rectorship, in Lexington, Ky., he held until 1837, though in 1832 he had become Bishop of the diocese. While he was presiding Bishop (from 1868) was organized the separatist movement which became the Reformed Episcopal church, under the leadership of Bishop Smith's own assistant bishop, George David Cummins. He published *Saturday Evening* (1876) and *Apostolic Succession* (1877).

SMITH, Benjamin Eli (1857-1913). An American editor, son of Eli Smith. He was born at Beirut, Syria, and was educated at Amherst College (A.B., 1877; A.M., 1881), which gave him the degree of L.H.D. in 1902. Of the *Century Dictionary* he was managing editor from 1889 to 1891 and editor after 1894. As editor he was responsible also for the *Century Cyclopedia of Names* (1894), the *Century Atlas* (1897), the two-volume *Century Dictionary Supplement* (1909), and the revised and enlarged *Century Dictionary, Cyclopedia, and Atlas* (12 vols., 1911). In addition he edited selections from Marcus Aurelius (1899), Epictetus (1900), and Pascal (1902), and translated Schwegler's *History of Philosophy* (1879) and Cicero's *De Amicitia* (1897).

SMITH, Buckingham (1810-71). An American antiquary, born on Cumberland Island, Ga. He graduated at the Harvard Law School in 1836, practiced in Maine, but removed to Florida and became a member of the Territorial Legislature. From 1850 to 1852 he was Secretary to the United States Legation in Mexico and acted as chargé d'affaires in 1851. Here he studied Indian philology and began to collect material on the Spanish exploration and settlement of America. While Secretary of Legation at Madrid (1855-58) he collected further material from the Spanish archives. He returned to Florida in 1859 and became a judge and a member of the State Senate. Among his translations and other publications are: *Relation of Alvar Nuñez Cabeza de Vaca* (1851; new ed., 1871); *Grammar of Pima or Névome, a Language of Sonora* (1862); *Narratives of the Career of Hernando de Soto in the Conquest of Florida* (1866).

SMITH, Charles Emory (1842-1908). An American journalist and politician. He was born at Mansfield, Conn., and graduated at Union College in 1861. In 1865 he became editor of the Albany *Express* and in 1870 of the Albany *Journal*. For many years he took an active interest in politics as a Republican and stood high in the party's councils. From 1880 to 1898 he conducted the Philadelphia *Press*. While American Minister to Russia (1890-92), he was active in distributing supplies to the famine sufferers in that country. In 1898-1902 he was Postmaster-General of the United States. During his administration rural mail routes were established.

SMITH, Charles Ferguson (1807-62). An American soldier, born in Philadelphia, Pa. He graduated at West Point in 1825 and served with distinction through the Mexican War. During the Civil War he rose to the rank of major general in the Federal army and was for some time commander of the District of Western Kentucky. He led the decisive charge at Fort Donelson, and soon afterward he was given command of the troops sent up the Tennessee. During these movements he was accidentally injured, and died April 25, 1862.

SMITH, Charles Forster (1852-). An American classical scholar, born in Abbeville Co., S. C. He was educated at Wofford College (A.B., 1872), Harvard (1874), Berlin (1875), and Leipzig (Ph.D., 1881). Smith was professor of classics and German at Wofford in 1875-79, assistant professor of Latin and Greek at Williams in 1881-82, and professor of modern languages (1882-83) and of Greek (1883-94) at Vanderbilt University. Thenceforth he was professor of Greek and classical philology at the University of Wisconsin. In 1903 he served as president of the American Philological Association. He edited several volumes of Thucydides, Xenophon's Anabasis (1905), and Herodotus, vii (1907); translated Hertzberg's *History of Greece* (1900); and is author of *Reminiscences and Sketches* (1909).

SMITH, Charles Henry (1826-1903). An American humorist, born at Lawrenceville, Ga. He graduated at Franklin College, Athens, and became a lawyer at Rome, both in his native State. Later he served in the Confederate army. After the war he removed to Cartersville, Ga. He was widely known for his newspaper letters, under the signature "Bill Arp," which began in 1861 and with their homely genuine humor cheered the hearts of the Southern people. The letters were subsequently collected as *Bill Arp's Letters* (1868), to which were added *Bill Arp's Scrap Book* (1886) and other volumes.

SMITH, Charlotte (1749-1806). An English poet and novelist, eldest daughter of Nicholas Turner of Stoke House in Surrey.

Through misfortune and separation she began to support herself and her children by literary work. She gained the attention of the London literary world with *Elegiac Sonnets and Other Essays* (1784), a volume which passed through many editions. Her wider public was won by a series of novels describing contemporary life. Among them are *Emmeline* (1788), *Desmond* (1792), and *The Old Manor House* (1793). Consult the memoir and generous estimate of Charlotte Smith, and criticism of her work, by Sir Walter Scott in his *Miscellaneous Prose Works*, vol. i (Edinburgh, 1834-36).

SMITH, CLEMENT LAWRENCE (1844-1909). An American Latin scholar, born at Upper Darby, Pa., and educated at Haverford College, at Harvard, and in Europe. In 1869-70 he was professor of Greek and German at Swarthmore College, and was then called to Harvard as tutor in Latin. He became assistant professor in 1873 and was professor from 1883 to 1904. He was also dean of Harvard College from 1882 to 1901 and of the faculty of arts and sciences from 1898 to 1902. In 1897-98 he was director of the American School of Classical Studies at Rome. With Professor Tracy Peck of Yale he edited the *College Series of Latin Authors*. In this series he edited *The Odes and Epodes of Horace* (Boston, 1894).

SMITH, DAVID EUGENE (1860-). An American mathematician and educator. He was born at Cortland, N. Y., where, after graduating from Syracuse University (1881), he practiced law and then was a teacher in the State Normal School (1884-91); meanwhile he took his Ph.D. at Syracuse in 1887. Subsequently he became professor in the Michigan State Normal College (1891), the principal of the State Normal School at Brockport, N. Y. (1898), and professor of mathematics in Teachers College, Columbia University (1901). He was elected member or fellow of various American and foreign societies and in 1905 received the degree of LL.D. from Syracuse. Besides serving as editor of the *Bulletin* of the American Mathematical Society and being prominently identified with other mathematical journals, he contributed to the NEW INTERNATIONAL ENCYCLOPÆDIA and published a series of textbooks and *History of Modern Mathematics* (1896; as a separate work, 1910); *The Teaching of Elementary Mathematics* (1900), *The Teaching of Arithmetic* (1909; rev. ed., 1913), and *The Teaching of Geometry* (1912); *Rara Arithmetica* (1908); *A Bibliography on the Teaching of Mathematics* (1912), with C. Goldziher; and *A History of Japanese Mathematics* (1914), with Y. Mikami. With George Wentworth, Smith was joint author of a large number of textbooks, and with W. W. Beman he wrote various textbooks and translated F. Klein's *Famous Problems of Geometry and* Fink's *History of Mathematics*. In 1915 he edited Augustus De Morgan's *Budget of Paradoxes*.

SMITH, DONALD ALEXANDER. See STRATHCONA AND MOUNT ROYAL.

SMITH, EDGAR FAHS (1856-). An American chemist and educator, born in York, Pa. He graduated at Pennsylvania College in 1874 and at Göttingen, Germany (Ph.D.), in 1876. After serving as instructor at the University of Pennsylvania and as professor at Muhlenberg and Wittenberg colleges, he held a chair of chemistry at the University of Pennsylvania from 1888 to 1911. In 1899 he became vice provost of the University, and, in 1911, provost. In recognition of his many important original contributions to chemistry, especially in the domain of electrolytic methods of analysis and of atomic weight determinations, he was elected to membership in the National Academy of Sciences and to the presidency of the American Philosophical Society and the American Chemical Society. He translated Richter's textbooks of inorganic and organic chemistry and wrote: *Electro-Chemical Analysis* (5th ed., 1911); *Theories of Chemistry* (1913); *Elements of Electro-Chemistry* (1913); *Chemistry in America* (1914).

SMITH, EDMUND KIRBY (1824-93). An American soldier, born at St. Augustine, Fla. He graduated at West Point in 1845. In the Mexican War he was brevetted first lieutenant for gallantry at Cerro Gordo and captain for bravery at Contreras and Churubusco. From 1849 to 1852 he was assistant professor of mathematics at West Point. He became first lieutenant in 1851, captain of the Second Cavalry in 1855, and major in 1861. He resigned from the army April 6, 1861, was appointed lieutenant colonel of cavalry of the Confederates, and became brigadier general June 17, 1861. He was chief of staff under Gen. Joseph E. Johnston in the Shenandoah valley during June and July, bringing in the fresh troops which decided the first battle of Bull Run (July 21), but was severely wounded. He became major general in 1861 and in 1862 was placed over the District of East Tennessee and afterward of the Department of East Tennessee, Kentucky, North Georgia, and Western North Carolina. He led the advance of Bragg's army into Kentucky, defeated Nelson at Richmond (near Lexington), Aug. 30, 1862, gathered men and threatened Cincinnati. On Oct. 9, 1862, he became lieutenant general and in February, 1863, was assigned to the Trans-Mississippi Department. He became general, Feb. 19, 1864, and in April baffled Banks's unfortunate Red River expedition. He finally surrendered to General Canby in May, 1865. From 1866 to 1868 Smith was president of the Atlantic and Pacific Telegraph Company, from 1870 to 1875 was chancellor of the University of Nashville, and from 1875 until his death was professor of mathematics in the University of the South at Sewanee, Tenn.

SMITH, ELI (1801-57). An American Protestant missionary and scholar. He was born at Northford, Conn., graduated from Yale in 1821 and from Andover Theological Seminary in 1826. The same year he was put in charge of the printing establishment of the American Board at Malta and remained there until 1829, except for a period spent at Beirut in studying Arabic. In 1829 he traveled through Greece, later through Armenia and Georgia to Persia in company with H. G. O. Dwight, and published the results of their observations in *Missionary Researches in Armenia* (2 vols., 1833). The Armenian and Nestorian missions were shortly afterward established by the American Board. In 1833 he settled in Beirut. In 1838 and 1852 he accompanied Edward Robinson (q.v.) on tours of investigation in the Holy Land. He kept up linguistic studies in preparation for what he considered his life work, the translation of the Bible into Arabic, but died after completing the New Testament, the Pentateuch, and part of the prophetical books. The work was completed by C. V. Van Dyck of the Syrian Mission and published in 1866–67.

SMITH, Elizabeth Oakes (Prince). See Smith, Seba.

SMITH, Ellison DuRant (1866–). An American planter and legislator, born at Lynchburg, S. C. He was educated at the University of South Carolina, Wofford College (A.B., 1889), and Vanderbilt University (A.M., 1890). Long a farmer, he became interested in improving methods of growing cotton and in perfecting farmers' organization. As a Democrat he was a member of the Lower House of the South Carolina Legislature from 1896 to 1900. Later he gave his time to betterment of agricultural conditions, organizing the Farmers' Protective Association and becoming the field agent of the Southern Cotton Association. His speeches attracted general attention, and in 1908 he was elected United States Senator. He became a member of the committees on agriculture and immigration and was one of the framers of the Burnett-Dillingham-Smith Immigration Law. In 1914 he was reëlected Senator, his opponent being Governor Blease.

SMITH, Erminnie Adelle (Platt) (Mrs. Simeon H. Smith) (1836–86). An American ethnologist, born at Marcellus, N. Y., and educated at Mrs. Willard's seminary in Troy (now called the Emma Willard School). She was married in 1855. While her sons were being educated in Germany, she studied mineralogy (graduating from the Freiberg Mining Academy) and other sciences. In 1878 she became connected with the Bureau of Ethnology and was detailed to study the dialects, customs, and myths of the Iroquois Indians. For this purpose she spent two summers in Canada among the Tuscaroras (of Iroquoian stock), who adopted her as a member. Her Iroquois English Dictionary was being printed when she died.

SMITH, Erwin F(rink) (1854–). An American plant pathologist. He was born at Gilbert's Mills, N. Y., and was educated at the University of Michigan (B.S., 1886; Sc.D., 1889). Subsequently he was expert pathologist of the United States Department of Agriculture, and later took charge of the laboratory of plant pathology of the Bureau of Plant Industry. He held the presidency of the Society for Plant Morphology and Physiology, of the Society of American Bacteriologists (1906), and of the Botanical Society of America (1910), and in 1913 was elected to the National Academy of Sciences. Besides serving as an associate editor of the *Centralblatt für Bacteriologie* and contributing to the *Standard Dictionary,* he published *Bacteria in Relation to Plant Diseases* (vols. i–iii, 1905–15) and papers and bulletins on bacteriology, general botany, mycology, and sanitary science.

SMITH, Eugene Allen (1841–). An American geologist, born in Autauga Co., Ala. He graduated from the State university in 1862, studied in Berlin and Göttingen in 1865–66, and received the degree of Ph.D. from Heidelberg in 1868. In 1862–65 he was a second lieutenant and captain in the Confederate army. After 1871 he was a professor at the University of Alabama. From 1873 he was also State geologist of Alabama and in 1911 became a member of the State Highway Commission. Smith served as president of the Geological Society of America in 1913.

SMITH, Francis Henney (1812–90). An American soldier, born at Norfolk, Va. He graduated in 1833 at the United States Military Academy and in 1837 was appointed professor of mathematics at Hampden-Sidney College. In 1839 he was selected to be superintendent and professor of mathematics in the newly organized Virginia Military Institute. Soon after the outbreak of the Civil War he was appointed colonel and was stationed at Norfolk and in command of Craney Island Fort. Subsequently he reopened the institute, whose buildings had been destroyed by fire during the war. His publications include: *The Best Methods of Conducting Common Schools* (1849); *College Reform* (1850); *The Virginia Military Institute* (1912), and textbooks on arithmetic and algebra.

SMITH, Francis Hopkinson (1838–1915). An American author, artist, and engineer, born in Baltimore, Md. His school days ended, he became a clerk in a Baltimore ironworks; subsequently he studied engineering and became a contractor. In this capacity he was engaged in several government works of importance on the Atlantic seaboard, including the construction of the sea walls at Block Island, Governor's Island (New York harbor), and Tompkinsville (Staten Island), the Race Rock Lighthouse, off New London, Conn., and the foundation for the Bartholdi Statue of Liberty. He was proudest of his work as an engineer and considered the Race Rock Lighthouse his greatest achievement. He became known also as a painter in water color and for his charcoal sketches. Although his work often shows a lack of technical training (for he was self-taught), it is not without charm and an intimate feeling for the picturesque. He received various awards and medals and is represented in the public collections of Washington, Baltimore, and Buffalo. Hopkinson Smith was a member of the American Academy of Arts and Letters. He was a great traveler, spending six months every year in foreign lands. As a novelist he was best in portraying Southern types and manners. His *Colonel Carter of Cartersville,* with its Southern gentleman of the old school, was perhaps his finest achievement as a novelist. Among his works are: *Old Lines in New Black and White* (1885); *Well-Worn Roads* (1886); *A Book of the Tile Club* (1887); *A White Umbrella in Mexico* (1889); *Colonel Carter of Cartersville* (1891); *A Day at Laguerre's* (1892); *American Illustrators* (1892); *A Gentleman Vagabond and Some Others* (1895); *Tom Grogan* (1896); *Gondola Days* (1897); *Caleb West, Master Diver* (1898), one of his most successful books; *The Other Fellow* (1899); *The Fortunes of Oliver Horn* (1902); *At Close Range* (1905); *The Wood-Fire in No. 3* (1905); *The Tides of Barnegat* (1906); *The Veiled Lady* (1907); *Peter* (1908); *Kennedy Square* (1911); *Charcoals of New and Old New York* (1912); *The Arm-Chair at the Inn* (1912); *In Thackeray's London* (1913) and *In Dickens's London* (1914), both with sketches. Posthumously appeared a novel *Felix O'Day* and a series of lectures, *Outdoor Sketching* (both 1915).

SMITH, Sir Francis Pettit (1808–74). An English inventor, born in Hythe. In 1834 he constructed a model of a steam vessel to be propelled by a screw driven by a spring, and three years afterward built a larger boat on the same principle, which he successfully tested in the English Channel. He constructed for the British navy the screw steamer *Archimedes* of 237 tons, 90 horse-power, which he completed in 1840, and the success of which led to the rapid introduction of screw vessels into the English navy and the mercantile marine.

SMITH, FRED B. (1864–). An American evangelist and Y. M. C. A. leader, born at Lone Tree, Iowa. He studied at the State University of Iowa in 1882–83. After some years' experience in similar work, in 1898 he was sent by the International Committee of the Y. M. C. A. to conduct evangelistic meetings at the army camp at Chickamauga and later in Cuba. The years 1899–1901 he spent in visiting city Y. M. C. A. organizations throughout the country, urging them to increase emphasis on the religious side of their work. In 1910 he became international secretary of the Y. M. C. A. He was largely instrumental in the initiation and successful work of the "Men and Religion Forward Movement," which within a few years after 1910 established organizations in 1500 cities and towns. He wrote *Men Wanted* (1911) and *A Man's Religion* (1913).

SMITH, SIR FREDERICK EDWIN (1872–). An English lawyer and statesman. He was born at Birkenhead, was educated at Wadham College, Oxford, and entered on the practice of law. He was extension lecturer in modern history for Oxford University in 1898 and for Victoria University in 1900. In 1906 he was elected Unionist member of the House of Commons for Walton Division, Liverpool. His remarkable success at the bar was recognized when he was made king's counsel and bencher of Gray's Inn in 1908. In Parliament he distinguished himself by debating power and knowledge of public questions and came to be considered one of the leaders of the Unionist and Conservative parties. After the outbreak of the European War in 1914, Smith served for a time at the front. In 1915 he became Attorney-General in Asquith's coalition cabinet. In 1915 he was knighted. He published: *Newfoundland* (1906); *Toryism until 1832* (1907); *The Licensing Bill* (1908); *International Law in the Far East* (2d ed., 1908); *International Law* (4th ed., 1911); *Speeches, 1906–09* (2d ed., 1912). Consult A. G. Gardiner, *Pillars of Society* (London, 1913).

SMITH, GEORGE (1800–68). An English Wesleyan writer on theology. He was educated in a Lancastrian school. Although he was engaged in business throughout life, he was a careful student of religious doctrines and history. He was the author of: *Religion of Ancient Britain* (2d ed., 1846); *The Hebrew People* (2 vols., 1850); *The Polity of Wesleyan Methodism Exhibited and Defended* (1851; 3d ed., 1852); *The Gentile Nations* (2 vols., 1852); *Wesleyan Local Preacher's Manual* (2d ed., 1855); *The History of Wesleyan Methodism* (3 vols., 1857; 2d ed., 1859); *The Life and Reign of David, King of Israel* (1867).

SMITH, GEORGE (1808–99). An American banker, born in Aberdeenshire, Scotland. He was educated at Aberdeen College, emigrated to America, in 1834 settled in Chicago, and for the next quarter of a century was closely identified with the industrial and financial history of the Northwest. In 1837 he was granted a charter for the Wisconsin Marine and Fire Insurance Company at Milwaukee, which allowed him to carry on a general banking business and issue notes to the amount of $1,500,000. This corporation was for many years the most stable financial institution in the West, and its notes, payment upon which was never refused, circulated widely and were of great benefit to other banks and to business houses in times of panic. In 1839 he also founded the house of George Smith & Co., the first banking house in Chicago. Subsequently he became interested in banking in the South, but after the outbreak of the Civil War gradually withdrew from active business and retired to London, where he died.

SMITH, GEORGE (1824–1901). An English publisher, born in London. In 1843 he took charge of most of the business of Smith and Elder, publishers, and in 1846, on the death of his father, became head of the firm. Under his supervision the early works of John Ruskin were published, Charlotte Brontë's *Jane Eyre* was brought out in 1848, and Thackeray's *Henry Esmond* in 1851. In 1859 Smith founded the *Cornhill Magazine*, with Thackeray as its first editor; and in 1865 he established the *Pall Mall Gazette*, an independent evening paper, retaining control of it until 1880. He projected and published the great *Dictionary of National Biography* (63 vols., 1885–1900) edited by Sir Leslie Stephen and Sir Sidney Lee (qq.v.). Subsequently an index volume and supplements were brought out.

SMITH, GEORGE (1840–76). An English Assyriologist, born at Chelsea. He was an engraver by trade. Becoming interested in Assyriology, he gave much of his leisure time and spare money to the study and attracted the favorable notice of Rawlinson. In 1866 he discovered a text relating to the tribute paid by Jehu to Shalmaneser III. His aptitude for arranging and classifying Assyrian documents led to his association with Rawlinson in the preparation of the third and fourth volumes of the *Cuneiform Inscriptions of Western Asia* (published 1870, 1875). In 1867 Smith became connected with the British Museum. In 1871 he published the *Annals of Assur-bani-pal* and prepared valuable papers on the *Early History of Babylonia* and *The Reading of the Cypriote Inscriptions*. In 1872 he made his most famous discovery—the Babylonian account of the deluge, which had been found at Nineveh and brought to England by Layard. As a result he was sent to Nineveh the following year at the expense of the *Daily Telegraph* to search for more fragments of the account and returned in a short time, having succeeded in his mission. He again conducted excavations at Nineveh for the British Museum in 1874. In October, 1875, he started a third time for the East; after many difficulties he reached Nineveh, only to find that it was impossible to excavate, owing to the disturbed state of the country. His health broke down from care and worry, and he died at Aleppo, Aug. 19, 1876. Besides the works already mentioned, he published: *Assyrian Discoveries* (1875), the account of his explorations; *The Assyrian Eponym Canon* (1875); *Ancient History from the Monuments: Assyria* (1875); *The Chaldean Account of Genesis* (1876; ed. by Sayce, 1880); and papers in the *Transactions* of different societies. *Ancient History from the Monuments: Babylonia* (1877) and *The History of Sennacherib* (1878) appeared posthumously.

SMITH, SIR GEORGE ADAM (1856–). A Scottish Hebraist, born at Calcutta, India. He was educated in Edinburgh at the university and at New College. In 1880–82 he was Hebrew tutor at the Free Church College in

Aberdeen; then, until 1892, was pastor of the Free Church, Queen's Cross, Edinburgh; and in that year was named professor of Old Testament language, literature, and theology in the United Free Church College of Glasgow. In 1909 he became principal and vice chancellor of Aberdeen University. Smith traveled in Palestine in 1891, 1901, and 1904; lectured in the United States at Johns Hopkins (1896), Yale (1899), and the University of California (1909); and in 1909 was visiting professor at the University of Chicago. He was also Jowett lecturer in London in 1900 and Schweich lecturer before the British Academy in 1910. In 1916 he was knighted. His writings include: *The Book of Isaiah* (2 vols., 1888–90); *The Preaching of the Old Testament to the Age* (1893); *Historical Geography of the Holy Land* (1894; 16th ed., 1910); *The Twelve Prophets* (2 vols., 1896–97); *The Life of Henry Drummond* (1898; 7th ed., 1902); *Modern Criticism and the Preaching of the Old Testament* (1901); *The Forgiveness of Sins and Other Sermons* (1904); *Jerusalem: The Topography, Economics, and History* (1908); *The Early Poetry of Israel* (1912); "Deuteronomy," in *Cambridge Bible for Schools* (1914); *War and Peace* (1915).

SMITH, George Gregory (1865–). A British literary scholar, born in Edinburgh and educated at Edinburgh University and at Balliol College, Oxford. From 1892 to 1905 he was lecturer in English literature and languages at Edinburgh University; from 1905 to 1909 professor of English literature at Queen's College, Belfast; and thereafter professor at the University of Belfast. His publications include notably: *The Days of James IV* (1890); *The Book of Islay* (1895); an edition of *The Spectator* (8 vols., 1897–98; 4 vols., 1907); *The Transition Period* (1900), treating of the literature of Europe in the fifteenth century; *Specimens of Middle Scots* (1902); *Elizabethan Critical Essays* (2 vols., 1904); the Globe edition (1905) of *Pepys's Diary; Poems of Henryson* (3 vols., 1906–14).

SMITH, George Otis (1871–). An American geologist, born at Hodgdon, Me. He graduated from Colby College in 1893 and from Johns Hopkins (Ph.D.) in 1896. Joining the United States Geological Survey in 1896, he was an assistant geologist until 1901, geologist in 1901–07, and thereafter director of the Survey. In 1909 he was president of the Washington Geological Society. Smith is author of reports on areal, economic, petrographic, and physiographic geology in the reports of the Survey.

SMITH, Gerard Fowke. See Fowke, Gerard.

SMITH, Gerrit (1797–1874). An American philanthropist, son of Peter Smith of Utica, N. Y., who, associated in the fur trade with John Jacob Astor, accumulated a fortune which the son greatly increased. Gerrit graduated from Hamilton College in 1818 and with some study of law entered upon that profession and practiced with distinction in both State and Federal courts. His home was in Peterboro, Madison Co., N. Y. Entering Congress in 1853, he found public life distasteful and abandoned it after the long session of 1854. At this time a very large landowner, Smith developed radical views in opposition to private land monopoly. Putting theory into practice, he began and for years continued to distribute holdings to poor families—often to negroes—in parcels of 50 acres each. In religious matters he was a radical and attempted to build up an independent church both by money gifts and his own preaching. Plunging at length into the antislavery movement, he became by generosity and earnestness one of its most effective agitators. His private gifts are said to have amounted to $8,000,000. A stanch and lifelong friend of John Brown, he supported him in his Kansas raids and through subsequent tribulations. The signing of Jefferson Davis's bail bond when the Civil War was over, by Gerrit Smith and Horace Greeley, was one of the most characteristic acts of each of those unusual men. Besides numerous speeches and pamphlets, chiefly on the slavery issue, Smith wrote *The Religion of Reason* (1864) and *Nature the Base of a Free Theology* (1867). Consult the biography by O. B. Frothingham (New York, 1878).

SMITH, Gerrit (1859–1912). An American organist and composer, born at Hagerstown, Md., and educated at Hobart College. After studying music abroad he was organist of St. Paul's Cathedral, Buffalo, of St. Peter's Church, Albany, N. Y., and, from 1885 until his death, of the Old South Church, New York, where he gave some 300 free organ recitals. He was also professor of music at Union Theological Seminary and professor of theory at the Master School, Brooklyn. For six years he served as president of the Manuscript Society of Composers, and he was honorary president of the American Guild of Organists. His compositions include a cantata (*King David*), a *Song Cycle*, more than 75 songs, and numerous piano pieces.

SMITH, Goldwin (1824–1910). A British American publicist, historian, and educator. He was born at Reading, Berkshire, England, Aug. 20, 1824, and was educated at Eton and at Oxford (Christ Church, Magdalen College, and University College, of which he was elected a fellow in 1847). He was called to the bar at Lincoln's Inn, but never practiced. His interest in university reform led to his appointment as assistant secretary to the first Oxford commission (1850) and as secretary to the second commission (1854). From 1858 to 1866 he was regius professor of modern history at Oxford. Even before the outbreak of the Civil War in the United States he had enthusiastically championed the North, and in 1864 he visited the United States and spoke and wrote strongly for the Union. From 1868 until 1871 he was professor of English and constitutional history at Cornell University, but in 1871 he went to Toronto, retaining a nonresident professorship at Cornell. In Canada he at once took the lead in literary activity and became prominent in educational circles. Politically he at first favored independence, but later he was convinced that the destiny of Canada was annexation to the United States, which, he said, "was written in the stars." After this was known, his name was for many years a storm centre in Canadian political life. Goldwin Smith was unsparingly denounced in the press and on the platform, but the compass and variety of his intellectual interests prevailed against a provincial criticism and dislike. His great services to Canadian journalism were widely acknowledged. He was the founder and editor successively of the *Canadian Monthly*, the *Nation*, the *Toronto Week*, and the *Bystander*, and later he was the principal contributor to the *Sun*, a paper published in the farming interest. Although these periodicals, except the last, were comparatively short-lived, they were unequaled in Canada for their treatment of public questions. At the same time he contributed to the leading British and American reviews, besides writing many books and pamphlets remarkable for keen insight and a felicitous style which won for him an international reputation. His philosophy of history reserved the largest liberty for the individual, thus upholding a moral rather than a physical theory of historical evolution. He denounced American imperialism as a grave danger and was opposed to Irish home rule, government paternalism, woman suffrage, and the legal prohibition of the liquor traffic. In 1904 he was president of the American Historical Association. His regard for Cornell, whose hall of humanities is named for him, was shown by the bequest of most of his property, amounting to about $650,000, to that university. He married Mrs. W. H. Boulton (née Dixon), widow of a Conservative member of Parliament. He died at his residence, The Grange, Toronto, on June 7, 1910. His writings include: *The Empire* (1863); *Speeches and Letters* (1865), dealing with the American Civil War; *Lectures on Modern History* (1866), delivered at Oxford; *Three English Statesmen* (1867); *Lectures and Essays* (1882); *False Hopes* (1883); *Cowper* (1887), in the "English Men of Letters Series"; *Canada and the Canadian Question* (1891); *Essays on the Questions of the Day* (1894); *Guesses at the Riddle of Existence* (1897); *The United States: An Outline of Political History* (1899); *The United Kingdom: A Political History* (1899); *Irish History and the Irish Question* (1904); *My Memory of Gladstone* (1905); *In Quest of Light* (1906); *No Refuge but in Truth* (1909). Consult his *Reminiscences* (1910), edited by his private secretary, T. A. Haultain; also the latter's *Goldwin Smith: His Life and Opinions* (London, 1913).

SMITH, GREEN CLAY (1832–95). An American soldier, legislator, and preacher, born at Richmond, Ky. He served through the Mexican War as lieutenant in a Kentucky regiment, graduated at Transylvania University in 1850 and at the Lexington Law School in 1853, and settled in Covington at law practice in 1858. In 1860 he was elected to the Kentucky Legislature, where on the approach of Civil War he tried to keep the State in the Union. On the outbreak of hostilities he became colonel of the Fourth Kentucky Cavalry (Federal), took part in the Tennessee campaigns of 1862, and in that year was commissioned brigadier general of volunteers. In 1863, having been elected a Unionist member of the Thirty-eighth Congress, he resigned his commission. He was reëlected to Congress in 1864 and in 1866 was appointed by President Johnson Governor of Montana Territory. He retired from politics in 1869, was ordained to the Baptist ministry, and attained prominence as an evangelist. In 1876 he was presidential candidate of the Prohibition party.

SMITH, GUSTAVUS WOODSON (1822–96). An American soldier, born in Scott Co., Ky. He graduated at the United States Military Academy in 1842, fought in the Mexican War, and was brevetted lieutenant for gallantry at Cerro Gordo and captain for services at Contreras. In 1861 he was commissioned major general in the Confederate service. After Gen. Joseph E. Johnston was wounded in the battle of Seven Pines, Smith was for a short time in command of the Army of Northern Virginia, but was seized by a temporary attack of paralysis and was superseded by General Lee. Afterward he was in command of Richmond and then of the Georgia militia. He published *Confederate War Papers* (1883; 2d ed., 1884) and *Battle of Seven Pines* (1891).

SMITH, HANNAH WHITALL (1832–1911). An American religious and feminist leader, born in Philadelphia. A Quaker herself, she was educated at the famous Quaker school of Miss Mary Anna Longstroth and in 1851 was married to Robert Pearsall Smith. For many years she conducted Bible classes for women in Philadelphia, and her home was a centre of religious life there. In 1873–74 Mr. and Mrs. Smith held a series of religious conferences in various cities of England, and after 1888 they made their home in London. Mrs. Smith was president of the British organization of the Woman's Christian Temperance Union and was also closely connected with the English woman-suffrage movement. She wrote many religious tracts and *The Unselfishness of God* (1903), *The God of All Comfort* (1906), *The Christian's Secret of a Happy Life* (1908).

SMITH, SIR HENRY BABINGTON (1863–). A British financier. He was born at Jordan Hill, Renfrewshire, Scotland, and was educated at Eton and at Trinity College, Cambridge. In 1894–99 he was private secretary to the Earl of Elgin, Viceroy of India, whose daughter he married in 1898. He was British representative abroad at various postal, telegraph, and other congresses and conferences of importance. Smith became president of the National Bank of Turkey in 1909. In 1915 he was a member of the Anglo-French Commission which came to New York City and in October negotiated a loan of $500,000,000 for the allies in the European War. He was knighted in 1908 (K.C.B.).

SMITH, HENRY BOYNTON (1815–77). An American educator and theologian. He was born at Portland, Me., graduated at Bowdoin College in 1834, and studied theology at Andover and abroad at Paris, Halle, and Berlin. For several years he was a Congregational minister. Subsequently he was professor of philosophy in Amherst College (1847–50), and then for 24 years was at Union Theological Seminary, holding the chair of Church history and then that of systematic theology. He belonged to the liberal and progressive school in theology and was prominent in the work of Presbyterian union. He edited the *New York Evangelist* and was coeditor of the *American Theological Review*, the *American Presbyterian and Theological Review* and afterward of the *Presbyterian Quarterly and Princeton Review*. His writings, most of which appeared posthumously, include: *Tables of Church History* (1859); *Faith and Philosophy* (1877); *Lectures on Apologetics* (1882); *Introduction to Christian Theology* (1883); *System of Christian Theology* (1884).

SMITH, HENRY HOLLINGSWORTH (1815–90). An American surgeon, born in Philadelphia. He graduated from the medical department of the University of Pennsylvania in 1837, studied for two years in the hospitals of London, Paris, and Vienna, and was professor of surgery in the University of Pennsylvania from 1855 till his retirement in 1871. During the first two years of the Civil War (1861–62), as surgeon-general of Pennsylvania, he organized the field hospital service thoroughly and introduced the practice of embalming on the field of battle. Among his published works are: *Minor Surgery* (1843; 3d ed., 1850); *System of Operative Surgery* (2 vols., 1852; 2d ed., 1855); *The Treatment of Disunited Fractures by Means of Artificial Limbs* (1855); *The Principles and Practice of Surgery* (2 vols., 1863).

SMITH, HENRY JOHN STEPHEN (1826–83). A British mathematician, born in Dublin, Ireland. He was educated at Balliol College, Oxford, of which he was elected fellow. He won numerous prizes and was a brilliant scholar. In 1850 he was appointed lecturer in mathematics at Balliol College and in 1851 senior scholar in mathematics. In 1860 he became Savilian professor of geometry and in 1861 was elected fellow of the Royal Society and of the Royal Astronomical Society. Smith was the leading English writer on the theory of numbers and a disciple of Gauss, whose writings he thoroughly examined. These researches occupied his time from 1854 to 1864 and are contained in his *Report on the Theory of Numbers*, presented to the British Association in six parts (1859–65). His most important contributions were contained in two papers: "On Systems of Linear Indeterminate Equations and Congruences" and "On the Orders and Genera of Ternary Quadratic Forms" (1861, 1867). Jacobi had proved the cases of numbers as the sum of two, four, and six squares; Eisenstein had proved the case of three squares but left that of five squares without demonstration. The formulæ for this were supplied by Smith (as also for that of seven squares), but through an oversight the French Academy set this as the subject of their "Grand prix de sciences mathématiques" for 1882. The prize of 3000 francs was awarded him two months after his death. Smith also devoted his attention to elliptic functions, his results being published in the *Proceedings* of the London Mathematical Society. Smith's published writings were collected and edited by Glaisher in two volumes (Oxford, 1894). Consult *Monthly Notices of the Royal Astronomical Society*, vol. xliv (London, 1884), and the *Fortnightly Review* (ib., May, 1883).

SMITH, HENRY PRESERVED (1847–). An American theologian and Orientalist, brother of Richmond Mayo-Smith (q.v.). He was born in Troy, Ohio, and was educated at Amherst (A.B., 1869), at Lane Theological Seminary, and in Berlin. He was appointed professor at Lane Seminary in 1877. In 1891, after the Briggs heresy case (see BRIGGS, C. A.), Professor Smith in an address on *Biblical Scholarship and Inspiration* urged a distinction between inerrancy and inspiration, and, for his attack on the former doctrine, citing parallel accounts in Chronicles and in Samuel and Kings, he was tried by the Presbytery of Cincinnati in 1892 and suspended. (Consult his *Inspiration and Inerrancy*, 1893.) Subsequently he entered the ministry of the Congregational church and served in succession as professor at Andover Seminary in 1893–98, at Amherst College from 1898 to 1906, and Meadville (Pa.) Theological School (Unitarian) in 1907–13, and as chief librarian of Union Seminary, New York. He published: *The Bible and Islam* (1897); *A Commentary on Samuel* (1899); *Old Testament History* (1903); *The Religion of Israel* (1914).

SMITH, HOKE (1855–). An American lawyer and statesman, born at Newton, N. C. He was educated at Chapel Hill in a school of his father's, and on removal to Georgia he studied law. Practicing in Atlanta, he became one of the most successful lawyers in the State. From 1887 to 1898 he was president and publisher of the Atlanta *Journal*, which became a power in Georgia politics. In recognition of his able support of Cleveland, Smith was made Secretary of the Interior in Cleveland's second cabinet and he served acceptably for three years (1893–96). In 1896 he supported Bryan for President. Although active in Democratic politics, he subsequently devoted himself to his law practice until 1906, when he was elected Governor of Georgia on a reform ticket. Defeated for reëlection in 1910 he was chosen Governor again by an overwhelming majority. (See GEORGIA, *History*.) Smith was elected United States Senator in 1911 to fill an unexpired term and in 1914 was reëlected. He was a supporter of President Wilson. In 1915 he criticized bitterly the English blockade system.

SMITH, HORACE. See SMITH, JAMES AND HORATIO.

SMITH, JACOB HURD (1840–). An American soldier. He was born at Jackson, Ohio, and graduated at the Collegiate and Commercial Institute, New Haven, in 1858. He fought in the Civil War (rising to be captain), in the frontier Indian Wars, and in the Spanish-American War. He was made brigadier general of volunteers in 1900 and in 1901 brigadier general in the regular army. In the autumn of 1901, while commander of the Sixth Separate Brigade in Samar, Philippine Islands, Smith gave heated oral orders for severe treatment of belligerent natives. He was afterward tried by a court-martial convened in the Philippines under an order of President Roosevelt dated April 21, 1902. It was decided that Smith's instructions were prejudicial to good order and discipline, but in view of his previous good record and of the circumstances of the case he was given the light sentence of being retired from active service. His sentence was further mitigated by the fact that in 1902 he had reached the age limit.

SMITH, JAMES (c.1720–1806). An American legislator, one of the signers of the Declaration of Independence, born in Ireland. He came to America with his father, who settled on the Susquehanna in Pennsylvania in 1729. He was educated at the College of Philadelphia and studied law. He was a delegate to the Provincial Conference to discuss the state of the Colonies in July, 1774, raised a volunteer company, and wrote an *Essay on the Constitutional Power of Great Britain over the Colonies in America*. He was a delegate to the Pennsylvania Convention in January, 1775, to the Provincial Conference in June and to the State Constitutional Convention in July. From 1775 to 1778 he served in the Continental Congress and during this time signed the Declaration of Independence. In 1779 he was a member of the Pennsylvania General Assembly and in 1784 was elected to Congress for one term.

SMITH, JAMES (1737–1812). An American backwoodsman, born in Franklin Co., Pa. He was captured by the Indians in 1755 and was adopted into the Caughnewaga nation, but escaped in 1759. He was the leader (1763) of the Black Boys, organized to fight the Indians, served as lieutenant in Bouquet's expedition of 1764 (see BOUQUET, HENRY), and in 1766–67, with four companions, explored the southern part of Kentucky. In 1769, at the head of 18 men, he captured Fort Bedford and released several prisoners there, this being the first fort ever taken from British troops by American colonists. He served as captain of rangers in Lord Dunmore's War and sat in the Pennsylvania Assembly in 1776–77 and in the latter year was commissioned colonel. He published *An Account of the Remarkable Occurrences in the Life and Travels of Col. James Smith* (1799) and *A Treatise on the Mode and Manner of Indian War* (1811).

SMITH, JAMES (1775–1839) and HORATIO (generally known as Horace) (1779–1849). Authors of the *Rejected Addresses* and sons of a London solicitor. Both were educated at a school at Chigwell. James succeeded his father as solicitor to the Board of Ordnance; Horace adopted the profession of stockbroker and made a handsome fortune, on which he retired with his family to Brighton. Both were popular and accomplished men—James remarkable for his conversational powers and gayety, and Horace distinguished for liberality and benevolence. The work by which they are best known is a small volume of verse parodies, perhaps the most felicitous in the language. On the opening of the new Drury Lane Theatre in October, 1812, the committee of management advertised for an address to be spoken on the occasion, and the brothers adopted a suggestion made to them that they should write a series of supposed "Rejected Addresses." They accomplished their task in six weeks—James furnishing imitations of Wordsworth, Southey, Coleridge, Crabbe, Cobbett, etc., and Horace those of Scott, Byron (all but the first stanza), Monk Lewis, Moore, and others. Horace Smith also wrote several historical novels in imitation of Scott. The best is *Brambletye House* (1826), dealing with the Commonwealth and the Restoration. Horace's *Poetical Works* appeared in 1846. Consult *Rejected Addresses* (ed. by Percy Fitzgerald, London, 1890).

SMITH, JESSIE WILLCOX (?–). An American illustrator and painter. She was born in Philadelphia and studied there at the Pennsylvania Academy of Fine Arts, also under Howard Pyle at the Drexel Institute, and after 1890 was known for her illustrations in current magazines. Her child subjects, of which she made a specialty, became very popular and display genuine love for and insight into child nature. Well-known series are: "The Child's World," "The Five Senses," "Seven Ages of Childhood" (1909), and illustrations for Mother Goose Rhymes. She made her home in Philadelphia. She received a silver medal at the Panama-Pacific Exposition (1915).

SMITH, JOHN (c.1570–1612). See SMYTH, JOHN.

SMITH, JOHN (1580–1631). A famous adventurer, explorer, and colonist, born at Willoughby, Lincolnshire, England. He was left an orphan at an early age. At 15 he accompanied the sons of an English nobleman on a tour of the Continent as a page, but left them and enlisted with the Protestants of France. He was a soldier of fortune in different lands and met with a series of romantic adventures. Upon his return to England, in 1605, he was induced to take part in the colonization of Virginia and sailed thence in 1606. He was named a member of the Council for the community in the secret list prepared before departure, but during the voyage he was imprisoned on a charge of sedition. On arrival, when the sealed instructions were opened, he was not allowed to take his seat.

Smith went out on expeditions for forage and discovery among the Indians and conducted them ably. After the first trip of discovery he was, in June, 1607, admitted to the Council. On one of these occasions, in December, 1607, he was captured by the Indian chief Powhatan (q.v.). The story which he relates of the young Indian maiden Pocahontas, the daughter of Powhatan, who, when he was condemned to death by the savage chieftain, saved his life by her interposition, is not now fully credited. (See POCAHONTAS.) After a period of turbulence and disaster Smith's influence became paramount in Jamestown. During another of his journeys, in 1608, he explored Chesapeake Bay as far as the Patapsco. He was elected President of the Council in September, 1608, but the statement so often made that he saved the colony from ruin rests upon no adequate foundation. (See DALE, SIR THOMAS.) In his dealings with the Indians he showed himself astute and valiant, and an adept in Indian peculiarities. His services were not sufficiently appreciated, and upon the grant of a new charter and the reorganization of the government he returned to England at the close of 1609. He was sent out on voyages of discovery and in 1614 made a fairly complete exploration of the New England coast from the Penobscot to Cape Cod. To the same end he twice sailed in 1615, the first time being driven back by bad weather and the second time being captured by the French. He died in 1631.

His two really historical works are his *True Relation*, published in 1608 (the best edition being that edited by Charles Deane, Boston, 1867), and his *General Historie of Virginia, New England, and the Summer Isles*, published in 1624. Three other works of importance are his maps of Virginia (1612), his *Description of New England* (1616), and his *New England's Trials* (1620). The only comprehensive edition of Smith's *Works* is that by E. Arber (Birmingham, 1884; London, 1895). Consult: C. D. Warner, *Life of Captain John Smith* (New York, 1881); John Ashton, *Adventures and Discoveries of Captain John Smith* (ib., 1883); Tudor Jenks, *Captain John Smith* (ib., 1904); A. G. Bradley, *Captain John Smith* (ib., 1905); note on Capt. John Smith in Edward Channing, *History of the United States*, vol. i (ib., 1907); T. J. Wertenbaker, *Virginia under the Stuarts* (Princeton, 1914); E. B. Smith, *Pocahontas and Captain John Smith* (Boston, 1914).

SMITH, JOHN (1618–52). One of the founders of the Cambridge Platonists. See CAMBRIDGE PLATONISTS.

SMITH, JOHN BERNHARDT (1858–1912). An American entomologist, born in New York. He studied law and was admitted to the bar in 1879, but was more interested in entomology and in 1884 became a special agent of the United States Department of Agriculture. He was assistant curator of the United States National Museum in 1886 and after 1889 professor at Rutgers College and entomologist of the New Jersey Agricultural College Experiment Station. He was in charge of the New Jersey campaign against mosquitoes and was best known for this work and that against the San José scale. His writings include *Economic Entomology for Farmer and Fruit Grower* (1896) and *Our Insect Friends and Enemies* (1909).

SMITH, John Lawrence (1818–83). An American chemist. He was born in Louisville, Ky., and was educated at the University of Virginia, the Medical College of South Carolina (M.D., 1840), in Germany under Liebig, and in Paris under Pelouze. In 1844 he began the practice of medicine in Charleston and established the *Medical and Surgical Journal of South Carolina.* During 1846–50 he investigated the mineral resources of Turkey, for the government of that country, and he discovered deposits of coal, chrome ore, and the famous emery deposits of Naxos. From 1852 to 1854 he was professor of chemistry in the University of Virginia. He was president of the American Association for the Advancement of Science (1872) and of the American Chemical Society (1877). His collection of meteorites was the finest in the United States and on his death passed to Harvard. He published *Mineralogy and Chemistry, Original Researches* (1873; enlarged with biographical sketches, 1884).

SMITH, John Raphael (1752–1812). An English mezzotint engraver and painter. He was born in Derby, the son of Thomas Smith, a landscape painter. Without regular instruction he started to paint miniatures and then to engrave in stipple and mezzotint, in which medium he became the most conspicuous master of his time, being especially noted for originality and brilliancy of technique. He excelled in interpreting Reynolds, Romney, and Morland. Smith was appointed engraver to the Prince of Wales and was also engaged as a print dealer and publisher. At the close of his life he confined himself to drawing portraits in chalk. Consult *John Raphael Smith*, in "Great Engravers" (London, 1911).

SMITH, John Walter (1845–). An American legislator, born at Snow Hill, Md. He was engaged in the lumber business from 1865 and was president of the Snow Hill Bank from its organization. As a stanch Democrat he was a member of the Maryland Senate (1889–99), receiving the minority vote for United States Senator in 1896. Elected a Representative in Congress in 1898, he resigned in 1900 to become Governor of Maryland, serving until 1904. He was generally regarded as an able politician of conservative tendencies. In 1908 he was elected to fill the unexpired term of W. P. Whyte (q.v.), later in the same year was elected for a full term, and in 1914 was reelected.

SMITH, Joseph, Jr. (1805–44). The founder of Mormonism. He was born at Sharon, Vt., Dec. 23, 1805, but as a child moved with his parents to western New York, and settled near Manchester. It was there that in 1820 and 1823 he experienced the visions which called him to be the leader of a new religious sect. The *Book of Mormon* (see Mormon, Book of) was published in 1830, and in the same year the Mormon church was organized. The new faith spread rapidly, and Joseph Smith established headquarters at Kirtland, Ohio, in 1831. Subsequently the church built a temple at Independence, Mo., and when forced to leave in 1838 they founded Nauvoo, Ill. Here also their doctrines aroused much hostility, reaching a climax on June 27, 1844, when Joseph Smith was murdered by a mob at Carthage, Ill. For a detailed account of Smith's life see Mormons. See also Smith, Joseph (1832–1914), and Smith, Joseph Fielding.

SMITH, Joseph (1832–1914). An American Mormon leader, son of Joseph Smith (q.v.), founder of the Mormon church. He was born at Kirtland, Ohio, and received a common-school education at the Mormon settlement of Nauvoo, Ill., but he did not join his fellow religionists in their migration to Utah. He opposed the practice of polygamy, and always denied that his father was a polygamist or ever sanctioned polygamy. He became a leader among the Mormons of the Middle West and in 1860 was chosen president of the Reorganized Church of Jesus Christ of Latter-Day Saints (q.v.). In 1863 he became editor of the Mormon paper, the *Saints' Herald.*

SMITH, Joseph Fielding (1838–). An American Mormon leader, nephew of Joseph Smith, the Mormon prophet. He was born at Far West, Mo., and in 1848 drove an ox team in the exodus of the Mormons to Salt Lake valley. In 1858 he was ordained a high priest and a member of the high council and spent several years as a missionary to the Sandwich Islands and to Great Britain. Ordained an apostle in 1866, he became a member of the council of twelve in the following year, from 1880 to 1901 was second counselor in the first presidency of the church, and thenceforth was its president. He was several times a member of the Utah Legislature and in 1882 presided over the Constitutional Convention that framed a constitution for the State of Utah and petitioned Congress for admission to the Union. He wrote *Origin of the "Reorganized" Church* (1909).

SMITH, Joshua Toulmin (1816–1869) (known in letters as Toulmin Smith). An English lawyer and author. In 1837 he came to the United States, settling in Detroit, then in Utica, later in Boston, where he lectured. His studies of the Icelandic sagas resulted in *The Northmen in New England, or America in the Tenth Century* (1839), said to be the earliest account in English of the voyages of the Norsemen to Vineland. He returned to England in 1842. At the time of his death he was at work on a history of *English Gilds*, which was edited in 1870 by his daughter for the Early English Text Society. He wrote on and worked for sanitary and municipal reform and also on geological and antiquarian subjects.

SMITH, Judson (1837–1906). An American educator, born at Middlefield, Mass. He graduated at Amherst in 1859 and at Oberlin Theological Seminary in 1863 and was ordained a Congregational minister in 1866. He was professor of Latin in Oberlin in 1866–70, of ecclesiastical history in the Oberlin Theological Seminary in 1870–84, and lecturer on modern history there in 1875–84. In 1884 he became corresponding secretary of the American Board of Commissioners for Foreign Missions. He visited the board's missions in Turkey in 1888 and those in China in 1898. In 1882–84 he was editor of the *Bibliotheca Sacra* and was its associate editor after that time. He published *Lectures in Church History and the History of Doctrine from the Beginning of the Christian Era till 1864* (1881) and *Lectures on Modern History* (1881).

SMITH, Marcus Aurelius (1852–). An American lawyer and legislator, born near Cynthiana, Ky. He was educated at Transylvania University, from which he graduated in law. In 1881 he moved to Arizona, where he practiced law and entered politics as a Democrat. While Arizona was a Territory he served during several periods as delegate to Congress, and when it became a State he was elected United States Senator (1912), having been chosen in the primary election. He was reelected in 1914. In Congress he was deeply interested in the solution of irrigation problems and in the reclamation service.

SMITH, Melancton (1810–93). An American naval officer, born in New York City. He was appointed midshipman in the navy in 1826 and in 1839 on board the *Poinsett* coöperated with land forces against the Seminoles in Florida. He became a commander in 1855 and in 1861–62 commanded the *Massachusetts* in the Gulf blockading squadron. Smith became captain in 1862. He commanded the naval forces in the capture of Biloxi, Miss., and after running by the Confederate forts took part in the capture of New Orleans. He attacked and destroyed the Confederate ram *Manassas*, but in the attack on Vicksburg his vessel ran aground while attempting to pass the Confederate batteries and was abandoned. In the battle of Mobile Bay he distinguished himself in command of the *Monongahela* and in both attacks on Fort Fisher commanded the *Wabash*. He became a commodore in 1866, a rear admiral in 1870, and retired in 1871.

SMITH, Morgan Lewis (1822–74). An American soldier, born in Oswego Co., N. Y. In 1846 he joined the United States army as a private, but later engaged in business. Upon the outbreak of the Civil War he organized the Eighth Missouri Volunteer Regiment and was chosen its colonel in 1861. He commanded a brigade at the capture of Fort Donelson and in the battle of Shiloh was promoted to brigadier general in 1862 and commanded a division in the Vicksburg and Chattanooga campaigns under Sherman. In 1864 he succeeded to the command of the Fifteenth Army Corps. After the war he was for a time United States Consul at Honolulu.

SMITH, (Edmund) Munroe (1854–). An American jurist and historian, born in Brooklyn. He graduated at Amherst in 1874 and at Columbia Law School in 1877 and in 1880 received the degree of J.U.D. at Göttingen. Instructor in Columbia from 1880 to 1883 and adjunct professor of history until 1891, he was then appointed professor of Roman law and comparative jurisprudence. He was managing editor of the *Political Science Quarterly* in 1886–93 and 1904–13, wrote articles on Roman law and cognate subjects for the New International Encyclopædia, and contributed to Johnson's *Universal Encyclopædia*, to Harper's *Classical Dictionary*, to Lalor's *Cyclopædia of Political Science*, and to the *Law Quarterly Review* and other periodicals. His works include: *Bismarck and German Unity* (1898; 2d ed., 1910); "Orations and Essays of Cicero," in *The World's Great Books* (1900); *Military Strategy versus Diplomacy in Bismarck's Time and afterwards* (1915).

SMITH, Nathan (1762–1829). An American physician. He was born in Rehoboth, Mass., and served in the Vermont militia during the last 18 months of the Revolutionary War. He studied medicine at Harvard and Edinburgh. In 1798 he became professor of medicine at Dartmouth College, and later he held the chair of anatomy and surgery there. In 1813 he was elected professor of surgery and physics at Yale. His name is connected with the amputation of the thigh, for which he developed a new method, and with the introduction of the method of trephining of the bone in necrosis. He published *A Practical Essay on Typhous Fever* (1824).

SMITH, Nathan Ryno (1797–1877). An American surgeon, son of Nathan Smith (q.v.). Born in Concord, N. H., he was educated at Yale (M.D., 1822). He was professor variously of surgery, anatomy, or medicine at the University of Vermont, Jefferson Medical College, Philadelphia, the University of Maryland, Transylvania University at Lexington, Ky. (1828–40), and again at the University of Maryland (1840–70). Smith invented an instrument for lithotomy and published *A Physiological Essay on Digestion* (1825); *Surgical Anatomy of the Arteries* (1832; 2d ed., 1835); *Treatment of Fractures of the Lower Extremities* (1867). He also edited his father's *Medical and Surgical Memoirs* (1831) and wrote *Legends of the South*, under the nom de plume "Viator." His son, Alan Penniman Smith (1840–98), was born in Baltimore and in 1861 graduated M.D. from the University of Maryland, where he became professor of surgery in 1875.

SMITH, Percey Franklyn (1867–). An American mathematician, born at Nyack, N. Y. He was educated at Yale (Ph.B., 1888; Ph.D., 1891) and studied also at the universities of Göttingen, Berlin, and Paris in 1894–96. After 12 years of teaching at the Sheffield Scientific School (Yale), he was appointed professor of mathematics there in 1900. Besides editing the *Transactions* of the American Mathematical Society, and *Elements of Differential Calculus* (1904), with W. A. Granville, his publications include: *Elementary Calculus* (1902); *Four-Place Logarithmic Tables* (1902); *Elements of Analytic Geometry* (1905), with A. S. Gale; *Introduction to Analytic Geometry* (1905), with Gale; *Theoretical Mechanics* (1910), with W. R. Longley; *Elementary Analysis* (1910), with Granville; *New Analytic Geometry* (1912), with Gale.

SMITH, Persifor Frazer (1798–1858). An American soldier, born in Philadelphia, Pa. He graduated at the College of New Jersey (Princeton) in 1815. As colonel of Louisiana Volunteers he served against the Seminole Indians (1836 and 1838). He was brigadier general of Louisiana volunteers at the outbreak of the Mexican War, but entered the regular service of the United States as colonel of mounted rifles in 1846. He was brevetted brigadier general for gallantry at Monterey and major general for his conduct at Contreras and Churubusco. He helped arrange an armistice with Mexico in August, 1847, and was placed in charge of the Second Division of the army. In 1847 he was military and civil Governor of Mexico and in 1848 held the same position at Vera Cruz. He remained in the army, became brigadier general (Dec. 30, 1856), and was sent to Kansas to quiet disturbances there.

SMITH, Richard Somers (1813–77). An American soldier and educator, born in Philadelphia, Pa. He graduated at West Point in 1834. He resigned his commission in 1836 and for four years was engaged in engineering work. He was reappointed to the army in 1840 and in 1840–55 was stationed at West Point, first as instructor and after 1852 as professor of drawing, but again resigned in 1855 and was professor of mathematics at the Brooklyn Polytechnic Institute until 1859 and director of the Cooper Institute in 1859–61. In the latter year he was commissioned major in the regular army (Twelfth Infantry), was engaged as a recruiting officer in Maryland and Wisconsin, commanded his regiment in the operations of the Army of the Potomac in 1862 and a brigade in the early months of 1863, until after the battle of Chancellorsville. He resigned from the army on May 30, 1863, to become president of Girard College, where he remained until 1868. In 1868–70 he was professor of engineering at Pennsylvania State College and in 1870–77 was professor of drawing at the United States Naval Academy. He published *A Manual of Topographical Drawing* (1853; 3d ed., 1894) and *A Manual of Linear Perspective* (1857).

SMITH, RICHMOND MAYO-. An American economist. See MAYO-SMITH, RICHMOND.

SMITH, ROBERT (1689–1768). An English mathematician and astronomer, born at Lea, near Gainsborough. He was educated at Trinity College, Cambridge. In 1716 he was elected to succeed Cotes as Plumian professor of astronomy at Cambridge, a position which he held till 1760. Besides astronomy he also lectured on optics and hydrostatics and was a defender of Newton's method of fluxions. He also effected the completion of the observatory over the great gate at Trinity College. In 1742 he became master of Trinity College and also acted as vice chancellor of the university (1742–43). He wrote: *A Compleat System of Opticks* (2 vols., 1728; student's ed., 1778); *Harmonics, or the Philosophy of Musical Sounds* (1744; 2d ed., 1759, and postscript, 1762).

SMITH, (WILLIAM) ROBERTSON (1846–94). A Scottish biblical critic and Arabic scholar. He was born Nov. 8, 1846, at Keig, Aberdeenshire. He graduated at Aberdeen University in 1865. He studied theology at New College, Edinburgh, and spent two summers in Germany, at Bonn and Göttingen, where he heard the lectures and made the acquaintance of Bertheau, Lotze, and Ritschl, by whom he was particularly influenced. In 1870 he became professor of Oriental languages and exegesis of the Old Testament in the Free Church College, Aberdeen. During the summer of 1872 he was again in Germany, studied Arabic with Lagarde, and became acquainted with Fleischer, Wellhausen, and other prominent Orientalists. In 1875 he became a member of the Old Testament revision committee. His articles "Angels" and "Bible," written for the ninth edition of the *Encyclopædia Britannica*, aroused suspicion and hostility in the church. A committee was appointed by the General Assembly in 1876 to investigate, and eventually (1881) Professor Smith was dismissed from his chair. The case is a famous one; its practical outcome was to popularize his scholarly methods and views. While his case was pending he spent two winters in the East, visiting Egypt, Palestine, Syria, and Arabia. From his dismissal till 1888 he was associated with Professor Baynes as editor of the *Britannica*. At the same time he continued his Semitic studies with most valuable results. In 1883 he became Lord Almoner's professor of Arabic at Cambridge, in 1886 chief librarian of the university, and in 1889 Adams professor of Arabic. He died at Cambridge, March 31, 1894.

Besides numerous papers, he published: *What History Teaches us to Look for in the Bible* (1870); *The Old Testament in the Jewish Church* (1881; 2d ed., 1892); *The Prophets of Israel* (1882; 2d ed., 1895); *Kinship and Marriage in Early Arabia* (1885); *Lectures on the Religion of the Semites: Fundamental Institutions* (1889; 3d ed., 1907), the first of three series of lectures at Aberdeen. Consult Bryce, *Studies in Contemporary Biography* (New York, 1903).

SMITH, SAMUEL (1752–1839). An American soldier, born at Lancaster, Pa. He became a captain in Smallwood's Maryland Regiment in January, 1776, and served at the battles of Long Island and White Plains, attaining the rank of lieutenant colonel in 1777. He was in the attack on Staten Island and the battle of Brandywine and commanded at Fort Mifflin (q.v.), repelling the attacks of the English, though finally badly wounded. He was a member of the Maryland House of Delegates in 1792, was a member of Congress (1793–1803 and 1816–22), for a time in 1801 Secretary of the Navy, United States Senator (1803–15 and 1822–33). He commanded the State troops as major general of militia in the defense of Baltimore in 1814 and was mayor of Baltimore in 1835–38.

SMITH, SAMUEL FRANCIS (1808–95). An American clergyman and hymn writer. He was born in Boston, graduated at Harvard in 1829, and at Andover Seminary in 1832. He was professor of modern languages in Waterville (later Colby) College (1834–42), editor of the *Christian Review*, Boston (1842–48), and editor of the Publications of the American Baptist Missionary Union (1854–69). He wrote "My Country, 'Tis of Thee" (first sung in the Park Street Church, Boston, July 4, 1832) and other favorite hymns. His publications include lives of Rev. Joseph Grafton (1848) and William Hague (1889); *Missionary Sketches* (1879; 2d ed., 1883); *History of Newton, Mass.* (1880); *Rambles in Mission Fields* (1884). A collected edition of his poems appeared at New York in 1895.

SMITH, SAMUEL STANHOPE (1750–1819). An American clergyman and educator. He was born at Pequea, Pa., graduated at the College of New Jersey (Princeton) in 1769, and was ordained a Presbyterian minister. He served as first president of Hampden-Sidney College (1775–79), and returned to his alma mater to be successively professor of moral philosophy, professor of theology, vice president, and president (1795–1812). Among his publications are: *Lectures on the Evidences of the Christian Religion* (1809); *Lectures on Moral and Political Philosophy* (1812); *Comprehensive Views of Natural and Revealed Religion* (1815). Consult the memoir prefixed to his *Sermons* (Philadelphia, 1821).

SMITH, SEBA (1792–1868). An American humorist, born at Buckfield, Me. After graduating at Bowdoin in 1818, he became a journalist in Portland, Me., editing three papers, the last of which was the *Daily Courier*, to which he contributed, beginning in 1830, the humorous letters on local and national politics which purported to be written by "Major Jack

Downing." These letters are not to be confounded with the amusing letters of a second "Major Downing" published in 1834 by Charles Augustus Davis (1795–1867) of New York City. Among his works may be named: *Dewdrops of the Nineteenth Century* (1846); *Powhatan: A Metrical Romance* (1841); and *Way Down East, or Portraitures of Yankee Life* (1855); *My Thirty Years out of the Senate* (1859).

His wife, Elizabeth Oakes (Prince) Smith (1806–93), aided her husband, and was an early lecturer on woman's suffrage and other subjects and published, among other books, *Woman and her Needs* (1851).

SMITH, Sir (William) Sidney (1764–1840). An English admiral, born at Westminster, London. In 1790–92 he aided the King of Sweden in the war with Russia and was knighted by Gustavus III for his services. In 1798 he was made plenipotentiary to Constantinople and in 1799, from March till May, made the famous defense of St. Jean d'Acre against Bonaparte, which earned for him a permanent place among English naval commanders and drew from Parliament a vote of thanks and an annuity of £1000. His customary vanity was rendered unrestrainable by these tokens of enthusiasm, and, usurping the prerogatives of commander in chief, he concluded the untenable Treaty of El Arish (Jan. 24, 1800), which caused a renewal of the war. He was made an admiral in 1821 and created G.C.B. in 1838. Consult Barrow, *Life of Sir W. S. Smith* (1848), and A. T. Mahan, *Influence of Sea Power upon the French Revolution and Empire* (Boston, 1892).

SMITH, Sidney Irving (1843–). An American biologist, born at Norway, Me. In 1867 he graduated from the Sheffield Scientific School (Yale), where he was professor of comparative anatomy from 1875 to 1906. He had charge of deep-water dredging in Lake Superior for the United States Lake Survey in 1871 and of similar work about St. George's Banks for the United States Coast Survey in 1872. In 1871–87 he was connected with the work of the United States Fish Commission. He was elected a member of the National Academy of Sciences in 1884. Professor Smith became known for his papers on American marine invertebrate zoölogy, particularly on crustaceans and their postembryonal stages.

SMITH, Sophia (1796–1870). An American philanthropist, born in Hatfield, Mass. She founded Smith Academy in her native town and gave liberally to Andover Theological Seminary and to foreign missions. The bulk of her estate, however, amounting in all to about $450,000, she left for the establishment at Northampton, Mass., of Smith College (q.v.) for women.

SMITH, Sydney (1771–1845). An English humorist, born at Woodford in Essex and educated at Winchester and at New College, Oxford. From 1798 to 1803 he lived in Edinburgh. In 1800 he published *Six Sermons*. In 1802 he joined Jeffrey, Horner, and Brougham in founding the *Edinburgh Review*, the first three numbers of which he mainly edited. To this periodical he contributed during the next 25 years about 80 articles of various kinds. In 1803 he gave up tutoring, which he had hitherto combined with preaching, and settled in London, where he gained fame as preacher, lecturer, and humorist. In 1828 Lord Lyndhurst, the Chancellor, presented him to a prebend in Bristol Cathedral and the next year enabled him to exchange Foston for Combe-Florey, a more desirable rectory in Somersetshire. In 1831 Earl Grey appointed him one of the canons residentiary of St. Paul's. In 1839 he inherited from his brother £50,000 and took a house in Grosvenor Square, London.

Smith's writings comprise the famous *Letters on the Subject of the Catholics, to my Brother Abraham, who Lives in the Country, by Peter Plymley* (anonymous, 1807–08), written to promote the cause of Catholic emancipation and abounding in wit and irony worthy of Swift; *Three Letters to Archdeacon Singleton on the Ecclesiastical Commission* (1837–39); *Letters on American Debts* (1843). His *Works* (1839–40) appeared in four volumes. Though the writings of Smith relate mostly to temporary controversies, they yet hold a place in our literature as specimens of clear and vigorous reasoning, rich humor, and solid good sense. His jokes, exaggeration, and ridicule are all logical, driving home his arguments; and his wit is sportive, untinctured with malice.

Bibliography. His *Works* (3 vols., London, 1839; Philadelphia, 1844; Boston, 1856), with many later issues of selections, etc.; *Wit and Wisdom of S. Smith*, with memoir, by Duyckinck (New York, 1856; often reprinted); Lady Holland, *Memoir of Rev. Sydney Smith, with a Selection from his Letters* (new ed., 2 vols., London, 1869); G. E. B. Saintsbury, *Essays in English Literature, First Series* (ib., 1891); André Chevrillon, *Sydney Smith et la renaissance des idées libérales en Angleterre au XIXme siècle* (Paris, 1894); S. J. Reid, *Sketch of the Life and Times of Sydney Smith* (4th ed., London, 1896); G. W. E. Russell, *Sydney Smith*, in "English Men of Letters Series" (New York, 1905).

SMITH, Theobald (1859–). An American biologist and pathologist, born at Albany, N. Y., and educated at Cornell and at the Albany Medical College (M.D., 1883). In 1884 he became director of the pathological laboratory of the Bureau of Animal Industry at Washington and two years later also professor of bacteriology at Columbian (now George Washington) University. In 1895 he went to Boston to be director of the pathological laboratory of the Massachusetts Board of Health, and he was also appointed, in the following year, professor of comparative pathology at Harvard. Smith, who became known as the leading scientist in the United States in the field of infectious diseases, made important observations and discoveries. He was the first to demonstrate the theory of immunization by practice when, in 1886, he showed that injection of the filtered virus of cholera in hogs produced immunity against the disease in man. In 1889 he found the organism of Texas fever in *Pyrosoma bigeminum*, which he and F. L. Kilborne demonstrated was transferred by the tick *Boöphilus bovis*. In 1898 he declared that there existed a distinction between the human and bovine types of tubercle bacilli, a statement indorsed by Robert Koch in 1900. Smith was elected to the National Academy of Sciences in 1908. His contributions to medical journals, government bulletins, etc., appeared in reprint form.

SMITH, Theodore Clarke (1870–). An American historical writer. He was born at Roxbury, Mass., and was educated at Harvard (A.B., 1892; Ph.D., 1896) and abroad at Paris and Berlin. He served as an assistant professor at Ohio State University from 1901 to 1903 and thereafter was professor of American history at Williams College. He published: "Political Reconstruction," in *Cambridge Modern History*, vol. viii (1903); *Liberty and Free Soil Parties in the Northwest* (1898); *Parties and Slavery* (1906); *Wars between England and the United States* (1914).

SMITH, Sir Thomas (1513–77). An English statesman and scholar, born at Saffron Walden in Essex and educated at Queens' College, Cambridge. He traveled and studied abroad, receiving honorary degrees from Padua, Cambridge, and Oxford. In 1544 he became regius professor of civil law in Cambridge and in 1548 was made Secretary of State. A zealous supporter of the Reformation, he lived in retirement under Mary, but in Elizabeth's reign became eminent as a statesman and diplomatist. In 1564 he negotiated the peace of Troyes with France. While in Paris he wrote his *De Republica Anglorum: The Maner of Government, or Policy of the Realme of England* (London, 1583; new ed. by Leonard Alston, Cambridge, 1906). From this date diplomatic missions occupied much of his time. In 1572 he succeeded Burleigh as Secretary of State, but retired in 1576. His *De Recta et Emendata Linguæ Anglicæ Scriptione Dialogus* (Paris, 1568), a proposed reform in spelling, is interesting. Consult also John Strype, *Life of Sir Thomas Smith* (Oxford, 1820).

SMITH, William (1728–93). A Canadian jurist and historian. He was born in New York City, graduated at Yale in 1745, and practiced law in New York. He was appointed Chief Justice of the Province of New York in 1763 and was a member of the Council in 1767–82. After the evacuation of New York by Sir Guy Carleton he went to England, where he remained until appointed Chief Justice of Canada, which office he filled until his death. When the Stamp Act was passed Smith devised a comprehensive plan of union of all the English colonies. During his term of office in Canada he established for the first time the employment of constables instead of soldiers in courts of justice. Consult D. C. Scott, *John Graves Simcoe* (Toronto, 1905), and A. G. Bradley, *Lord Dorchester* (ib., 1907), both in the "Makers of Canada Series."

SMITH, William (1749–1867). A Canadian historian, son of William Smith, Chief Justice of Canada. He was born in New York City. He was appointed a member of the Quebec Provincial Executive Council in 1814. In 1815 he published in two volumes his *History of Canada from its First Discovery to the Year 1791*, a narrative unattractive in style, but valuable because of the author's access to first-hand material.

SMITH, William (1769–1839). Called "the father of English geology." As a result of his investigations he formulated the principle that stratified rocks exhibit a definite order of succession and that the different horizons in the stratigraphical series may be identified by their included fossils. In 1794 he made a long tour through England, examining the geological structure of various regions and gathering evidence in support of his theories. Some of the data thus collected were published in *Order of the Strata and their Embedded Organic Remains, in the Neighbourhood of Bath, Examined and Proved Prior to 1799* (1799). After this he began the preparation of a geological map of England and Wales, which was supplemented by separate maps of the counties published in colors on 21 sheets. These were the first geological maps of England to be published and the first attempt to show the distribution and arrangement of the rock formations of a whole country. His services were recognized officially by a government pension, while the Geological Society of London conferred upon him the Wollaston medal. Besides his geological contributions he published a treatise on *Irrigation* (1806). For an estimate of his scientific work, consult Sir Archibald Geikie, *The Founders of Geology* (2d ed., New York, 1906).

SMITH, Sir William (1813–93). An English classical and biblical scholar. He was born in London and graduated at London University; was professor of Greek, Latin, and German in Highbury and Homerton colleges, then independent, and when they were consolidated as New College he became professor there of the Greek and Latin languages and literatures. He was editor of the *Quarterly Review* in 1867, was knighted in 1892, and was the editor of many valuable works, among them (in their latest editions): *English-Latin Dictionary* (1899); *Dictionary of Greek and Roman Antiquities* (1890–91); *Dictionary of Greek and Roman Biography and Mythology* (1890); *Dictionary of Greek and Roman Geography* (1854–57); *Dictionary of Christian Antiquities* (1875–80); *Dictionary of the Bible* (1863; rev. ed., 1887); *Dictionary of Christian Biography* (1877–87). Consult J. E. Sandys, *A History of Classical Scholarship*, vol. iii (Cambridge, 1908).

SMITH, William Alden (1859–). An American lawyer and legislator, born at Dowagiac, Mich. He was early a newsboy, telegraph messenger, and page in the Michigan House of Representatives. Becoming office boy of the law firm of Burch & Montgomery, he studied law and after 1883 practiced at Grand Rapids. He was active in the Republican party, serving as State chairman from 1888 to 1892. Subsequently he was a member of Congress from 1894 to 1907, then resigning to enter the United States Senate. He was reëlected in 1912. As Senator he became chairman of the Committee on Territories. While chairman of a subcommittee of the Committee on Commerce, appointed to investigate the causes of the *Titanic* disaster (1912), he showed lack of nautical knowledge, but the report was important in causing laws for greater safety at sea.

SMITH, William Farrar (1824–1903). An American soldier, born at St. Albans, Vt. He graduated from West Point in 1845 and (1846–48 and 1855–56) was assistant professor of mathematics there. He participated in the first battle of Bull Run, became brigadier general United States volunteers (Aug. 13, 1861), and was in command of a division in the Peninsular campaign from March to August, 1862. He was brevetted lieutenant colonel United States army for gallantry in the battle of White Oak Swamp (June 28, 1862). He became major general United States volunteers (July 4, 1862), was brevetted colonel United States army for gallantry at Antietam, and commanded the Sixth Corps of the Army of the Potomac (1862–63), when he was transferred to the Ninth Corps, serving till March 17. He commanded a division of the Army of the Susquehanna from June 17 to Aug. 3, 1863, and pursued the Confederates after the battle of Gettysburg. He was chief engineer, Department of the Cumberland, in 1863 and by building a bridge at Brown's Ferry (October 26) was able to join Hooker's forces with the Army of the Cumberland, saving the latter from possible capture at Chattanooga. He was again promoted to the rank of major general United States volunteers (March 9, 1864), and served with the Army of the Potomac from May 2 to July 9, 1864, before Richmond. He was brevetted brigadier general United States army (March 13, 1865) for services at Chattanooga and major general the same day for services during the war. From 1864 to 1873 he was president of the International Telegraph Company, and in 1877 became president of the board of police commissioners of New York. After 1881 he practiced civil engineering.

SMITH, William Henry (1825–91). An English statesman, born in London. He was elected to Parliament in 1868, became Secretary to the Treasury in 1874, and in 1877 entered the cabinet as First Lord of the Admiralty under Disraeli. In 1885 he served as Secretary for War and then as Chief Secretary for Ireland and in the following year became First Lord of the Treasury and leader of the House of Commons under the premiership of Lord Salisbury. In recognition of Smith's services his widow was created Viscountess Hambledon, with succession to his heirs.

SMITH, William Henry (1833–96). An American journalist, born at Austerlitz, N. Y. In 1855 he became editor of the *Type of the Times*, a political weekly at Cincinnati, and in 1858 was on the editorial staff of the Cincinnati *Gazette*. In 1863 he was private secretary to Governor Brough for one year and was then Secretary of State until 1867, when he resigned to take editorial charge of the Cincinnati *Evening Chronicle*, a new daily. In 1870 he became manager of the Western Associated Press at Chicago, and in 1883, upon its consolidation with the New York Associated Press as the American Associated Press, he became general manager of the new organization, remaining until 1893. In 1877 he became collector of the port of Chicago. His publications include *The Saint Clair Papers* (2 vols., 1882), containing much interesting material on the early history of the Northwest Territory, and *A Political History of Slavery* (1903), a narrative of antislavery and reconstruction.

SMITH, William Sooy. See Sooy Smith.

SMITH, William Waugh (1845–1912). An American college chancellor. He was born at Warrenton, Va., and served in the Confederate army in 1862–65. In 1871 he graduated A.M. from Randolph-Macon College, where he was professor in 1878–86 and president in 1886–97. He afterward organized and became chancellor of the Randolph-Macon System of Colleges and Academies, for which he raised large sums of money for buildings and endowment. Smith was author of *Outlines of Psychology* (1884), *A Parallel Syntax Chart of Latin, Greek, German, French, and English* (1885), and many special articles.

SMITH COLLEGE. An institution for the higher education of women at Northampton, Mass., chartered in 1871 and opened in 1875. The college was founded by Miss Sophia Smith (q.v.), of Hatfield. The undergraduate course combines certain fixed requirements with a plan of directed electives organized under a group system and leads to the degree of Bachelor of Arts. The degree of Master of Arts is also conferred. A number of annual scholarships in the various departments provide incomes of $75 to $300 for needy students. Two tables at seaside laboratories are maintained by the college, which also contributes to the support of a table at the zoölogical station at Naples and to the classical schools at Athens and Rome. The college buildings, centrally located in the town, include College Hall, containing the offices of administration; Seelye Hall, with 20 recitation rooms; the John M. Greene Hall, an auditorium, with a seating capacity of about 2300; the Library, containing books and pamphlets to the number of 53,241; Lilly Hall of Science; Chemistry Hall, in part the gift of the class of 1895; a well-equipped observatory; Music Hall; the Hillyer Art Gallery, containing extensive collections, with an endowment of $50,000 for their increase; the Alumnæ Gymnasium; and the Lyman Plant House, which with the botanic gardens furnishes material for laboratory work and opportunity for special investigations. In 1915–16 the student enrollment was 1724 and the faculty numbered 163. The endowment was $2,182,000, the grounds and buildings were valued at $1,890,000, and the income was $483,000. The president in 1916 was Marion L. Burton, D.D.

SMITH-DORRIEN, Sir Horace Lockwood (1858–). A British soldier. He was educated at Harrow and entered the army in 1876. Between 1879 and 1886 he served with distinction in the Zulu War, in the Egyptian War, in the Nile expedition with the Egyptian army, in the Sudan campaign, and in the Sudan Frontier Field Force. Thereafter, until 1898, when he accompanied another Nile expedition, he served in various parts of India. In 1900, as major general, to which rank he had been promoted, he commanded a brigade and a division in the South African War. He was adjutant general in India (1901–03) and commanded the Fourth Division there (1903–07). He was made lieutenant general in 1906 and general in 1912. In 1907–12 he was commander in chief at Aldershot and in 1912–14 held the Southern command. On the outbreak of the European War in 1914 he was given command of an army corps in the British expeditionary force sent to France and led his corps with great skill and energy, both in meeting the onset of the Germans, who outnumbered the British four to one, and in conducting the retreat from Mons so as to preserve the morale and strength of his men. In December, 1915, he was given supreme command of the expedition against German East Africa. Shortly after beginning his campaign he was taken ill, resigned, and was succeeded by Gen. Jan Christian Smuts (q.v.). In 1904 he was knighted (K.C.B.), and later he received the G.C.B. and the G.C.M.G.

SMITH'FIELD, or SMOOTHFIELD. An historic cattle market in London, mentioned as early as 1150 and since 1868 the seat of the Central Meat Market, covering 3½ acres. In the twelfth century Smoothfield was an open spot, which served the citizens as a playground and promenade. It was outside the city walls. Here Wat Tyler met his death in 1381, and the place is associated with trials by battle, tournaments, the burning of martyrs, and public executions during many centuries. The most celebrated fair in England, Bartholomew Fair (q.v.), was formerly held in Smithfield.

SMITHS FALLS. A town of Lanark County, Ontario, Canada, 39 miles south-southwest of Ottawa, on the Rideau River and Canal and on the Canadian Pacific and the Canadian Northern railways (Map: Ontario, K 3). It possesses a public library, a collegiate institute, two hospitals, and a park. It has flourishing manufactures. Pop., 1901, 5155; 1911, 6370.

SMITH'SON, JAMES (1765–1829). A British mineralogist and the founder of the Smithsonian Institution (q.v.) at Washington. In early life he was known as James Lewis (or Louis) Macie. He was born in France, the natural son of Hugh Smithson, first Duke of Northumberland, and of Mrs. Elizabeth Keate Macie, a member of the Hungerford family of Studley. He studied at Pembroke College, Oxford, and became a fellow of the Royal Society in 1787. He read 28 papers before the Royal Society and published 18 in Thomson's *Annals of Philosophy*. A large collection of minerals left by him were destroyed by fire in the Smithsonian Institution Building in 1865. He was associated with some of the most notable scientists of his time. Smithson passed a large part of his life on the Continent and died in Genoa, Italy. His remains were removed to the United States in 1904 and are interred in the grounds of the Smithsonian Institution. Smithson was never in America, and it is not known what induced him to give his fortune to the United States, except that a sense of wrong in the illegitimacy of his birth alienated him from his native land. Relative to his bequest, he wrote: "My name shall live in the memory of man when the titles of the Northumberlands and the Percies are extinct and forgotten." Consult: W. J. Rhees, "Smithson and his Bequest," and "Scientific Writings of James Smithson," in Smithsonian Institution, *Miscellaneous Collections*, vol. xxi (Washington, 1879–80); S. P. Langley, "James Smithson," in *The Smithsonian Institution, 1846 to 1896* (ed. by G. B. Goode, ib., 1897); id., *Removal of the Remains of James Smithson* (ib., 1904).

SMITHSO'NIAN INSTITUTION, THE. An institution in Washington, District of Columbia, created by an Act of Congress on Aug. 10, 1846, in accordance with the will of James Smithson (q.v.), who bequeathed the reversion of an estate amounting to $515,169 to the United States to be devoted to the "increase and diffusion of knowledge among men."

History. The regents appointed to carry out the provisions of Smithson's will elected Joseph Henry as executive officer. He recommended to "increase knowledge" by these methods: (1) to stimulate men of talent to make original researches by offering rewards for memoirs containing new truths, and (2) to appropriate annually a portion of the income for particular research under direction of suitable persons. To "diffuse knowledge" he proposed (1) to publish periodically reports on the progress of different branches of knowledge and (2) to publish occasional separate treatises on general subjects.

Under Henry was begun the construction of a building, designed by James Renwick in Norman style, which has since been the home of the Smithsonian Institution. A library was formed by exchange and purchase and museum materials collected. Research was fostered. One of the first subjects to be studied under its direction was the phenomena of storms, and the investigations of Espy and others led to the establishment of a telegraphic weather service, subsequently the Weather Bureau. The material collected by exploring expeditions and Pacific railway surveys was deposited here, and that led in time to the formation of the United States National Museum (q.v.). "Diffusion of knowledge" was inaugurated by issuing various publications. These include: (1) *Smithsonian Contributions to Knowledge*, a quarto series of memoirs embracing records of extended original investigations and researches, which began in 1848 with a monograph by Squier and Davis, and now comprises 35 quarto volumes. (2) *Smithsonian Miscellaneous Collections*, an octavo series of papers on the present state of knowledge on particular branches of science, which began in 1860. The series includes the valuable meteorological, geographical, physical, and mathematical tables. Since 1903 a quarterly issue has been published as part of this series. (3) *Annual Reports of the Board of Regents*, also octavo in form. These consist of the reports and proceedings of the officers of the institution, with a general appendix containing a selection of memoirs of interest to collaborators and correspondents of the institution, teachers, etc. These reports began in 1847 and have been published annually since. Each department of the institution also issues reports in its own field, and since 1910 the institution has had charge of the publication of the *Harriman Alaska Series*.

Research Library. The publication of these different series led to an extensive exchange with learned societies, resulting in a most notable collection, the greater portion of which has been deposited in the Library of Congress. A working library is maintained at the institution and includes some 300 current foreign and domestic scientific periodicals.

International Exchanges. In 1851 a system of international exchanges was established primarily for the circulation of the Smithsonian publications, but in 1867 the duty of exchanging official documents for similar works published by foreign departments was assigned to this service. This work was placed upon an international basis by treaty with various nations, as the result of a conference held at Brussels in 1886. Since the establishment of this department more than 4,000,000 packages of books have been distributed through it. In 1914 there were handled 341,667 packages. This bureau is supported by an annual appropriation from Congress.

National Museum. See UNITED STATES NATIONAL MUSEUM.

Bureau of American Ethnology. Early in its history the Smithsonian Institution showed an interest in American anthropology, chiefly in ethnology, with special reference to American Indians. From 1867 various exploring parties, under the direction of John W. Powell (q.v.), were sent out. Special mention is due the exploration of the Grand Cañon of the Colorado. Subsequently the United States Geographical and Geological Survey of the Rocky Mountain region was organized under Major Powell and the collections deposited in the National Museum. On the consolidation of the various geological surveys in 1879, the Bureau of American Ethnology was established by Act of Congress and placed under direction of the Smithsonian Institution; it has since been continued with appropriations from Congress. It publishes *Annual Reports*, quarto, begun in 1879, and a series of octavo bulletins begun in 1877; it also completed the *Contributions to North American Ethnology*, a series of nine quarto volumes begun in 1877. The first director of the bureau was Powell, who continued in that office until his death in 1902, when he was succeeded by William

H. Holmes. In 1916 the ethnologist in charge was F. W. Hodge, who took office in 1910.

National Zoölogical Park. A desire to preserve the wild animals of the continent that were disappearing led to the establishment of temporary quarters for captive specimens in the vicinity of the Smithsonian Building. This collection grew until in 1890 Congress appropriated $200,000 for the purchase of about 170 acres of land in Rock Creek Valley, near Washington, and in that year established a National Zoölogical Park, under the direction of the Smithsonian Institution. A collection of over 1400 animals is cared for in the park.

Astrophysical Observatory. The early desire of the founders that a portion of the bequest should be devoted to research in physics found culmination, soon after the appointment of Langley to the secretaryship of the institution, in the annual appropriation by Congress, beginning in 1891, of $10,000, since increased to $14,000, for maintenance of an astrophysical observatory. Apparatus valued at about $30,000 has been accumulated. Considerable investigation under the immediate direction of Langley was carried on, especially on the infra-red portion of the spectrum, and the observatory has issued a volume of *Annals*.

Langley Aërodynamical Laboratory. The laboratory was reopened in 1913 for the "study of the problems of aërodromics, particularly those of aërodynamics" with a view to securing the safety of aërial locomotion "for the purposes of commerce, national defense, and the welfare of man." The investigations tended to rehabilitate the Langley aëroplane, the first capable of sustained free flight with a man, and invented in 1896. See AËRONAUTICS.

Research. In 1891 Thomas G. Hodgkins made a donation of $200,000 to the Smithsonian Institution, of which the interest of $100,000 is permanently devoted to the increase and diffusion of more exact knowledge of the nature and properties of atmospheric air. In accordance with this bequest a prize of $10,000 was awarded to Lord Rayleigh and Sir William Ramsay in 1895 for the discovery of the element argon in the atmosphere. A medal bearing the name of Hodgkins, given for important contributions to knowledge concerning the nature and property of air, or for practical applications of existing knowledge to the welfare of mankind, was established and was awarded to James Dewar in 1899 for researches on the liquefaction and solidification of atmospheric air and in 1901 to J. J. Thomson for investigation on the conductivity of gases, especially gases composing air. Numerous grants from the Hodgkins fund have been made to students, both in the United States and abroad, engaged in this study. In 1908 the topic for the Hodgkins fund prize was on "the relation of atmospheric air to tuberculosis." For many years a table for original investigation in biology has been supported by the institution at the Naples Zoölogical Station. Beginning with 1906, Congress made an appropriation to continue this. In 1912 the Smithsonian Institution became connected, through the presence of its secretary on the board of directors, with the Research Corporation organized in New York in that year. The institution may receive funds for research and experimentation.

International Catalogue. Subsequent to a conference held in London in 1898, an international catalogue of scientific literature was undertaken in England and cataloguing was begun about 1900. The collecting of titles of American scientific publications was accepted by the Smithsonian Institution and has since been conducted under its supervision. In 1914 the institution sent to London 28,606 reference cards, making a total of 318,936 prepared in the United States since 1901.

American History. In 1889 the American Historical Association (q.v.) was incorporated by Act of Congress and authorized to report annually to the secretary of the Smithsonian Institution concerning the condition of historical study in America. Collections, manuscripts, books, pamphlets, and other material for the history of this association are deposited in the Smithsonian Institution and the National Museum. In 1896 the National Society of the Daughters of the American Revolution was incorporated. Their collection is deposited in the National Museum.

Funds. To the original bequest of Smithson other gifts and bequests, including over $200,000 from Thomas G. Hodgkins, have been added; also funds held in bonds and real estate devised to the institution; making the property which gives the income about $1,000,000. The total resources available in 1914 amounted to $124,623.94.

The institution has had the following secretaries: Joseph Henry, 1847–78; Spencer F. Baird, 1878–87; Samuel Pierpont Langley, 1887–1906; Charles Doolittle Walcott, 1906– .

Consult G. B. Goode (ed.), *The Smithsonian Institution, 1846–1896* (Washington, 1897), and W. J. Rhees (ed.), *The Smithsonian Institution, Documents Relative to its Origin and History, 1835–1899* (2 vols., ib., 1901).

SMITH'SONITE (named in honor of James *Smithson*). A mineral zinc carbonate crystallized in the hexagonal system. It has a vitreous lustre and is white to gray and light green and brown in color. It occurs with galena and other zinc minerals, also with copper and iron ores in veins and in beds, and is sometimes produced by the action of zinc sulphide on carbonated waters. The zinc is often partially replaced by copper, iron, or manganese. Smithsonite occurs crystallized or in botryoidal and stalactitic forms, granular or earthy. The rich colored varieties are occasionally cut for cabinet gems.

SMITH SOUND. The channel, about 30 miles wide, separating Ellesmere Land from the Prudhoe Land of Greenland and connecting Baffin Bay with Kane Basin (Map: Canada, Q 1). The sound was discovered by Bylott and Baffin in 1616. For subsequent explorations, see POLAR RESEARCH.

SMOCK, JOHN CONOVER (1842–). An American geologist, born at Holmdel, N. J., and educated at Rutgers College, where he graduated in 1862. He became professor at Rutgers in 1871, after having studied for two years at the Mining Academy, Freiberg, and at the University of Berlin. From 1864 to 1885 he assisted on a geological survey in New Jersey and from 1890 to 1901 he was geologist of that State. He wrote *Climate of New Jersey* (1881), *Building Stone in New York* (1888), and volumes iii and iv of *Geological Survey of the State of New Jersey*.

SMOHAL'LA (c.1815–1907) (corrupted from *Shmoquala*, preacher, the name assumed by him in later life). The originator and high priest of the "Dreamer" Indian religion of the Columbia River region. He was chief of the Wanapum, a small tribe living about Priests Rapids on the upper Columbia, Washington. About 1860 he announced that he had been in the spirit world, from which he had returned to deliver a new revelation, the burden of which was an immediate return to the primitive Indian customs. He fell into frequent prolonged trances, in which he was perfectly insensible to the most painful tests and from which he always emerged with a fresh revelation from the spirit world. He forbade his disciples to follow the white man's road, to use liquor or tobacco, or to sell their lands. His following soon included nearly all the Indians of eastern Washington and Oregon and western Idaho. About 1870 the matter came to the notice of the government from the refusal of the "Dreamers" to come under reservation restrictions. In 1884 his doctrines were made the subject of a special military investigation in connection with land troubles on the Yakima reservation. There were then two principal Dreamer churches—at Priests Rapids, where Smohalla resided, and at Union Gap on the reservation. Besides Sunday services at these, according to their own ritual, the Dreamers had a memorial lament for the dead in early spring, a salmon thanksgiving in April, and a berry thanksgiving in the fall, each being accompanied by processions, bell ringing, trance recitals, and a feast. Consult James Mooney, *The Ghost Dance Religion* (Washington, 1897).

SMOKELESS POWDER. An explosive substance that burns without developing much smoke and is used chiefly for military purposes. The present employment of smokeless powder may be said to have begun with the invention of *poudre B.* by Vieille in France in 1886.

Guttmann divides the smokeless powders into three classes, as follows: (1) powders in which guncotton, either the insoluble or the soluble variety alone, is used, which by the aid of a solvent has been converted into a plastic substance, then formed into flakes or cords and hardened or "indurated" by the evaporation of the solvent; (2) powders in which a mixture of nitroglycerin and either dinitro- or trinitro-cellulose is transformed into a rubberlike substance, either with or without the aid of a solvent; and (3) powders that contain nitroderivatives of the aromatic hydrocarbons, either by themselves or in connection with nitrocellulose. The nitrocellulose powders are those most generally used and the process of manufacture consists in steeping cellulose in a mixture of nitric and sulphuric acids and bringing the resulting nitrocellulose into the colloidal condition by treatment with some solvent such as a mixture of alcohol and ether, ethyl acetic ester, or acetone. The solvent chosen depends on the character of the cellulose nitrate used and the special qualities sought in the product. In certain of the smokeless powders oxidizing agents, such as the nitrates of metallic bases, are added to increase the velocity of combustion of the explosive, and when the action of the explosive is too violent a deterrent or substance rich in carbon is added. The colloid substance is then cut into flakes by machines, or as originally in Italy forced through spaghetti machines, and formed into cords, either solid or perforated, of the desired dimensions, which are then cut into grains and indurated.

Smokeless sporting powders for use in rifles are made in the manner described above for small-arm military powders, but they are too dense for use in shotguns and fowling pieces. Hence a porous bulky grain, which is measured instead of being weighed out into charges, just as black sporting powder has for long been, is made by cementing together, with agitation, particles of nitrocellulose. Some are so lightly cemented that they may be easily crushed between the thumb and finger, and there is danger of such grains being crushed to dust in the chamber of the gun, producing there an excessive pressure. By Von Freeden's process of granulating an emulsion of cellulose nitrate in amyl acetate by rotation in water, a bulk grain is obtained which is hardened throughout and strongly resists crushing. All these powders yield a faint haze due to the condensation of combustion products. Though smokelessness is the characteristic of these powders which has attracted popular attention, their superior power is a factor of prime importance, for, while black gunpowder imparted to the projectile an initial velocity of 1700 feet per second, initial velocities of over 3000 foot seconds have been attained with smokeless powders, and this has compelled fighting modern engagements in open order and at long range and demanded an increase in thickness and resistance of the armor of battleships. See EXPLOSIVES.

Among the various smokeless powders are: *ballistite*, invented by Alfred Nobel in 1888, and made in England; *cordite*, invented by Sir Frederick Abel and James Dewar, and made in England; *Du Pont powder*, invented by F. C. & P. S. Du Pont in 1893, and made in Wilmington, Del.; *indurite*, invented by Charles E. Munroe in 1889, and made at Newport, R. I.; *oibalite*, invented by J. K. von Falkenstein, and made in Germany; *poudre J.*, invented by Bruneau, and *poudre pyroxyée*, made by the French government; *Troisdorf*, *Von Förster*, *Walsrode*, and *Wetteren* powders, made in Germany, each of which varies slightly from the others in the preparation of the mixture or proportions of the ingredients.

Consult the history of the development of smokeless powders given in Charles E. Munroe's presidential address before the Washington Section of the American Chemical Society in 1896; also J. A. Longridge, *Smokeless Powder and its Influence on Gun Construction* (London, 1890); O. Guttmann, *The Manufacture of Explosives* (ib., 1895); J. B. Bernadou, *Smokeless Powder, Nitro-Cellulose, and Theory of Cellulose Molecule* (New York, 1901); P. G. Sanford, *Nitro-Explosives* (2d ed., ib., 1906); H. Brunswig, *Explosives: A Synoptic and Critical Treatment of the Literature;* English translation by Munroe and Kibler (ib., 1912).

SMOKE NUISANCE. Smoke is produced by the incomplete combustion of fuel, tiny bits of unconsumed matter being wafted into the air by the gases which are liberated and not decomposed. In order to effect complete combustion it is necessary that all the constituent gases be raised to a very high temperature and mixed with oxygen before the temperature falls.

In recent years a number of American states have authorized some or all cities within their boundaries to prohibit the emission of dense smoke from chimneys and smokestacks and to establish special departments to abate the smoke nuisance. The smoke nuisance has also been the subject of legislation in European countries, notably in Great Britain.

The exact effect of smoke on health has not been established, but, excluding sunlight and filling the air with soot and sometimes with gases, it is thought to be injurious. Studies at Pittsburgh have led to the conclusion that smoke there increases the mortality from pneumonia, but does not, to say the least, increase the tuberculosis death rate. The economic loss caused by smoke in cities is great, both through the imperfect combustion of coal that causes the smoke and also, and often far more, because of the damage it causes to buildings, furnishings, goods, and the like. The electrification of steam railways in cities lessens smoke, but not to such a degree as is popularly supposed. This and various other notable conclusions are presented in a report on Smoke Abatement and Railway Electrification at Chicago, made by the Chicago Railway Electrification Commission in behalf of the Chicago Association of Commerce, published at Chicago in December, 1915, and abstracted in the leading railway engineering papers of that time. Extensive studies of the whole smoke problem begun at Pittsburgh in 1912 are noted in the following bibliography.

Consult: W. Nicholson, *Smoke Abatement* (London, 1905); Booth and Kershaw, *Smoke Prevention and Fuel Economy*, based on the German work of E. Schmatolla (ib., 1908); W. M. Barr, *The Combustion of Coal and the Prevention of Smoke* (New York, 1913); Mellon Institute of Industrial Research, *Smoke-Investigation Bulletins* (Pittsburgh, 1912 et seq.), nine bulletins up to 1915 dealing with various phases, No. 2 (1913) being an extensive annotated bibliography; W. B. Munro, *Bibliography of Municipal Government* (Cambridge, Mass., 1915).

SMOKE PIPE. A pipe, usually of thin iron or steel, which serves to conduct the smoke and gases of a steam boiler to the open air. In large vessels there are usually several, in some instances with a diameter of more than 25 feet and a height of 125 feet above the furnaces. The area of the cross section of the pipe depends upon the amount and speed of the gases expected to escape. The speed of the moving gases (i.e., the draft) is much accelerated by increasing the height. Most steamship companies have adopted different-colored bands or painting for the smoke pipes of their ships as distinguishing marks.

SMOKE TELEGRAPH. See Military Aëronautics.

SMOKY (or Great Smoky) **MOUNTAINS.** A division of the Appalachians. See Unaka Mountains.

SMOLENSK, smŏ-lyĕnsk′. A government of Russia (Map: Russia, D 3). Area, about 21,624 square miles. The northern part belongs to the central elevation of European Russia and is generally hilly. In the south and the east the surface is mostly level and marshy in the northwest. The Government of Smolensk is well watered by the Dnieper, Düna, and several tributaries of the Volga and the Oka. The soil is mostly unfertile, and about one-third of the government is still covered with forest. The principal agricultural products are rye, oats, and flax. Stock raising is in a state of decline, while the house industry is only slightly developed. Of late there has been a considerable growth in the manufacturing industries. Oil, textiles, trimmed lumber, and spirits are the chief products. Pop., 1912, 2,050,200, chiefly Great and White Russians. The mediæval Principality of Smolensk is mentioned first as a separate state in 1054. It attained great power in the twelfth century, but declined greatly under the sway of the Tatars and was annexed to Lithuania at the beginning of the fifteenth century. The region was permanently reunited with Russia in 1654.

SMOLENSK. The capital of the Government of Smolensk, Russia, situated on the Dnieper, 260 miles west-southwest of Moscow (Map: Russia, D 4). The main part of the city on the left bank of the river is surrounded by the remnants of the old walls and contains the Uspensky Cathedral, with a venerated picture of the Virgin. There are a seminary for priests and a historico-ethnological museum. The philanthropic institutions are numerous. There are few industries, and the export trade is unimportant. Pop., 1911, 71,311. Smolensk, sometimes referred to as the "key and the gate of Russia," is one of the oldest cities of Russia and is mentioned by Nestor as the capital of the Slavonic Krivitchi. It was the capital of the Principality of Smolensk and later obtained Magdeburg rights and other privileges from Lithuania. In 1514 it was taken by the Russians, and in 1611 it was recovered by the Poles, after a siege of 20 months. With its final annexation to Russia in 1668, Smolensk was deprived of its privileges and gradually lost its importance. It played a prominent part in the wars of Peter I with the Swedes and is especially noted as the scene of a fierce engagement between the French and the Russians in August of 1812, during which most of the town was burned and after which the Russians fled to Moscow, leaving Smolensk to the French forces.

SMOLENSK, Mikhail Ilarionovitch Golenishtchev, Prince of. See Kutusov, M. I. G.

SMOLENSKY (or Smolenskin), **Perez** (1842–85). A Hebrew writer and Nationalist, born near Mogilev, Russia. While studying the Talmud he read Russian and modern Hebrew literature and abandoned religious orthodoxy. Compelled to leave the *Yeshibah* of Shklov, he traveled through Russia, Austria, Germany, France, and England and made extensive studies. In the course of his travels he found confirmation for his idea that the essence of Judaism is a national and not a religious idea. In furtherance of this view he founded at Vienna in 1868 a periodical, *Ha-Shahar* (Daybreak), and in it published several novels from Jewish life. His masterpiece, *'Am 'Olam* (The Eternal People), became the platform of the Jewish Nationalist movement.

SMOL′LETT, Tobias George (1721–71). A British novelist, descended from an old Scottish family having a seat called Bonhill, near Dumbarton, Scotland. Tobias wished to enter the army, but was thwarted by his grandfather, who appears in *Roderick Random* as the unamiable Old Judge. After attending the Dumbarton grammar school, Tobias was sent to the University of Glasgow to qualify for medicine, and was apprenticed (1736) for five years to Dr. John Gordon, of Glasgow. Much later (1750) he obtained the degree of M.D. from Marischal College, Aberdeen. In 1739 Smollett went to London with a tragedy called *The Regicide*. Embittered by his fruitless attempts to get it performed, he accepted the post of surgeon's mate on board the *Cumberland*, which sailed in 1741 to join Admiral Vernon's fleet, then in the West Indies, on the unfortunate expedition to Cartagena. On the return voyage he met in Jamaica a beautiful Creole, whom he brought to London and afterwards married (1747). He left the navy for good in 1744, and settled in London as surgeon. As his profession did not prove remunerative, he turned to literature. After some parodies, satirical verse, and his vigorous poem, *The Tears of Scotland* (1746), anent the manner of crushing the Highland rebellion, he published his first novel, *Roderick Random* (1748), which met with instant success. For it he drew largely on family history, his journey from Glasgow to London, his troubles over *The Regicide*, and his experiences in the navy. Here first appear in fiction the real English tars. As a result of a visit to Paris (1750) he produced *Peregrine Pickle* (1751), containing the brilliant but brutal satire on Mark Akenside and the notorious "Memoirs of a Lady of Quality" (Frances Hawes, Lady Vane). For the insertion of these memoirs written by Lady Vane herself Smollett is said to have received a handsome fee. After practicing medicine for a short time at Bath Smollett returned to London and settled at Chelsea, where he wrote *Ferdinand, Count Fathom* (1753), more ideal in motive than his other novels. For some years he was engaged in hack work, translating *Don Quixote* (1755) and writing, among many other things, a history of England (1757–65). On the founding of the *Critical Review*, a Tory organ (February, 1756), Smollett became editor. He wrote many abusive articles, one of which, an attack on Admiral Knowles, led to a fine of £100 and imprisonment for three months (1759). In the meantime his farce *Reprisal, or the Tars of Old England* (1757) was performed at Drury Lane, under the direction of Garrick. Resuming the novel, Smollett contributed to the *British Magazine* (1760–61) *The Adventures of Sir Launcelot Greaves* (1762), an adaptation of *Don Quixote*. It is of bibliographical interest as the first English novel to appear in a serial. In 1762 he edited the *Briton*, a weekly paper started to defend the Tory policy of Lord Bute.

Broken in health and sorely grieved by the death of his daughter (1763), Smollett now spent two years on the Continent, where he wrote his *Travels through France and Italy* (1766). The next few years were passed in a visit to Scotland, at Bath, and in London. The most noteworthy production of this time is the fierce political satire, *The Adventures of an Atom* (1769). Now utterly unnerved, he left England never to return (December, 1769). At a villa near Leghorn in Italy he wrote *Humphrey Clinker* (1771), an amusing novel in letter form, based upon his own vain search for health at Bath and in the North. For 50 years after his death Smollett was ranked high as a novelist, but during the latter half of the nineteenth century his fame unduly sank. Thackeray was the last of the great novelists to praise him. His novels, constructed after the type of *Gil Blas*, possess no organic unity. On the other hand he wrote vigorous English and created many living characters.

Bibliography. His *Miscellaneous Works* have been published in various editions (6 vols., Edinburgh, 1790; 6 vols., London, 1796, with memoir by Robert Anderson; 12 vols., ib., 1895, ed. by G. E. B. Saintsbury; 12 vols., ib., 1899–1901, with introduction by W. E. Henley). Also the *Memoirs*, by W. Scott, containing a famous comparison between Fielding and Smollett, prefixed to Smollett's novels in the *Novelists' Library* (London, 1821); the *Quarterly Review*, vols. ciii, clxiii (ib., 1858, 1886); R. Chambers, *Smollett: His Life and Selections from his Writings* (ib., 1867); David Hannay, *Life* (ib., 1887); "Topography of Humphrey Clinker," in Austin Dobson, *Eighteenth Century Vignettes* (2d series, ib., 1894); Sir Walter Raleigh, in *The English Novel* (ib., 1894); Oliver Smeaton, *Tobias Smollett* (Edinburgh, 1897); Harold Child, "Fielding and Smollett," in *Cambridge History of English Literature*, vol. x (New York, 1913), containing an exhaustive bibliography.

SMOOT, Reed (1862–). An American legislator, born at Salt Lake City, Utah. He graduated from the Brigham Young Academy, Provo, Utah, in 1879 and in 1900 was made one of the apostles of the Mormon church. He was president of a number of banks and corporations and had large holdings in realty, from all of which he accumulated a large fortune. From 1903 he was a member of the United States Senate. There was strong opposition to his serving on account of his position in the Mormon church, and in June, 1906, the Senate Committee on Privileges voted, 7 to 5, that he should be unseated. It was officially charged that he was a member of a body which encouraged polygamy. The charge that he himself was a polygamist was not supported by proof. The Senate in February, 1907, voted, 42 to 23, that he was entitled to his seat and appropriated funds to reimburse him. Smoot was one of the ablest of the Conservative Republicans and was regarded as a tariff expert. See MORMONS.

SMOOTH′FIELD. See SMITHFIELD.

SMRITI, smrĕ′tê (Skt., memory). In Sanskrit literature, the technical term for those works, especially the Sutras (q.v.) which deal with civil and religious usage, regarded as based only on tradition derived from ancient sages and not on divine revelation. Consult A. A. Macdonell, *History of Sanskrit Literature* (London, 1913). See SRUTI.

SMUCKER, Samuel. See SCHMUCKER, SAMUEL.

SMUGGLING (from *smuggle*, LG. *smuggeln*, to smuggle). The act of fraudulently importing or exporting goods from a country in violation of a law. Such infringement of the laws is defined by the United States statutes substantially as follows: To "knowingly and willfully, with intent to defraud the revenue of the United States, smuggle or introduce into the United States any goods, wares, or merchandise subject to duty, and which should have been invoiced, without paying or accounting for the duty," or to "make out or pass, or attempt to pass, through the customhouse any false, forged, or fraudulent invoice." A person convicted may be fined not exceeding five thousand dollars, or imprisoned for a time not exceeding two years, or both. It is necessary to prove intent and knowledge of the wrongful act in order to convict, and the defense of innocent intention is often successful in preventing prosecution. Concealment of dutiable articles in baggage is punishable by the forfeiture of such articles, and the persons guilty are liable to a penalty of treble the value of them. The court may in proceedings other than criminal, arising under the revenue laws, direct the defendant to produce in court all bills of lading, invoices, books, etc., relating to the importation of the goods in question. Smuggled property is condemned and sold, and the proceeds, after payment of costs and rewards for information, if any, are paid into the United States Treasury.

SMUT BALL. See Bunt.

SMUT (probably from AS. *smitta*, stain). A term for fungi, parasitic upon cereals and other plants, characterized by black dustlike masses (spores) which take the place of the natural seed parts and occur as well on leaves, stalks, flowers, and other plant organs. There are about a dozen genera of smuts and many species, nearly every kind of cereal being subject to the attack of one or more. In some species spores which, as a rule, are adhering to the grain when sown, germinate at the same time as the seed, the fungus entering the young plantlet in which it develops unseen until about the time the grain is beginning to head, when the flower or grain becomes filled with a mass of delicate threads which soon mature their spores for the infection of the next crop. In other species the infection takes place only during the flowering stage of the host plant. The common cereal smuts are roughly grouped into two classes: the stinking smuts, so called from their disagreeable odor, and the loose smuts. The former destroy only the kernel; the latter, which are dusty and are blown away, leaving a bare stalk, destroy the whole head. The amount of injury done the cereal crops is very great. A conservative estimate places the annual loss due to smut on the oat crop of the United States at $18,000,000. Other crops and countries suffer in like manner.

The smuts of wheat, barley, rye, and oats can be controlled to a great degree by treating the seed prior to sowing with various fungicides. Oat smut (*Ustilago avenæ*), barley smut (*Ustilago hordei*), and stinking smut of wheat (*Tilletia fœtens*) may be controlled by soaking the seed for two hours in one pound of formalin in 45 to 50 gallons of water. Or the seed may be thoroughly wet with the solution and allowed to stand for the same length of time, after which the grain is sown. For the other smuts the hot-water or Jensen treatment is recommended. Two vessels of at least 20 gallons' capacity are filled with water (one at a temperature of 110°-120° F., the other at 132°-135° F., and kept constantly at those temperatures). The seed is placed in covered baskets or loose bags and dipped into the first for one to two minutes and then plunged into the second vessel, raised and lowered several times for 10 to 15 minutes, and then spread to dry. In Germany drying the grain after soaking in cold water by placing it in a hot-air apparatus has given good results. The temperature of the air is about the same as that recommended for the hot water. In treating wheat and barley for loose smut (*Ustilago tritici* and *Ustilago nuda* respectively) a preliminary soaking for four hours in cold water is advised. For the stinking smuts of wheat (*Tilletia fœtens* and *Tilletia tritici*) and the covered smut of barley (*Ustilago hordei*), soaking seed for 12 hours in copper-sulphate solution (one pound to 24 gallons of water) and dipping a few minutes into lime water is also recommended. In all these treatments the treated seed must not come in contact with smut in unclean grain bags, bins, or seeding implements. Evidence has been recently obtained that indicates wheat smut may winter over in the soil in parts of Washington and Idaho. A system of crop rotations is suggested where this condition prevails.

None of these treatments is of benefit in preventing maize or corn smut (*Ustilago maydis*). The black spores germinate upon the ground, in manure or other suitable locations, and quickly develop thin-walled colorless spores that are carried by wind, germinate upon the rapidly growing tissues of the corn plant, which they may infect locally at any time, and in a few weeks produce boil-like growths. Each smut mass is believed to represent a separate infection. Destruction by burning all smut balls, whenever found, is the only remedy. Throwing them upon the ground or manure heaps or feeding to stock will only aid in spreading the disease. Experiments with cows have shown that corn smut is not poisonous, as it is often believed to be, the animals having eaten 10 pounds or more daily without any noticeable inconvenience. See Basidiomycetes; Uredinals; Ustilaginales; and Plate of Fungi, Types of.

SMUTS, smüts, Jan Christian (1870-). A South African soldier and statesman. He was born in Cape Colony and was educated at the University of Cape Town and at Christ's College, Cambridge (of which in 1915 he became an honorary fellow). After being called to the bar he practiced law in Cape Town for a year, went to Johannesburg in 1896, and in 1898 was appointed by Paul Kruger State Attorney to the Transvaal Republic. During the South African War (1899–1902) he served under Gen. Petrus Jacobus Joubert (q.v.) in Natal and later under Gen. De la Rey (q.v.), after the fall of Pretoria. As commandant of the Boer forces in Cape Colony he made several destructive raids in the Cape districts in 1901. Smuts loyally accepted the results of the war, aided importantly in the work of reconstruction, and was Colonial Secretary of the Transvaal (1907–10). He was the ablest thinker and debater in the National Convention which resulted in the Union of South Africa in 1910. He became Minister of Finance and Defense in the cabinet of General Louis Botha (q.v.), the first Premier of the Union, and had a prominent part in enacting the Defence Act of 1912. During the labor troubles at Johannesberg, when strikes threatened, he proclaimed martial law and had the labor leaders deported. After the outbreak of the European War in 1914 he loyally coöperated with Premier Botha in the measures taken for the suppression of the Boer rebellions under Colonel Maritz and Gen. Christian Rudolph De Wet (q.v.), and in the campaign which resulted in the defeat of the Germans in German Southwest Africa and the conquest of that colony. In the general elections in the fall of 1915 Smuts was again returned as a member of Parliament and retained his position in the Botha cabinet. On Nov. 13, 1915, he was placed in supreme command of a South African military expedition against German East Africa; but shortly afterward, for reasons which in no way reflected on his ability or loyalty, the command was given to Gen. Sir Horace Smith-Dorrien (q.v.). Upon the latter's illness and resignation Smuts was reinstated, and in February, 1916, had reported considerable progress in his campaign. Consult P. J. Sampson, *The Capture of De Wet* (London, 1915), and W. S. Rayner and W. W. O'Shaughnessy, *How Botha and Smuts Conquered German South West* (ib., 1916).

SMYBERT, smī'bĕrt, or **SMIBERT**, John (1684–1751). A Scottish painter, the earliest noteworthy artist in America. He was born in Edinburgh and studied in London in Sir James Thornhill's academy (having Hogarth as a fellow pupil), and in Italy (1717). On his return he practiced portrait painting in London with considerable success. When Bishop Berkeley received permission from the British government in 1728 to found a college in the Bermuda Islands, he took Smybert with him to be professor of fine arts. But the promised funds were not forthcoming, and after remaining in Newport, R. I., three years, Berkeley returned to England. Symbert went to live in Boston and influenced the painters Copley, Trumbull, and Allston. His best work is "Bishop Berkeley and his Family," a group containing eight figures and the first of the kind produced in America. It was painted in 1731, presented to Yale College in 1808, and is now in the Dining Hall there. Other portraits, characterized by a dry formal style, but good in drawing and sincere likenesses, include those of Jonathan Edwards and Judge Edmund Quincy (in the Boston Art Museum); Governor Endecott, Peter Faneuil, and Mrs. Smybert (in the gallery of the Massachusetts Historical Society).

SMYRNA, smẽr′nȧ. The capital of the Vilayet of Aidin (or Smyrna), the chief city of Asia Minor and the second seaport of the Ottoman Empire, situated at the head of the Gulf of Smyrna, and somewhat over 200 miles southwest of Constantinople, with which it is connected by rail (Map: Turkey in Asia, A 2). The city is laid out partly on level land and partly on the slopes of Mount Pagus and presents an imposing appearance from the sea. It is divided into five quarters: the Moslem Quarter, with its numerous minarets and narrow crooked streets; the Jewish Quarter, poor, overcrowded, and dirty; the Armenian and Greek quarters, well built and European in their cleanliness; and, finally, the European Quarter, with its fine quay, shops, and hotels. The centre of archæological interest is Mount Pagus with its ruined castle and portions of the Acropolis walls, in which Greek masonry can be traced. Of considerable interest also is the Caravan Bridge, with its Greek and Roman foundations, although the statement that the stream crossed by it is the celebrated Meles is generally discredited. The mosque called Hissar Jami is of some interest. The finest Christian churches are the Greek cathedral of St. Photini and the Armenian cathedral of St. Stephen. Smyrna contains numerous schools maintained by the various nationalities which make up the heterogeneous population. A number of interesting collections and libraries are attached to some of the higher schools, and hospitals and other benevolent institutions are maintained by the foreign colonies. The industries are limited in extent, and the product for which the town is most famous, Smyrna rugs, comes from the small places around the city. The chief manufactures are silk, woolen, and cotton goods, pottery, leather, and some machinery and iron and steel products. The chief exports are figs, raisins, tobacco, rugs, silk, sponges, hides, cereals, etc. The imports are manufactures, coal, iron, dairy products, etc. Pop. (est.), 350,000, of whom over one-half are Greek. The Mohammedans constitute about one-fourth of the population.

History. Smyrna was an Æolian colony, but early in the seventh century B.C. it was seized by exiles from Colophon and thus brought into the Ionian League. Its situation, which commanded the route from Sardis to the coast, enabled it to develop a rich commerce, but excited the jealousy and aggressions of the Lydian kings. Gyges was defeated by Smyrna, but Alyattes about 575 B.C. captured and destroyed the city. Only a village remained at this point until after the Macedonian conquest. Antigonus began to build a new city on the shore a few miles southeast of the old site. His death (301 B.C.) checked its growth, but the new city was completed by Lysimachus. It was laid out with great magnificence and adorned with fine buildings, among which was the Homereum, where Homer was worshiped as a hero. The city had an excellent harbor and from its admirable situation soon became one of the finest and most flourishing cities in Asia. It was favored by the Seleucidæ (q.v.) and in 243 B.C. was declared by Seleucus II sacred and inviolable. It was treated with consideration by the Romans, and, when it suffered severely in 179 A.D. from an earthquake, the Emperor Marcus Aurelius helped to restore it. It is mentioned in the Apocalypse as the seat of a Christian church, and it is said to have been the scene of the martyrdom of Polycarp. Throughout the greater part of the Middle Ages Smyrna belonged to the Byzantine Empire. In the fourteenth century it passed into the possession of the Knights of St. John. The Mongols under Tamerlane destroyed it in 1402. Since the early part of the fifteenth century the town has belonged to the Turks. It was heavily bombarded by the allied war vessels during the war which began in 1914. See War in Europe.

Bibliography. Charles de Scherzer, *Smyrne considérée au point de vue géographique, économique, et intellectuel* (2d ed., Leipzig, 1880); Demétrius Georgiadès, *Smyrne et l'Asie Mineure au point de vue économique* (Paris, 1885); W. M. Ramsay, *Letters to the Seven Churches* (New York, 1904); F. X. Lubry, "Smyrne," in *La Palestine . . . souvenirs de voyage* (Paris, 1908); Baedeker, *Konstantinopel, Balkanstaten, Kleinasien, Archipel, Cypern* (2d ed., Leipzig, 1914); "Smyrna," in Friedrich Lübker, *Reallexikon des klassischen Altertums*, vol. ii (8th ed., ib., 1914).

SMYRNA, Quintus of. See Quintus Smyrnæus.

SMYRNA, Theon of. See Theon of Smyrna.

SMYRNA RUGS. See Rugs.

SMYTH, smĭth, Charles Henry, Jr. (1866–). An American geologist. Born at Oswego, N. Y., he was educated at Columbia (Ph.B., 1888; Ph.D., 1890) and at Heidelberg (1890–91). From 1891 to 1905 he was professor of geology and mineralogy at Hamilton College and thenceforth held the chair of geology at Princeton. Smyth is author of many papers and reports on pre-Cambrian, economic, and chemical geology and similar subjects.

SMYTH, Charles Piazzi (1819–1900). An English astronomer, born in Naples, Italy. He was employed in the observatory at the Cape of Good Hope under Sir Thomas Maclear and was astronomer royal of Scotland (1845–1888). He made elaborate studies of the Great Pyramid of Egypt, which he maintained was built by divine inspiration as a standard of weights and measures. He advocated this peculiar theory in *Our Inheritance in the Great Pyramid* (1864), and *Life and Work at the Great Pyramid* (3 vols., 1867). He also wrote *Three Cities in Russia*

(2 vols., 1858) and *On the Antiquity of Intellectual Man* (1868).

SMYTH, Herbert Weir (1857–). An American classical scholar, born at Wilmington, Del. He was educated at Swarthmore College, at Harvard University, and at Göttingen. After teaching at Johns Hopkins he was appointed professor of Greek in Bryn Mawr College in 1888. In 1901 he accepted a similar position at Harvard, where from 1902 he held the Eliot professorship of Greek literature. He was professor in the American School of Classical Studies at Athens in 1899–1900. In 1904–05 he served as president of the American Philological Association. His most important publications are *The Sounds and Inflections of Greek Dialects; Ionic* (1894); *Greek Melic Poetry* (1900); *Greek Grammar* (1914).

SMYTH, or **SMITH,** John (c.1555–1612). An English clergyman. He graduated at Christ's College, Cambridge, in 1575, became a fellow of his college, and took orders. He preached in Lincoln (1603–05); then, influenced by the Brownist movement (see Brownists), he left the Established church and set up an independent congregation at Gainsborough in 1606. About 1608 he went to Amsterdam, where he adopted Baptist principles and publicly baptized himself, whence he gained his name of the Se-Baptist. His views changed rapidly, and in a short time he and those who agreed with him were excommunicated by the Amsterdam church. After his death (at Amsterdam, 1612) the remnant of his followers joined the Mennonites. He was the author of some of the first expositions of General Baptist principles printed in England, and hence has been regarded as the "father" of the English General Baptists. Consult: H. M. Dexter, *The True Story of John Smyth, the Se-Baptist* (Boston, 1881); A. H. Newman, *History of Antipedobaptism* (Philadelphia, 1897); Edward Arber, *The History of the Pilgrim Fathers as Told by Themselves, their Friends, and their Enemies* (Boston, 1897).

SMYTH, John Paterson (?1856–). A Canadian clergyman and author. He was born in Ireland, graduated at Trinity College, Dublin, and was ordained a priest of the Church of England in 1881. After holding various charges in Ireland he was appointed canon of Dublin Cathedral in 1907. He was professor of pastoral theology in Trinity College, Dublin, in 1902–07. In the latter year he went to Canada and was appointed rector of St. George's Church, Montreal. He became a canon of Christ Church Cathedral in 1910 and archdeacon in 1914. His writings include: *Israel's Prophets and Kings* (1906); *Life and Letters of St. Paul* (1907); *The Prayer Book* (1908); *How God Inspired the Bible* (1909); *The Gospel of the Hereafter* (1910); *How we Got our Bible* (1899; new ed., 1912); *The Bible in the Making in the Light of Modern Research* (1914); *God and the War* (1915).

SMYTH, (Samuel Phillips) Newman (1843–). An American Congregational clergyman, born at Brunswick, Me. He graduated at Bowdoin College in 1863 and afterward served as lieutenant in the Sixteenth Regiment of Maine Volunteers, which saw active service in Grant's Virginia campaigns. He graduated at Andover Theological Seminary in 1867 and filled pulpits in Bangor, Me., and Quincy, Ill., and then for 26 years (1882–1908) was pastor of the First Congregational Church at New Haven, Conn. His publications include: *The Religious Feeling: A Study for Faith* (1877); *Old Faiths in New Light* (1879); *The Orthodox Theology of To-Day* (1881); *The Reality of Faith* (1884); *Christian Facts and Forces* (1887); *Christian Ethics* (1892); *The Place of Death in Evolution* (1897); *Through Science to Faith* (1902); *Passing Protestantism and Coming Catholicism* (1908); *Modern Belief in Immortality* (1910); *Constructive Natural Theology* (1913).

SMYTH, William Henry (1788–1865). An English naval officer, the son of an American Loyalist, born at Westminster, London. For nine years he was engaged in making a survey of the Italian, Sicilian, Greek, and North African coasts and constructed charts that form the basis of those still in use. He was one of the founders of the Royal Geographical Society, of which he was president in 1849–50, and was president of the Royal Astronomical Society in 1845–46. He attained the rank of admiral in 1863. Among his works are: *Memoir . . . of the Resources, Inhabitants, and Hydrography of Sicily and its Islands* (1824); *The Cycle of Celestial Objects for the Use of Naval, Military, and Private Astronomers* (2 vols., 1844); *The Mediterranean: A Memoir, Physical, Historical, and Nautical* (1854).

SMYTHE, Ethel (1858–). An English composer, born in London. After a short stay at the Leipzig Conservatory she went in 1877 to Herzogenberg. At first she devoted herself to writing songs and chamber music, a string quintet and a sonata for violin and piano being produced in Leipzig. A mass in D, produced in London in 1893, attracted attention in England, but it was not until the production of her first opera, *Fantasio* (Weimar, 1898), that she became more widely known. Her second opera, *Der Wald* (Dresden, 1901), attained more than average success, being produced the following year in London, and one year later at the Metropolitan Opera House in New York. Her most ambitious work is *The Wreckers,* produced as *Strandrecht* in Leipzig (1906). The outbreak of the War of 1914 prevented the performance of *The Boatswain's Mate* at Frankfort. It was produced in London (1916). She also wrote an overture, *Antony and Cleopatra,* and a *Serenade* for orchestra.

SNAIL (AS. *snægel,* snail). The name applied to many gastropod mollusks, but more especially to the terrestrial air-breathing gastropods (Pulmonata) and to the fresh-water gastropods such as the pond snails (*Physa, Linnæa,* etc.). The Pulmonata are gastropods with

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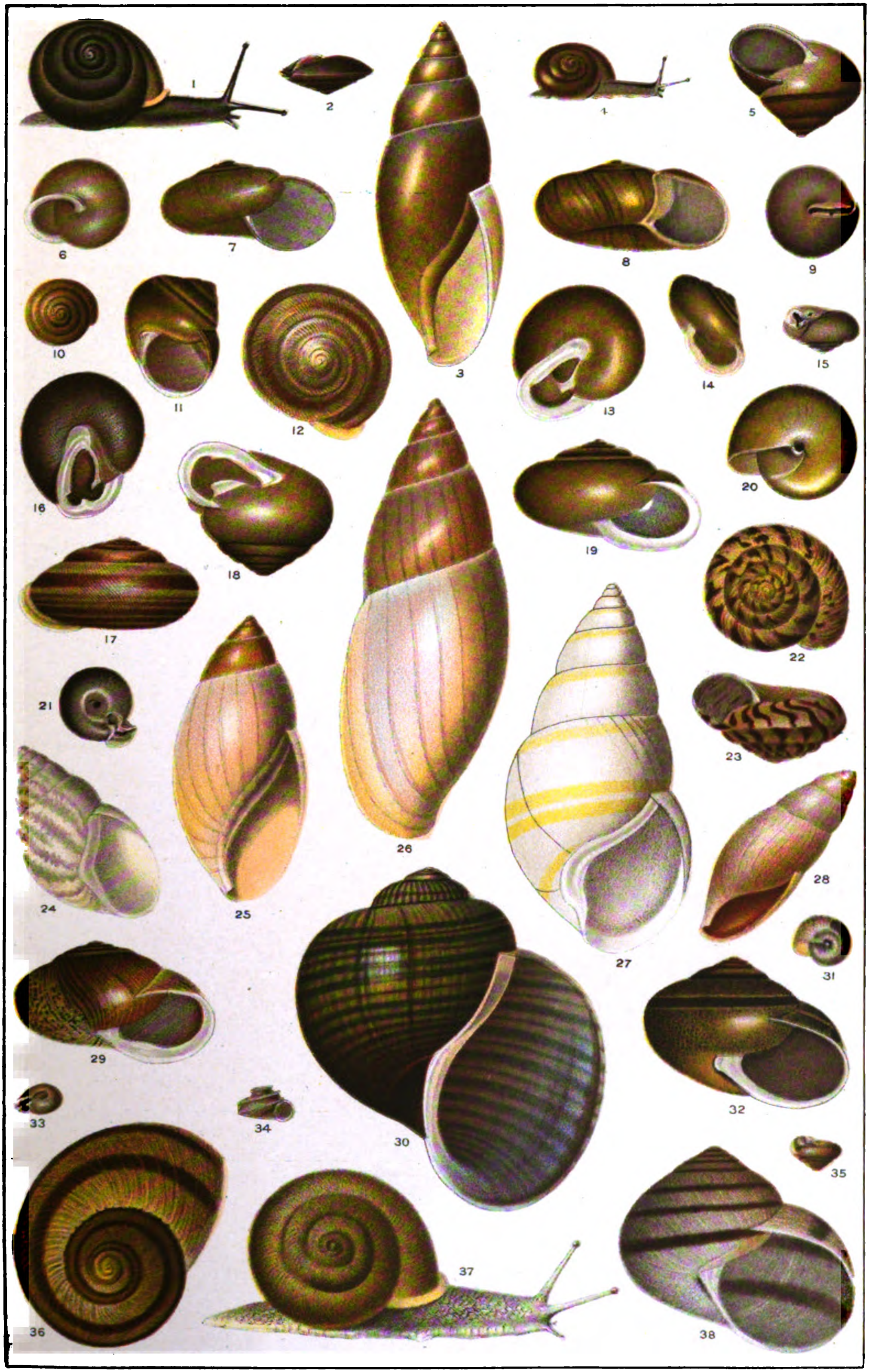
KEY TO PLATE OF NORTH AMERICAN SNAILS

1, *Helix pennsylvanicus;* 2, *Helix spinosa* (side view); 3, *Glandina decussata;* 4, *Helix glaphyra;* 5, *Helix nickliniana;* 6, *Helix clausa;* 7, *Helix fuliginosa;* 8, *Helix vancouverensis;* 9, *Helix spinosa* (showing aperture; cf Fig. 5); 10, *Helix hirsuta;* 11, *Helix californiensis;* 12, *Helix multilineata;* 13, *Helix appressa;* 14, *Helix columbiana;* 15, *Helix auriculata;* 16, *Helix palliata;* 17, *Helix profunda;* 18, *Helix elevata;* 19, *Helix thyroideus;* 20, *Helix subplana;* 21, *Helix auriculata* (varietal form of Fig. 15); 22, *Helix alternata* (spire); 23, *Helix alternata* (aperture); 24, *Bulimus dealbatus;* 25, *Glandina truncata* (small form); 26, *Glandina truncata* (typical large form); 27, *Bulimus fasciatus;* 28, *Glandina truncata* (Key West variety); 29, *Helix townsendiana;* 30, *Ampullaria depressa;* 31, *Helix indentata;* 32, *Helix tudiculata;* 33, *Helix plicata;* 34, *Valvata tricarinata;* 35, *Helix gularis;* 36, *Helix aspersa* (spire); 37, *Helix albolabris;* 38, *Helix aspersa* (aperture).

NORTH AMERICAN SNAILS



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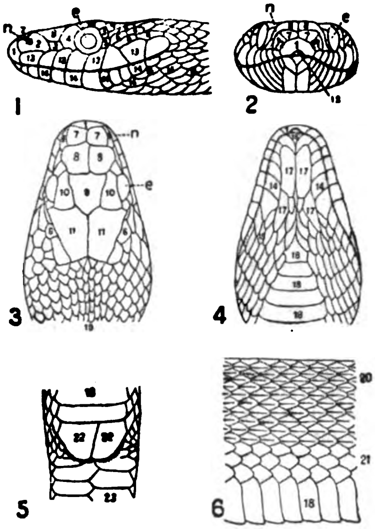
For Names and Description see Article "Snail"

two pairs of tentacles, the nervous ganglia concentrated around the œsophagus and fitted to breathe air through a pallial cavity formed by the union of the front edge of the mantle with the neck region. The spiral shell is either well developed or in the slugs either vestigial or absent. The eyes are either at the base of the tentacles or situated at the end of the larger pair. Snails are mostly plant eaters or live on dead leaves, cutting their food by means of the long slender rasplike radula or "lingual ribbon." After passing through the cleavage, gastrula, and trochosphere stages a definite veliger stage is finally attained. Soon the definite molluscan characters are assumed. The range of form and type of coloration is shown on the accompanying Plate.

Use as Food. In southern Europe and France snails are everywhere eaten, and snail gardens (*escargotières*) still exist in France, also at Brunswick and Ulm, in Germany, and at Copenhagen. When snails are eaten directly after being collected, they may, from having fed on some poisonous matters, prove harmful. They should be fed in gardens previous to being eaten. Consult: Amos Binney, *Terrestrial Mollusks of the United States* (ed. by A. A. Gould, 5 vols., Boston, 1851-78); A. H. Cooke, "Molluscs," in *Cambridge Natural History*, vol. iii (New York, 1895); Ingersoll, "In a Snailery," in *Wild Life of Orchard and Field* (ib., 1902).

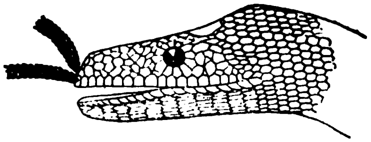
SNAIL, WHITE. See NATICA.

SNAKE (AS. *snacu*, OIcel. *snākr*, *snōkr*, snake, from AS. *snican*, to creep, Eng. *sneak;* ultimately connected with Skt. *nāga*, snake), or SERPENT. A reptile representing the highly specialized saurian order Ophidia. Snakes differ from their nearest relatives the lizard, primarily in having the halves of the lower jaw connected by an elastic band. They agree with them in many particulars, and the external resemblance is so close in some cases that the true relationships were long confused. Although snakes as a whole form an ascending series, degeneracy has played an important part in their phylogenetic history. This degeneracy consists mainly in the reduction of the mechanism for rapid movement, the shortening of the tail, and the decrease in the size of the eye and mouth. The most highly developed are those with a poison apparatus, and among these the rattlesnakes seem most advanced. The form is greatly elongated and ordinarily cylindrical, but in the sea snakes (q.v.) is likely to be laterally compressed in adaptation to an aquatic life. The body is clothed in scales (q.v.), which are folds in the skin, lacking osteoderms and covered with a horny epidermis. Ordinarily they overlap, like tiles on a roof, but sometimes are flat and edge to edge, like tiles in a floor. They are small on the back and sides, lie in a definite number of equilateral longitudinal rows, and frequently are ridged or keeled; but on the ventral surface (except in the burrowers and sea snakes) are so large as to reach from side to side, forming abdominal scutes (gastrosteges in front of cloaca and urosteges behind), each attached at both ends to a pair of ribs. The scales are often enlarged on the head into plates or shields. (See illustration.) The arrangement and shape of both the head plates and the gastrosteges are of great service in classification. In some the nasal plates are broadened, turned up, or bear curious appendages, as in *Herpeton* and the langaha (qq.v.). Periodically, usually several times a year, the snake sloughs off its corneous epidermis, which splits across the face and then is removed by the animal scraping through a crevice or a fold of its own body; even the coating of the eye is included.



PLATES AND SCALES OF A TYPICAL SNAKE.

1, side view of head, of a colubrine snake; 2, front view; 3, top of head; 4, underside of head and throat; 5, vent and anal plates; 6, side of a part of the body. Numbers and letters; *e*, eye; *n*, nostril; 1, rostral plate; 2, nasal; 3, loral; 4, preocular or anteorbital; 5, postocular or postorbital; 6, temporal; 7, internasal; 8, prefrontal; 9, frontal; 10, superciliary or supraocular; 11, parietal; 12, notch in rostral for protrusion of tongue; 13, labial; 14, infralabials; 15, gular; 16, mental; 17, submental; 18, abdominal scutes or gastrosteges; 19, dorsal scales; 20, keeled body scales; 21, unkeeled lateral scales; 22, divided anal scute covering anus; 23, urosteges.

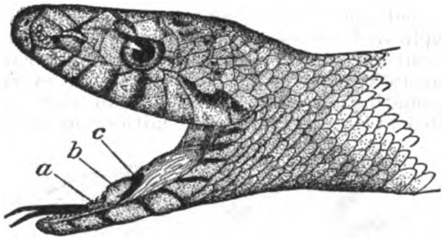


NASAL APPENDAGES OF HERPETON.

All snakes except the purely aquatic ones move by means of the abdominal scutes. No snake can leap from the ground; the more active sometimes hurl themselves from bough to bough or to the ground. The vertebræ are numerous, sometimes nearly 300, and are concave in front and convex behind, connected by free ball-and-socket joints, and provided with complicated processes, one effect of which is to prevent any considerable vertical motion. Every vertebra except the atlas bears a pair of ribs, articulating by the capitular head only, and united at their ventral extremities (in the absence of any sternum) by cartilages attached to the gastrosteges. The ribs admit of much movement and have an extensive and powerful musculature. The bones of the skull are not soldered together (except those of the brain case), but are loosely joined by elastic cartilages. The halves of the lower jaw are connected by a ligament so loose and elastic that they are capable of separation to a great extent. The teeth are simple, sharp, curved backward, and solidly fixed in sockets. When broken or lost they are renewed. There are typically two rows on the upper jaw and two on the palate (maxillaries, palatines, and pterygoids), and each mandible of the lower jaw bears a single row; but vipers and rattlesnakes have none in the upper jaw except the poison fangs, which are depressible at will and fold back out of the way of food entering the mouth. The process of swallowing is laborious. With a large victim it may last hours, the head and throat stretched almost to bursting, and the snake nearly exhausted by its efforts. A great amount of saliva is poured out in this process, but the story that snakes cover their prey with slime before swallowing it is a fable.

Most snakes are carnivorous. Small mammals, frogs, reptiles, and insects form the bulk of the diet of ordinary land species. Some of them eat eggs, and a few species are fond of milk. Many are of great assistance to the agriculturist by devouring grasshoppers, mice, gophers, and other farm pests. The stomach is long and narrow, as also are the lobes of the liver. Snakes drink much water when in active life, yet they possess no urinary bladder. The intestines are highly absorbent. The heart is placed well forward. The lungs are elongated, and when bilobed, as in boas and rattlesnakes, one lobe is far larger than the other. The trachea is long, is provided with air sacs, and opens far forward in the mouth, which guards against suffocation during the tedious process of swallowing. The forcible expulsion of air from the trachea makes the hissing sound which is the serpent's only vocal utterance; but the bull snake has special tracheal arrangements (see illustration) by which its hiss may be increased to a sort of bellow.

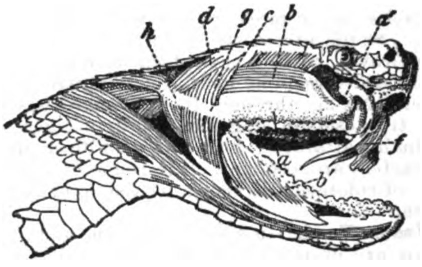
Snakes have a well-developed nervous system and are intelligent. Many may be tamed and show docility. Most of them are timid and harmless, endeavoring to frighten enemies by menacing attitudes (see HOGNOSE) or otherwise. Even the well-armed poisonous ones, though sullen and resistant, are rarely aggressive. All have good eyes and some of the many nocturnal forms very large ones; but the eyes have no lids and are not movable. No external ear is present, but a complicated internal apparatus exists, so that snakes hear well and are affected by musical sounds. The sense of taste is probably deficient, but that of smell is acute, and some serpents, as the American black snake, hunt largely by scent. Many serpents lay eggs, but most venomous ones and many of the commonest species are viviparous. The young are ready to take care of themselves as soon as they leave the egg, but are usually guarded for a time by the mother.



MOUTH OF A SNAKE.

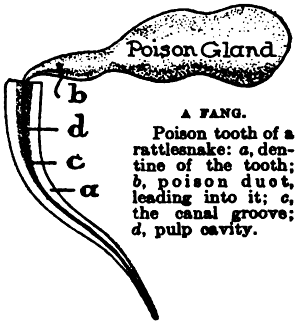
Open mouth of the bull or pine snake (q.v.) showing the (black) tongue and opening of the windpipe: *a*, sheath of the tongue; *b*, epiglottis; *c*, glottis.

A remarkable means of livelihood and of defense among snakes is the poison apparatus with which one large group (Solenoglypha) and some members of the generally harmless Colubridæ are provided. This consists of a pair of very large labial glands, one beside each upper jaw, modified from parotid salivary glands and containing saliva imbued with an alkaloid poison, usually fatal to all animals into whose circulation it enters. (See illustration.) These fangs are of three kinds. They may be the most forward of the maxillary teeth in the upper jaw, immovable and deeply grooved on the anterior side, as in the cobras and others of the Proteroglypha; or they may be thus fixed and grooved, but posterior in position (Opisthoglypha); or they may be lengthened and the maxillary bone so hinged as to dip down, allowing the fangs when not in use to lie back in a fold of the gum (where there are no other teeth); and the fang groove may be closed over for most of its length, forming a canal opening near the point of the tooth, as in vipers and rattlesnakes. This contrivance carries the poison into the deepest part of the wound. When the snake is about to bite the mouth is opened very wide, the fangs unsheathed, swung forward and fixed by muscular contraction, and then sunk into the flesh of the victim with a marvelously sudden and swift forward and downward stroke. Secondary and partly involuntary action of other muscles presses the poison out of the gland and through the duct and tooth. The venom will sometimes exude and drip from the fangs of a snake excited and ready to strike, and some of this may be blown forward by the forcible expulsion of the animal's breath; but the stories of "spitting poison" have no better foundation than this. For the nature, effects, and antidotes of snake poison, see TOXICOLOGY.



POISON APPARATUS OF A RATTLESNAKE.

a, poison gland; *a'*, poison duct leading to the fang; *b*, anterior temporal muscle; *b'*, mandibular portion of same; *c*, posterior temporal muscle; *d*, digastrious muscle; *f*, sheath of fang; *g*, middle temporal muscle; *h*, external pterygoid muscle.

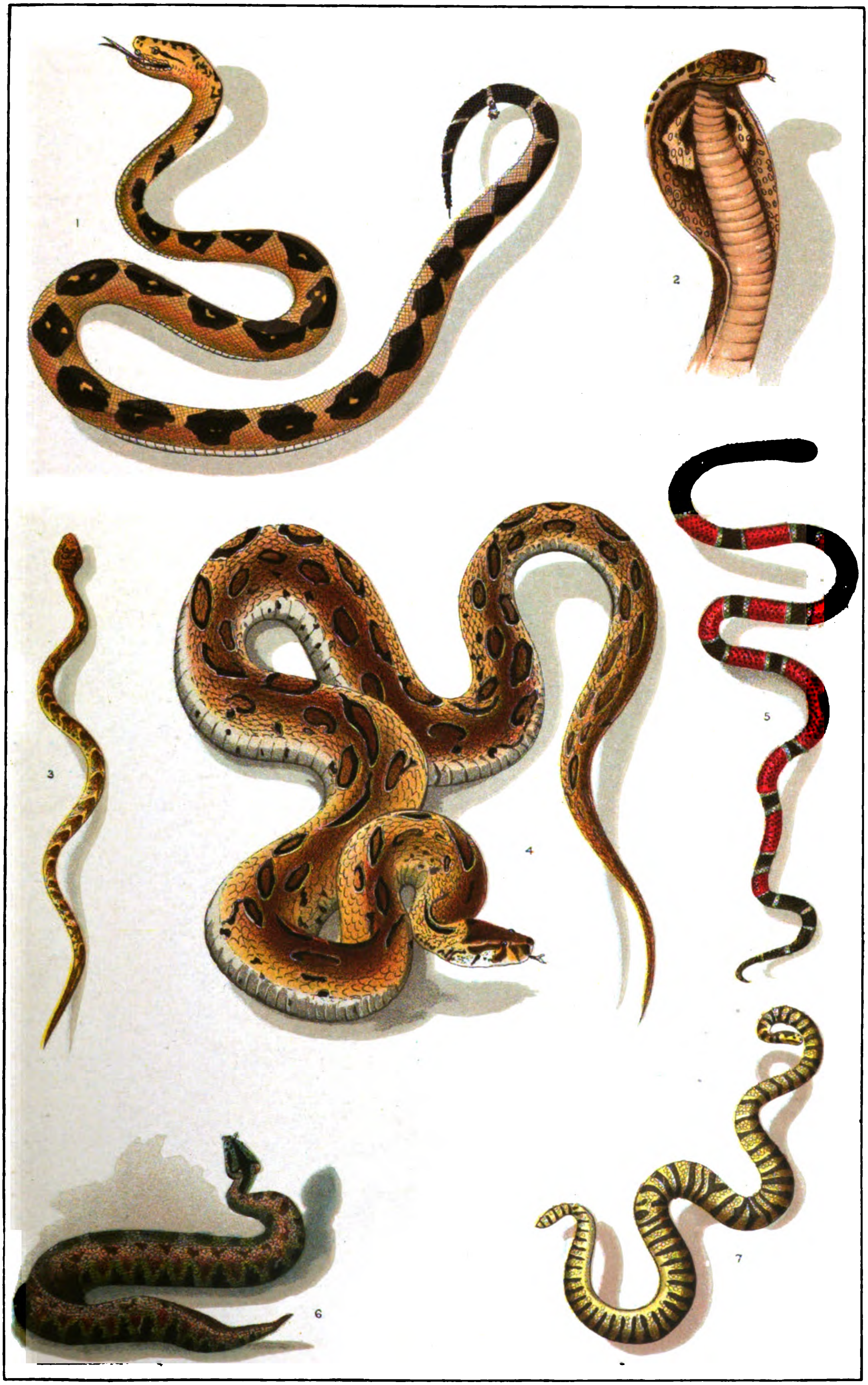


A FANG.

Poison tooth of a rattlesnake: *a*, dentine of the tooth; *b*, poison duct, leading into it; *c*, the canal groove; *d*, pulp cavity.

The older families of snakes are circumtropical; none are found where a cold climate prevails. The great family Colubridæ is cosmopolitan, as also is the Boidæ, being absent only from New Zealand, which, like most oceanic islands, has no serpents, and from the colder latitudes. Their near allies, the Amblycephalidæ, are altogether Oriental and Malayan. The

FOREIGN VENOMOUS SERPENTS



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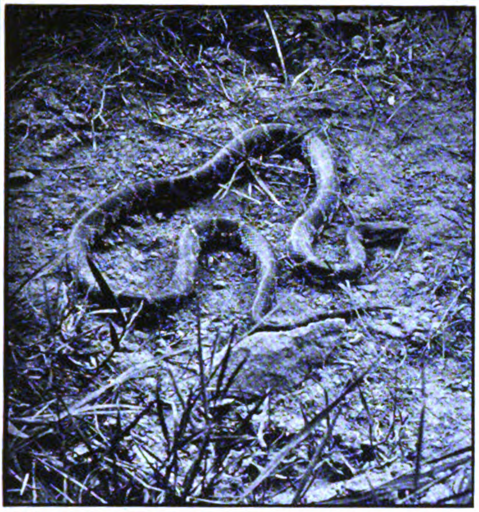
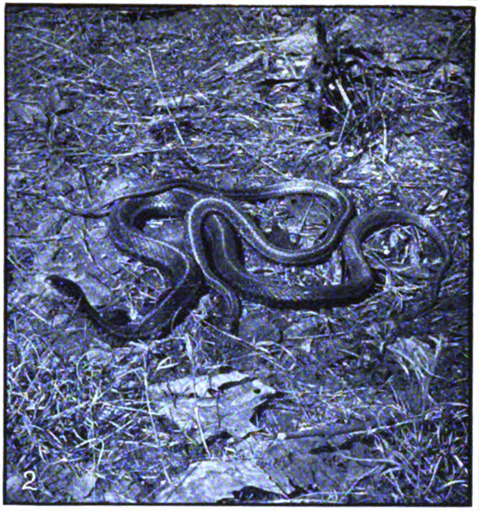
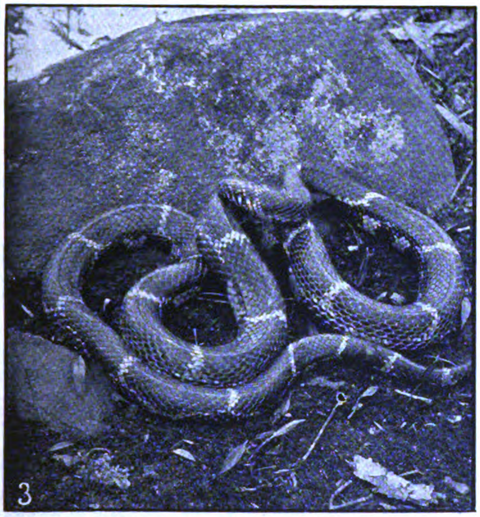
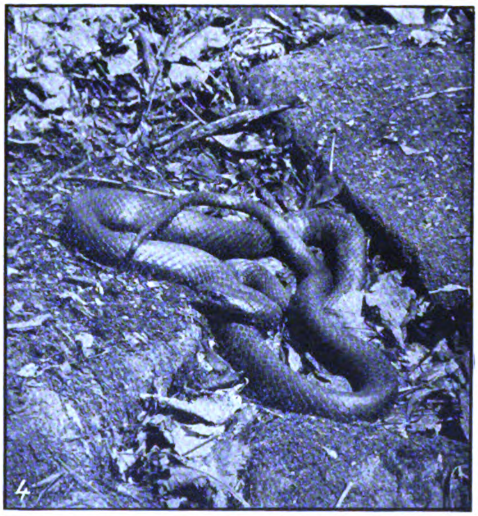
1 BUSHMASTER – (LACHESIS MUTUS)
2 COBRA – (NAJA TRIPUDIANS)
3 CARAWALA – (ANCISTRODON HYPNALE)
4 TIC-POLONGA – (VIPERA RUSSELLI)
5 CORAL SNAKE – (ELAPS CORALLINUS)
6 PUFF-ADDER – (BITIS ARIETANS)
7 EAST INDIAN SEA SNAKE – (HYDROPHIS NIGRICINCTA)

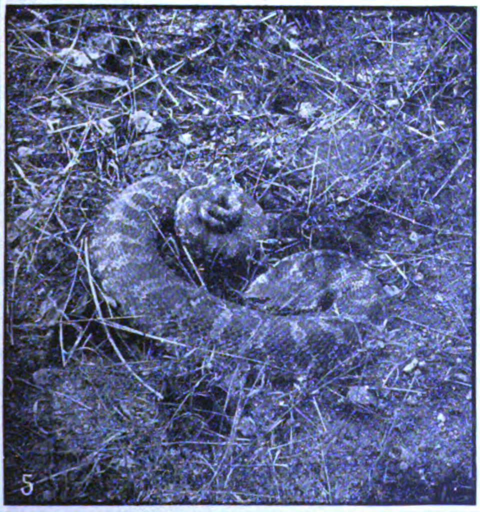
AMERICAN HARMLESS SNAKES

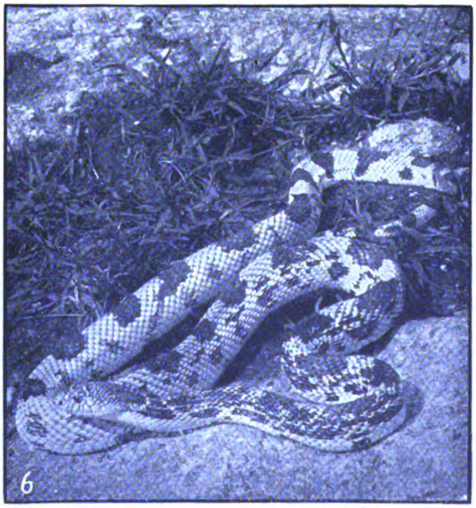












1. **MILK SNAKE** (*Osceola doliata*, var. *triangula*).
2. **GARTER SNAKES** (*Eutænia sirtalis*).
3. **CHAIN SNAKE** (*Ophibolus getulus*).
4. **BLACK SNAKE** (*Zamenis constrictor*).
5. **HOGNOSE** (*Heterodon platyrhinus*).
6. **PINE SNAKE** (*Pityophis Sayi*).

Viperidæ (including the crotaline group) are cosmopolitan, but no true vipers occur in America, whereas some crotalines are found in southern Asia, although all the rattlesnakes proper are American. The number of species of snakes is about 1800.

Snakes perform an important part in preserving the balance of life, for all are carnivorous and prey principally upon insects and the small animals, mostly rodents, which tend to multiply excessively. They are therefore of great service to agriculture in keeping down the hordes of injurious locusts, mice, gophers, and the like, which afflict the farmer. Their flesh is white, chicken-like, and wholesome and is eaten by savage peoples and occasionally by persons in civilization who are free from the traditional prejudice.

Fossil Snakes. About 35 species of Tertiary fossil snakes are known, and none of them presents any wide differences from its nearest living allies. They occur mostly in the fresh-water Tertiary deposits of Germany, France, England, and North America. No undoubted snake remains are known which are older than the Tertiary period.

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See BOA, and Plate; RATTLESNAKE, and Plate; VIPER; and other names of the various groups and species of serpents; also Plate of AMERICAN HARMLESS SNAKES and of FOREIGN VENOMOUS SERPENTS herewith.

SNAKEBIRD. A steganopode bird with a long bill, which is sometimes known as the darter (q.v.).

SNAKE CHARMING. A popular form of amusement which has existed in Egypt and throughout the East from remote antiquity. There are allusions to serpent charming in the Old Testament, and classical writers refer to it. Serpent charmers ascribe their power over snakes to some constitutional peculiarity; the power is often handed down in a family. It is supposed that the poisonous snakes used for the purpose have had fangs and poison glands removed but sometimes, at least, this is not the case. The assertion that snake charmers are immune from the poison of such snakes as the cobra or the rattlesnake is not credited by authorities, and the stories told about the effective use for this purpose by American Indians of certain herbs are not credited by scientific observers. See COBRA; RATTLESNAKE.

Certain feats of the snake charmer depend upon knowledge of the nature and peculiarities of the reptile. Many species like music; to the sound of the flute they will rise and sway the upper part of the body, while it rests upon the spiral formed by the lower half. The asp has no external ear and is deaf as to whistling or the sound of the pipe, but the snake's glance can be attracted to a moving object and it will follow the rhythmical movement. The Oriental snake charmer is reputed to have the power of removing serpents from the vicinity of houses by luring them out of their holes by magic words and music.

SNAKE DANCE. A ceremony of the Hopi (Moki, Moqui) Indians of northeastern Arizona in which the handling of live rattlesnakes is a striking feature. The ceremony is held every two years, alternating with the flute dance, and in only five of the seven pueblos, at a date near August 20. The most frequently visited dances are those of Walpi (odd years) and Oraibi (even years). The celebrants are the Snake and Antelope fraternities, whose meeting places are in separate kivas or underground chambers allotted to these societies. The public dance is the culmination of nine days' secret rites in the kivas, during which an extremely complicated ritual is carried on, the chief features being the gathering of snakes from the world quarters, the snake washing, and the snake drama. On the morning of the eighth day the Antelope Fraternity foot race occurs, and in the afternoon follows the Antelope dance, which is identical with the first portion of the snake dance proper which takes place the next day. The morning of the ninth day is ushered in with the snake drama and race, the runners coming to the pueblos from a spring some miles distant at sunrise. About five in the evening the costumed and painted dancers file into the plaza, at one side of which the kisi, a small hut of cottonwood boughs, has been erected as a house for the snakes. The Antelope priests appear first and make a circuit of the plaza four times, and during this procession each man stamps on a small board sunk in the ground, supposed to cover the entrance to the underworld, and throws sacred meal upon it. This action is for the purpose of notifying the dwellers of the underworld that a ceremony is going on. The Antelope priests line up at the side of the kisi, in which the snakes have already been placed, and the Snake priests make their circuit and form in line facing them. A low weird chant begins, growing louder and marked by the rattles in the hands of the Antelope chorus. After the Antelope dance of the preceding day has been reënacted the Snake priests form in groups of three and dance with a curious hopping step around the plaza, while the Antelope priests remain in line and sing. When the trios come near the kisi, the snake carrier drops on his knees and is handed a snake, which he grasps with his mouth about the middle, and, rising, dances with his two attendants around the plaza three times, when he drops the snake to the ground and secures another. One attendant places one hand upon the shoulder of the carrier and in the other holds a wand or "snake whip" of eagle plumes, which he waves in front of the snake. The other attendant, also armed with a feather wand, gathers up the snakes dropped by the carrier and holds them in his hands.

A third group of actors in this ceremony are women and girls arrayed in ceremonial costume and carrying plaques of sacred meal. Their office is to sprinkle the dancers with meal as they pass. When all the reptiles have been duly carried around the plaza, there is a pause while a cloud design in meal is thrown on the ground. Upon this the snakes are thrown, and a wild scramble for them ensues, and each priest runs with his prizes down the trails and sets them free at the prescribed places in each of the four directions. When the priests return they remove their trappings and drink of a powerful emetic for the purpose of purification. There follows general feasting by the entire pueblo. Several species of snakes are used in the ceremony, though from the nature of the case the rattlesnake preponderates. So far as is known no dancer has died from the bite of a snake in the ceremonies; it is exceedingly rare that they are bitten; the preliminary handling and the careful though seemingly fearless manipulation of the snake are sufficient to prevent accident. The ceremony is in effect a petition to the nature powers to give rain as the fundamental good in the arid region.

Consult: J. W. Fewkes, "Tusayan Snake Ceremonials," in *Bureau of American Ethnology, Sixteenth Annual Report* (Washington, 1897); Walter Hough, *The Moki Snake Dance* (Chicago, 1898); Dorsey and Voth, "Mishongnovi Ceremonies of the Snake and Antelope Fraternities," in *Field Museum of Natural History, Publications, No. 66* (ib., 1902).

SNAKE FEEDER. See DRAGON FLY.

SNAKE FLY. A neuropterous insect of the family Raphidiidæ, allied to the hellgramite flies (*Corydalis*) and so called on account of the long flexible "neck." They occur in Europe and on the Pacific coast of the United States and spend their life upon trees. They are known by the prolonged necklike prothorax; and the female has a long curved ovipositor, to place its eggs deep in bark crevices. The cruciform larvæ are active and voracious, developing in rotten wood and the dust under loose bark and preying upon other insects and their young. They are assiduous as food hunters and kill many larval codling moths and other fruit pests. The larva makes no cocoon, but changes to pupa beneath the shelter of bark, and begins to move about before it retransforms to the imago state. Consult L. O. Howard, *The Insect-Book* (new ed., New York, 1914).

SNAKE-HEADED FISH, or SERPENT HEAD. An East Indian fish of the family Ophiocephalidæ, relating to the climbing fish (q.v.) and so called on account of the long eel-like form and the flattened head, which is covered with large scales.

SNAKE INDIANS. See SHOSHONE.

SNAKE MELON. See MUSKMELON.

SNAKE RIVER, also called SHOSHONE. The largest tributary of the Columbia River (q.v.) (Map: Oregon, H 3). It rises among the high peaks of the Rocky Mountains in Yellowstone Park. From Shoshone, Lewis, and Hart lakes in that park the South Fork flows southward, widening into Jackson Lake (18 miles long and 4 miles wide), from which it passes through Jackson valley (40 miles long and 8 miles wide). Near the Idaho-Wyoming boundary it enters a long cañon in which occur the famous Shoshone Falls (q.v.). It receives the North Fork in the southern part of Fremont Co., Idaho, and then flows westward across Idaho to a point near the Oregon-Idaho line. Here it turns suddenly northward and for about 170 miles forms the boundary between those States and for more than 30 miles between Idaho and Washington. It crosses into Washington at Lewiston, flows northwest, west, and southwest and joins the Columbia near Pasco. The stream is about 900 miles long and offers immense water power, while its basin has many feasible storage sites, only a few of which have been developed.

SNAKE RIVER. See COATZACOALCOS.

SNAKEROOT. See COHOSH; POLYGALA; SERPENTARIA; and Plate of GOLDENROD, ETC.

SNAKE'S HEAD. See FRITILLARY.

SNAKEWEED. A name for bistort (q.v.).

SNAKEWOOD. See CECROPIA; LETTERWOOD.

SNAPDRAGON (*Antirrhinum*). A genus of about 25 species of annual and perennial herbs of the family Scrophulariaceæ, chiefly natives of the temperate parts of the Northern Hemisphere. The English name refers to a peculiarity of the corolla, the lower lip of which, if parted from the upper so as to open the mouth, shuts with an elastic spring or snap. Common snapdragon

COMMON SNAPDRAGON.

(*Antirrhinum majus*), a favorite plant with many fine varieties used for flower beds, borders, and rockeries, is the most frequently cultivated species. It is a native of Europe and bears racemes of variously colored flowers. The plants are propagated by seeds sown in gentle heat early in spring; the seedlings are transplanted to pans or pots and after having been hardened to light and air are set out in the open ground during May. Seeds are often sown as soon as they have ripened in the summer, the young plants being protected in cold frames until they are transplanted the following spring. Choice varieties are often increased by cuttings made in the fall from well-formed flowerless shoots. This species and *Antirrhinum orontium* have been introduced from Europe and are occasionally met with in a naturalized state.

SNAPPER. A name given to several active, marine, carnivorous fishes of the family Lutianidæ (and to some others) on account of their voracity and quick biting at food. They are related to the sea bass and drumfish. The name especially applies to the members of the "pargo" genus *Neomænis*, many species of which inhabit warm seas, especially along the American and African shores, and are highly valued as food. The best known and most valuable is the red snapper (*Neomænis aya*) or "pargo colorado," which is known on rocky banks as far north as New York, but is very numerous in the Gulf of Mexico. It reaches a length of 2 feet or more and is one of the best of American food fishes. The gray snapper (*Lutianus griseus*), sometimes called gray mangrove snapper or Pensacola snapper, in Florida attains an average weight of about two pounds, but averages five pounds along the coast of Cuba. It is considered an excellent food fish and in Florida a game fish as well. It resembles the red snapper in general contour, but is colored dark greenish gray on the back and sides and reddish below. The fish inhabit coastal waters as far north as the New Jersey coast. Consult G. B. Goode, *Fishery Industries*, sec. i (Washington, 1884), and D. S. Jordan, *Fishes* (New York, 1908). See Colored Plate of Food Fishes with article Fish as Food.

SNAPPING BUG. See Click Beetle.

SNAPPING TURTLE. A large fresh-water tortoise (*Chelydra serpentina*) of the rivers and marshes of North and Central America, noted for its fierceness. It sometimes exceeds 3 feet in length, but ordinarily is about half that. Its shell is too small to permit it to retract either the snakelike head and neck or the long tail. The carapace is covered with pyramidally thickened plates, and the plastron is reduced to a cruciform shape. Its jaws are large and so strong that often it may be lifted from the ground by the object it bites. It feeds upon fish and all sorts of small aquatic animals. A second species belongs to the lower Mississippi valley—the alligator snapper (*Macrochelys lacertina*), which is larger and is considered for its size the strongest of reptiles. These turtles, early in June, seek a sand bank, where the females dig holes with their hind feet and bury 25 or 30 small spherical eggs, smoothing the sand carefully over them. These two species constitute the family Chelydridæ.

SNARE DRUM (AS. *snear*, sinew + *drum*). The ordinary small military drum. It is built of a hollow body made of brass, over both ends of which a membrane is stretched which can be tightened or loosened. Across the lower membrane are stretched several strings of catgut, which vibrate and act upon the lower membrane very much like drumsticks. Thus a bright piercing sound is produced. See Drum.

SNEEK, snăk. A town in the Province of Friesland, the Netherlands, to the west of the Sneekermeer and 24 miles southwest of Leeuwarden (Map: Netherlands, D 1). There are a Gymnasium, an industrial institute, and some metal manufactures. Pop., 1900, 12,075; 1913, 13,954.

SNEERWELL, Lady. See School for Scandal.

SNEEUWBERGEN, snă'ŏŏ-bĕr'gen. A range of mountains in South Africa. See Cape of Good Hope.

SNEEZEWORT. An herb. See Achillea.

SNEEZING. The involuntary spasmodic expirations caused either by direct or reflex irritation of the sensory nerves of the nasal mucous membrane. The causes of excessive sneezing may be broadly divided into two classes, extrinsic and intrinsic. Extrinsic causes are those which act from without, e.g., irritating substances like tobacco snuff and dust. Intrinsic causes occur in association with such systemic diseases as hay fever, asthma, whooping cough, hysteria, derangement of the sexual functions, and gout. Sneezing may occur as a reflex from the external auditory canal as a result of collections of ear wax. See Asthma; Coryza; Hay Fever.

SNEF'RU, or **SNOF'RU.** The name of the first King of the fourth Egyptian dynasty. He reigned about 3000 B.C. and was the immediate predecessor of Cheops (q.v.). Snefru opened mines for copper and malachite at Wadi Maghara in the Sinaitic Peninsula, and on a rock tablet at this place the King is depicted in the act of slaying an enemy. Later accounts state that he defended Egypt from an invasion of Asiatic tribes. The tomb of Snefru is the so-called step pyramid of Medum (q.v.). Consult: K. A. Wiedemann, *Aegyptische Geschichte* (Gotha, 1884–88); E. A. T. Wallis Budge, *History of Egypt* (8 vols., Chicago, 1902); W. M. Flinders Petrie, *A History of Egypt* (6 vols., New York, 1905); J. H. Breasted, *A History of the Ancient Egyptians* (ib., 1908); id., *Ancient Records of Egypt*, vol. i (Chicago, 1906); W. M. Flinders Petrie and others, "Meydum and Memphis (III)," in *Publications of the Egyptian Research Account, 18* (London, 1910).

SNEHÆTTEN, snă'hăt'tan (Norw., snow cap). The highest peak of the Dovrefjeld in Norway, 80 miles southwest of Trondhjem (Map: Norway, D 5). Its altitude is 7615 feet.

SNELL, Henry Bayley (1858–   ). An American landscape painter. He was born at Richmond, London, and studied at the Art Students' League, New York. Characteristic examples of his landscapes, which interpret nature in her gentler moods and are rendered with finely modulated color and charming tonal qualities, include: "The Citadel at Quebec" (Albright Art Gallery, Buffalo); "Entrance to the Harbor of Polperro" (Worcester Museum); "Night-Fall" (Art Association, Indianapolis); "Low Tide" (1907); "Lake Como" (Metropolitan Museum, New York); "The Harbor Light" (1913). In 1906 he was elected a member of the National Academy; he became president of the New York Water Color Club and received, among other medals and prizes, a gold medal at the Pennsylvania Art Club in 1896. His wife, Florence Francis Snell, became known as a decorative landscape painter.

SNELLEN, snĕl′en, Herman (1834–1908). A Dutch ophthalmologist. He was born at Zeyst and studied medicine at Utrecht (M.D., 1857), where he was professor of ophthalmology from 1877 to 1899. He is best known as the originator of Snellen's test types for examination of the organ of sight, based upon physical and physiological methods, described in his *Optotypi ad Visum Determinandum* (1862; 20th ed., 1911). He was a prolific writer.

SNEL′LIUS, Willebrord (1591–1626). A Dutch mathematician and astronomer. He was born and educated at Leyden and succeeded his father as professor of mathematics there. Snellius discovered the law of refraction of light (1619) and the properties of polar spherical triangles and gave a scientific method for measuring the arc of a meridian. His chief works are *Eratosthenes Batavus* (1617) and *Cyclometrica* (1621).

SNI′DER, Denton Jaques (1841–). An American author. He was born at Mount Gilead, Ohio, and graduated at Oberlin College in 1862. Soon afterward he became a lecturer on literary subjects. He made his home in St. Louis. His writings include: *Commentaries on the Literary Bibles* (9 vols.: 3 on Shakespeare and 2 each on Goethe, Dante, and Homer, 1877–93); *Walk in Hellas* (1882); *The Freeburgers* (1889), a novel; *World's Fair Studies* (1895); *The Will and its World* (1899); *The Psychology of Froebel's Play-Gifts* (1900); *Social Institutions* (1901); *The State* (1902); *Modern European Philosophy* (1904); *A Tour in Europe* (1907); *Cosmos and Diacosmos* (1909). Among his poetical publications are: *Delphic Days* (1878); *Agamemnon's Daughter* (1885); *Homer in Chios* (1891); *Johnny Appleseed's Rhymes* (1894).

SNIDER, Jacob (?–1866). An American inventor. In 1859 he went to England, where he endeavored to secure the adoption by the British government of a system of breechloading or converting rifles. But although he succeeded in securing its introduction he was unable to obtain adequate remuneration and died without having received the reward of his labors.

SNIPE (Icel. *snipa*, snipe). A small limicoline marsh bird of the family Scolopacidæ and genus *Gallinago*, having a very long straight bill, with nasal grooves extending almost to the tip, which expands a little and is soft and very sensitive, smooth, and shining in the living bird, but soon after death becomes pitted like the end of a thimble by drying. The tip of the bill is filled with the terminals of the nerve fibres (for which consult Yarrell, *British Birds*, 4th ed., London, 1884). The head is compressed; the eyes are large and placed far back in the head. The feet have three toes before, divided to the base or very nearly so, not edged by membrane; the hind toe is short. The tail is short and contains 14 to 16 feathers.

The common snipe of Europe (*Gallinago gallinago*) is about 11 inches in entire length, the bill almost 3 inches. The sexes are alike in plumage, but the female is rather larger than the male. The general color of the upper parts is blackish brown, finely mixed with pale brown and buff; three pale brown streaks along the head are characteristic of the whole genus. The neck and breast are pale rust color mottled with black; the belly is white. It makes a rude nest of a little dry herbage in a depression of the ground or sometimes in a tuft of grass or rushes. The eggs are four in number, pale yellowish or greenish white, the larger end spotted with brown. North America has but a single species of *Gallinago*. The common American or Wilson's snipe (*Gallinago delicata*) is about equal in size to the common snipe of Europe and much resembles it also in plumage. This species is abundant in summer in northern parts of the United States and in Canada, in the more southern States in winter. The peculiar cry of this bird, "scape-scape," and its twisting motion in flight are highly characteristic; and in spring it circles about in the air near its nest with a queer zigzag flight, uttering a curious drumming or "bleating" noise. Consult: J. L. Bonhote, *Birds of Britain* (London, 1907); W. H. Rich, *Feathered Game of the Northeast* (New York, 1907), and general ornithologies. See Colored Plate of Shore Birds, and Colored Plate of Game Birds, with article Grouse.

SNIPE EEL (so called from the long jaws). One of a group of little-known, extremely slender eels forming the family Nemichthidæ. Many of them live in the ocean depths, the one illustrated on the Plate of Eels, Congers, and Morays (see Eel) belonging to the Gulf Stream. The best-known species is *Nemichthys scolopaceus*, common in rather deep water in the North Atlantic.

SNIPEFISH (so called from the long snout). A fish of the related hemibranch families Fistulariidæ and Macrorhamphosidæ, allied to the pipefish and variously known as trumpet fish, bellows fish, flutemouth, etc. Specifically the term usually refers to a small species of the south European coast, occasionally straying to America (*Macrorhamphus scolopax*), remarkable for the conformation of the head, the skull being elongated into a tube, at the extremity of which are the mouth and jaws. Some related species of tropical waters become from 4 to 6 feet in length.

SNIPE FLY. Any one of the small slender flies of the family Leptidæ. They have long legs and slender bodies and are predatory, destroying other insects. Generally they have smoky wings and velvety bodies. They are sluggish in habits. The larvæ are found in water, decaying wood, earth, moss, dry sand, and in the burrows of wood-boring beetles. More than 50 species occur in the United States.

SNOFRU. See Snefru.

SNOHOMISH. See Salishan Stock.

SNOILSKY, snoil′skĕ̇, Karl Johan Gustaf, Count (1841–1903). A Swedish poet, born in Stockholm and educated at Upsala University. He entered the diplomatic service in 1865 and held various secretarial posts until 1879, when he abandoned diplomacy for literature. His works include: *Orchideer* (1862); *Dikter* (1869; 4th ed., 1883); *Nya dikter* (1881); *Dikter: 3e Samlingen* (1883); *Dikter: 4e Samlingen* (1887); *Dikter: 5e Samlingen* (1897). He also published in 1876 a translation of Goethe's ballads. His *Samlade dikter* were published in 1903–04 in five volumes.

SNOOK (from Dutch *snoek*, pike, jack). A fish. 1. A barracouta (q.v.) of Australian and South African waters (*Thyrsites altun*), important as a food fish. 2. The robalo (q.v.).

SNOQUALUM, snō-kwŏl′ŭm. See Salishan Stock.

SNORRI STURLUSON, snŏr′rē stōōr′lụ-sŭn (1178–1241). An Icelandic historian and statesman, remembered as the author of the *Heimskringla* (annals of old Norwegian kings) and of the *Younger* or *Prose Edda.* Snorri, youngest son of a local chieftain, was a follower of the chief Jon Loptsson. He became a poet and lawyer and in 1215 was head of the Legislative Assembly and the highest court. King Haakon invited him to Norway in 1218, and later he negotiated a peace between Norway and Iceland. He returned to Iceland, where he used his power to his own advantage, and in 1239 political and domestic intrigue compelled his flight to Norway. He returned in 1240 and in 1241, by King Haakon's orders, was killed by Gissur, Snorri's son-in-law. The *Prose Edda,* finished in 1222, comprises the mythological *Gylfaginning,* the *Skáldskaparmál,* a sort of *Ars Poetica,* and the *Háttatal,* a commentary in 102 strophes on poems in honor of the author's Norwegian patrons, King Haakon and his tutor Skuli. The *Sagas* extend from the mythological kings to 1177 and are based on chronicles, tradition, and legend. They show great literary ability. The *Olaf Saga* he also elaborated separately. Snorri's *Heimskringla* has been edited by Peringskjöld (2 vols., Stockholm, 1697); Schöning and Thorlacius (6 vols., Copenhagen, 1777–1826); Unger (Christiania, 1868); and best by Finnur Jónson (Copenhagen, 1893–1901; and in briefer form, 1911). There are translations into Danish by Grundtvig (Copenhagen, 1818–22); Norwegian by Aall (Christiania, 1838–39) and Gustav Storm (ib., 1900); Landsmaal by Schjött (ib., 1900); Swedish by Richert (Stockholm, 1816–29) and H. Hildebrand (Orebro, 1889); German by Wachter (incomplete, Leipzig, 1835–36); and English by Laing (London, 1889 and 1906), M. Morris (ib., 1893–95, 1905), Anderson (New York, 1906).

SNOUCK HURGRONJE, snụk hụr-ɢrŏn′ye, CHRISTIAAN (1857–). A Dutch Orientalist, born in Oosterhout, North Brabant, and educated at Leyden, where he studied Arabic under De Goeje, and at Strassburg under Nöldeke. He taught Mohammedan law at Leyden in the civil-service college for the Dutch Indian service and in 1884 traveled in Arabia. Disguised as a native doctor of the civil law, he spent almost a year in Mecca. In 1888 he was sent on a governmental scientific expedition in the Dutch Indies and soon afterward settled in Java, where he assumed an official post as adviser to the Dutch Governor-General of Batavia. In 1907 he returned to Leyden as professor of Arabic. Among his works are: *Het Mekkaansche Feest* (1880), a doctoral thesis; *Mekka* (1888–89), with an atlas; *Bilder aus Mekka* (1889); *De beteekenis van den Islam voor zijne belijders in Oost-Indië* (1883); *Der Uahdi* (1885); "De Islam," in *De Gids* (1886); *De Atjèhers* (1894); *Het Gajoland en zijne bewoners* (1903); *Arabië en Oost-Indië* (1907); *Nederland en de Islâm* (1911).

SNOUT BEETLE. A weevil. See WEEVIL.

SNOW (AS. *snāw,* snow). Minute crystals of ice formed in the atmosphere when the aqueous vapor is condensed at temperatures below freezing. These crystals usually combine into groups, sometimes large and flocculent, but often small and arranged with great regularity. The elementary ice crystals or spiculæ are prisms of six sides whose ends are perpendicular to their lengths. When the length of the crystal is very small as compared with its diameter, these needles become thin flat plates. The early meteorological observers have recorded the figures of snow crystals, as observed under a magnifying glass, but later observers have secured photographs of the crystals as seen through the compound microscope. The longer rays that constitute the arms of the six-rayed stars are generally hollow tubes; they are evidently built up by additions to the edge of an original crystal.

The white color of snow results from the fact that the snow crystals are so minute that each cell of the retina receives a general impression produced by the combination of different wave lengths reflected from innumerable minute facets. Red snow, and more rarely other colors, such as green, blue, or black snow, are produced by the action of innumerable fungi known as the *Micrococcus nivalis.* Red snow has been photographed in natural colors. (Consult F. A. Carpenter, in *Transactions of the San Diego Society of Natural History,* 1911, vol. i, p. 108.) Snow rarely falls at sea level south of the parallel of lat. 30° N., and on the Pacific coast of North America it occurs at sea level only north of lat. 47° N.

Measurement of Snowfall. Snow is even more difficult to measure than rain. (See RAIN GAUGE.) The action of the wind interferes with the falling snowflakes as they are about to enter a snow gauge exposed to collect them, or drives them out after having entered. Even moderate winds often remove the snow cover from the ground in some places and heap deep drifts of snow in others. It is the ordinary custom to state the quantity of snowfall as so much depth (inches or other unit) of the newly fallen layer, or, better, the depth of the layer of water that would result if the snow were melted in place.

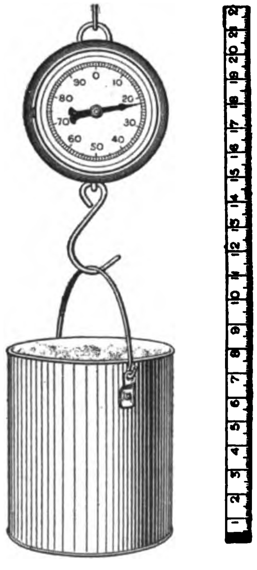


FIG. 1. MARVIN SNOW-DENSITY BUCKET, WEIGHING SCALES, AND MEASURING STICK.

The pail is carefully filled to the brim with the snow to be measured. The density indicated is 22%, the pail full of water weighs 100 units. The measuring stick is divided to tenths of inches.

Snow, when melting or mixed with rain, must be collected in a suitable gauge for satisfactory measurement. Such gauges must be freely exposed, but sheltered from strong winds and provided with appropriate wind shields which cut off or diminish the eddy actions of the wind playing around the mouth of the gauge. (See Fig. 3.) The quantity of snow collected in any gauge is most conveniently measured by weighing, but it is often determined by measuring the volume of water obtained by melting the snow. When the snow is relatively "dry," the quantity may be satisfactorily determined by measuring the depth of the freshly fallen layer in some spot unaffected by drifting. Obviously this method fails to indicate the entire precipitation if the snow is melting or is mixed with rain. There are two methods for measuring freshly fallen snow in such cases. One way is to cut out a representative section of the snow layer, melt it, and measure as if the layer had been water. The other way is to measure the density of the snow (relative to water) and multiply this by the average depth of the layer in inches as found by one or several representative measurements. (See Fig. 1.)

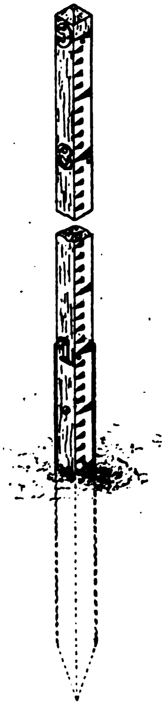


FIG. 2. SNOW STAKE, UNITED STATES WEATHER BUREAU PATTERN.

Certain engineering and meteorological demands call for the careful determination of the water equivalent of the whole layer of snow on the ground. This information is particularly important in mountainous regions constituting the headwaters of important rivers or streams used for power and irrigation purposes. For this purpose one employs appropriate sampling tubes, 50 or 60 inches long and 2 or more inches in diameter. The tube is forced completely through the snow to the ground. The water equivalent of the core or sample of snow is then determined either by weighing the tube and core together or by removing the snow to a separate container for weighing. The snow in deep beds is often found, at the opening of spring, to have a density as high as 30 to 50 per cent.

In remote and relatively inaccessible regions as well as elsewhere the Weather Bureau sets up so-called snow stakes by means of which the depth of the whole layer of snow is approximately determined and reported from time to time. (See Fig. 2.) A Weather Bureau shielded snow gauge exposed in a mountainous country is shown in Fig. 3.

The great accumulations of snow, by sliding downward in ravines until they join together in the river valleys and form glaciers (q.v.), constitute an important factor in the study of physical geography. A heavy snowfall is not merely a question of low temperature, but of inflowing and uprising cool moist air. In this respect the physical processes that determine the formation of snow are entirely similar to those that determine the formation of rain. The ordinary limits of snowfall and glaciation at sea level are north of the parallel of 30° N. and south of the parallel of 30° S. Snow is an exceedingly poor conductor of heat, owing to the nonhomogeneous texture of the mass, which may be considered as composed of alternate thin layers of ice and air. A covering of snow on the ground or a hut hastily built of blocks of snow is a very good protection against the cold storms from the north. The roots of the most tender vegetation prosper under a covering of snow, which ordinarily conserves the heat brought to the surface by conduction from warmer layers below and allows the soil to have a higher temperature than without the snow blanket.

From an agricultural and a geological point of view the amount of snow lying on the ground at any time is highly important. The United States Weather Bureau publishes weekly and monthly maps showing this feature of climatology; a general map has also been compiled showing the normal amount of snowfall for the whole year as a help towards the study of the climatic conditions that attend the accumulation of snow.

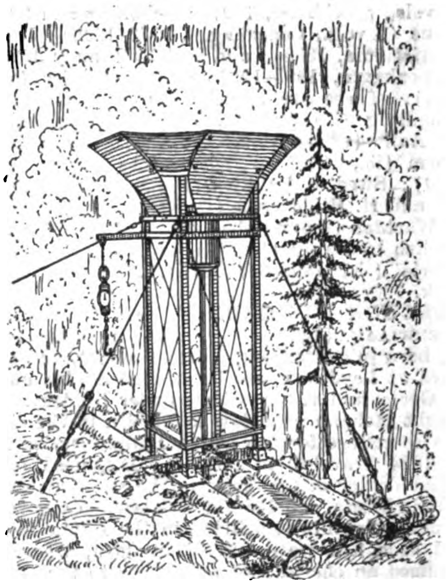
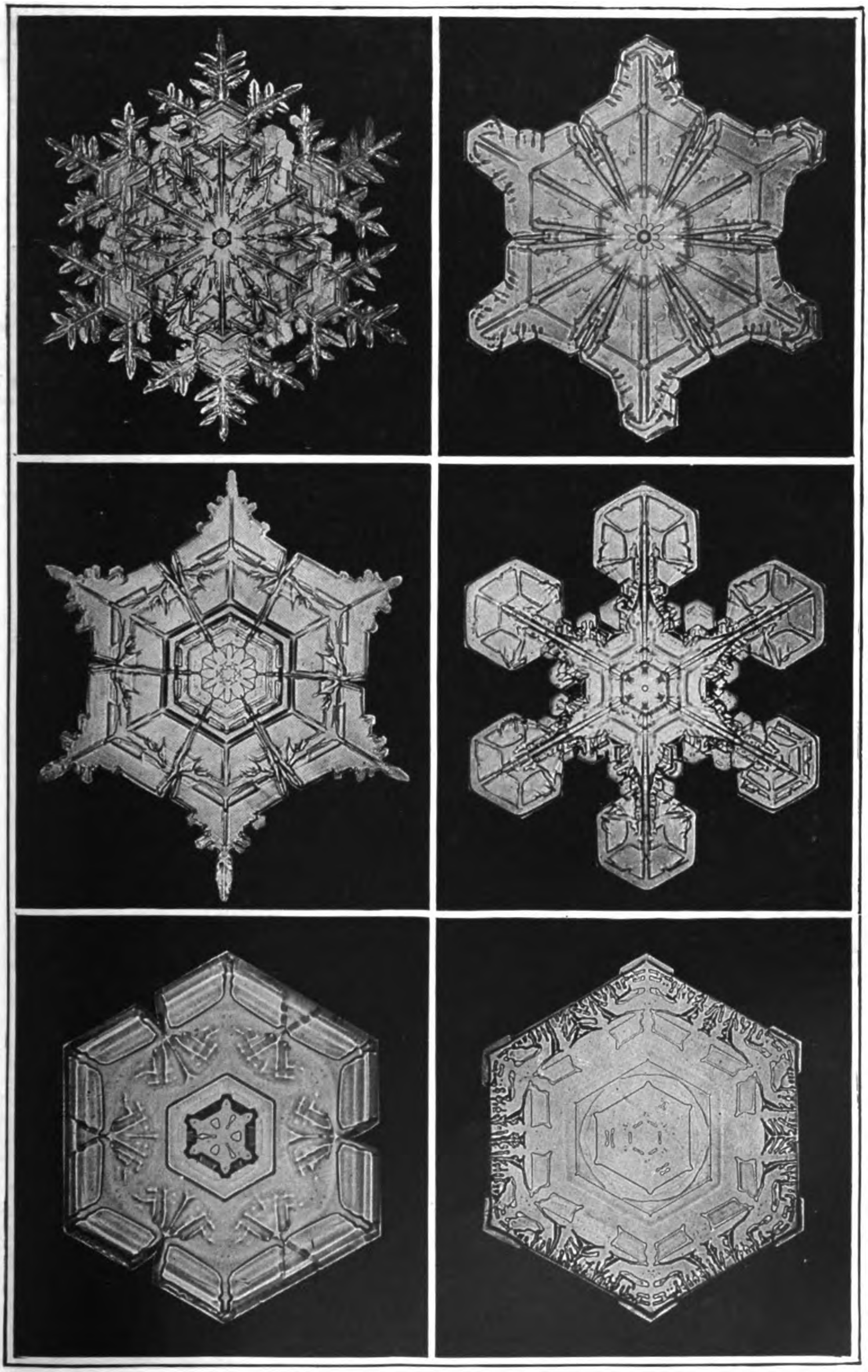


FIG. 3. MARVIN SHIELDED SNOW GAUGE, AS USED BY THE WEATHER BUREAU.

The cylindrical vessel in the centre of the trumpet-shaped wind shields collects the snow, whose quantity is found by weighing the receptacle.

Bibliography. The principal collection of snow photographs are those that we owe to Dr. Neuhass, of Berlin (1892–93); G. Nordenskiold, of Stockholm; A. A. Sigson, of Rybinsk, Russia; and, most important of all, those of W. A. Bentley, of Jericho, Vt. Consult articles in *Appleton's Popular Science Monthly* (New York, May, 1898); in the United States Weather Bureau, *Monthly Weather Review* (Washington, May, 1901), and the annual summary for 1902; also *Snow and Ice Bulletin* (ib., weekly).

SNOW



PHOTOMICROGRAPHS OF SNOW CRYSTALS SHOWING TYPICAL FORMS
Photographed by W. A. Bentley, Jericho, Vt.

SNOW, Lorenzo (1814–1901). An American Mormon leader, born at Mantua, Portage Co., Ohio. He studied at Oberlin College, in 1836 was converted to Mormonism, and in 1840 was a missionary to Great Britain. He was sent on missions to Italy in 1849 and to the Sandwich Islands in 1864. In 1852 he was elected to the Utah House of Representatives, and until 1882 he continued to be a member of either the House or the Council. Snow established the city of Brigham (Utah) in 1855, and there he organized a system of coöperative industry. In 1889 he was elected president of the Twelve Apostles and in 1898 president of the Mormon church. His publications include a translation of the *Book of Mormon* into Italian; *The Only Way to be Saved* (1851); *The Italian Mission* (1851); *The Voice of Joseph* (1852).

SNOWBALL TREE. Another name for the guelder-rose (q.v.).

SNOWBERRY (*Symphoricarpos racemosus*). A bushy deciduous shrub of the family Caprifoliaceæ, a native of northern North America and common in shrubberies. It has simple leaves, small flowers, white inedible berries, about the size of black currants, remaining on the bush after the leaves. There are about 10 species. The creeping snowberry (*Chiogenes hispidula*) is a native of North American bogs.

SNOW′BIRD. Any species of bird, usually a finch, associated with snow. In the United States the name is most commonly applied to the junco (q.v.), but also to the snow bunting (q.v.). See Plate of Sparrows.

SNOW BUNTING, or Snowflake. A large finch (*Passerina*, or *Plectrophenax*, *nivalis*) of a genus distinguished by the long larklike straight claw of the hind toe and a similarity to the larks in habits; there is a similar ease and celerity in running along the ground, and the song is very different from that of any of the true buntings. The color of the plumage is very different from most fringilline birds, for white predominates. In summer plumage the back and parts of the wings and tail are black. In winter plumage all the upper parts are rusty brown. The length of an adult is 7 inches. The snow bunting abounds in summer in all parts of the Arctic regions, and in winter migrates into the north-temperate regions, but is rarely seen, even in the northern United States, except in severe winters and when snow is plentiful. It feeds largely on the seeds of grasses and weeds and is often seen in company with longspurs (q.v.). See Plate of Buntings and Grosbeaks.

SNOW COCK. A name given by Anglo-Indian sportsmen to two different birds found near the snow line in the Himalaya. One is the Tibetan snow pheasant, a large and active species frequenting the stony heights of all Central Asia. It is *Tetraogallus himalayensis* and lives at elevations of from 11,000 to 18,000 feet. They feed in flocks and always have a sentinel perched on some projecting bowlder to give the alarm in case of danger. The golden eagle is their greatest enemy. (For the most complete account, consult Hume and Marshall, *The Game Birds of India, Burma, and Ceylon*, vol. i, Calcutta, 1879.) Other species are found in various other Asiatic mountain ranges. Another snow cock is the jer-monal (*Lerwa nivicola*) of the higher Himalaya and western China.

SNOWDEN, snō′d'n, James Ross (1810–78). An American numismatist, born at Chester, Pa. After graduating at Dickinson College he settled in Franklin. Subsequently he was State Treasurer (1845–47), Treasurer of the United States Mint (1847–50), and its director (1853–61). His publications include many pamphlets on coins and his *Description of Coins in the United States Mint* (1860); *The Mint at Philadelphia* (1861); *Coins of the Bible* (1864).

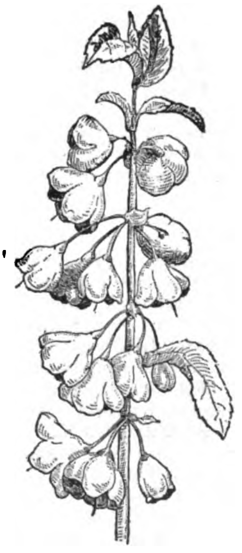
SNOWDEN, Philip (1864–). An English Socialist and labor leader. He was born at Keighley, Yorkshire, and was educated at a board school and privately. He entered the civil service in 1886, but retired in 1893 to take up journalism and lecturing. Entering politics as a member of the Labor party, he was elected a member of the House of Commons in 1900. He was chairman of the Independent Labor party in 1903–06 and was appointed a member of the Royal Commission on Canals and Waterways and of the Royal Commission on the Civil Service. He wrote much on Socialistic and political subjects, including *Socialism and Syndicalism* (1915).

His wife, Ethel Snowden, became known as the leader of the English nonmilitant woman suffragists. She visited the United States in 1915 to attend the Women's Peace Conference at San Francisco. Consult A. G. Gardiner, *Prophets, Priests, and Kings* (new ed., London, 1914).

SNOWDON, snō′don. A mountain group in Carnarvonshire, North Wales (Map: Wales, C 3). It is broken by valleys into four minor groups, whose chief peak, Moel-y-Wyddfa (the conspicuous peak), is the highest mountain in South Britain, being 3590 feet above sea level.

SNOW′DROP (so called from the color of the flower), *Galanthus*. A genus of plants of the family Amaryllidaceæ. The bulbous root produces two leaves and one single-flowered leafless stem. The common snowdrop (*Galanthus nivalis*) is found chiefly in the woods and pastures of southern Europe. Various species are popular spring flowers in flower gardens.

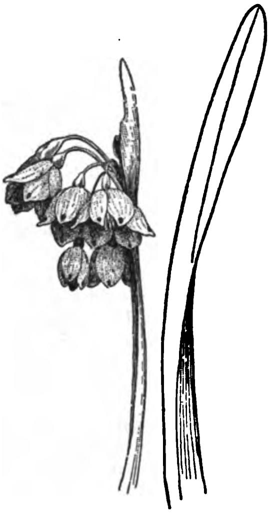
SNOWDROP TREE, or Silver-Bell Tree, also known as Opossum Wood (*Halesia carolina* and *Halesia diptera*). Two shrubs or small trees of the family Styracaceæ, with large and veiny pointed deciduous leaves and showy white flowers, drooping on slender pedicels in short racemes or clusters from axillary buds of the preceding year. They are beautiful shrubs for cultivation.



SNOWDROP TREE (*Halesia carolina*).

SNOW FENCES and **SNOW SHEDS.** See Railways.

SNOW′FLAKE (from the color of the flower), *Leucojum*. A genus of 9 or 10 species of bulbous herbs of the family Amaryllidaceæ, natives of the Mediterranean region. The spring snowflake (*Leucojum vernum*), the best-known species, produces umbels of sweet-scented flowers in March or April. The summer snowflake (*Leucojum æstivum*) is a beautiful, rapidly growing plant. *Leucojum autumnale*, a Portuguese species, produces drooping flowers in autumn. These plants make the best growth on rich sandy or loamy soils. Propagation is by offsets, obtained as soon as the leaves have become dry.



SUMMER SNOWFLAKE.

SNOWFLAKE. See SNOW BUNTING.

SNOWFLOWER. See FRINGE TREE.

SNOW GOOSE. An Arctic goose (*Chen hyperboreus*), seen in the United States during its migrations, sometimes in vast numbers. It is pure white, except in the black wing quills, washed on the head with reddish; the beak, which is strongly toothed, is pink and the feet reddish. An adult male measures 27 inches long and weighs 5¼ pounds. Ross's snow goose (*Chen rossi*) is a miniature of the other and is known all over the Hudson Bay country as horned wavey. Consult Elliott Coues, *Birds of the Northwest* (Washington, 1874), and W. H. Rich, *Feathered Game of the Northeast* (New York, 1907).

SNOW LEOPARD. The ounce (q.v.).

SNOW LINE. The level on a mountain slope above which snow exists all the year round or at least very nearly so. The height of this line above sea level varies greatly both from year to year and in different localities; it moves up and down within a broad zone and is determined principally by the direction of the slope, the temperature, moisture, and average velocity of the prevailing winds. The average height of the snow line is about 18,400 feet in the tropical Andes, 19,000 in the Himalaya, 6000 in Patagonia, 2000 in Greenland. See SNOW; MOUNTAIN; and articles on the separate mountain ranges, ALPS, HIMALAYA, ETC.

SNOW-ON-THE-MOUNTAIN. A euphorbiaceous plant. See SPURGE.

SNOW'PLOW. A machine for clearing roads and railways of snow. The rotary steam snow shovel has been adopted by all the transcontinental lines of the United States and Canada. It consists of a wheel, 9 feet in diameter, set in a round casing with a flaring front, 10 feet square, which feeds the snow into the wheel. The wheel contains an inner and outer series of knives pivoted on radial pins, with their surfaces inclined to one another; when they encounter any snow they are canted, or set so as to slice it off and feed it into the machine. Behind the knives is a fan wheel composed of a number of radial blades. When the wheel revolves the centrifugal force throws the snow to the outside of the wheel; it meets the inclosing case and is forced through an opening behind the headlight. A hood here regulates the direction in which the snow is thrown. The machine weighs about 20 tons.

SNOW'SHOEING. Snowshoes are of four permanent main varieties. One is long and narrow and sharp at each end, swelling only slightly in the middle, and slightly turned up at the toe. Another has a turned-up entry, which meets the snow nearly squarely, and a trailing pointed after end. These are favorite patterns in the north; they are about 5 feet long, 1 foot wide in the centre, made of hickory or some other tough wood which will bend without breaking, and laced with fine caribou-skin webbing, except just under the foot, where there is an open bed cording of thick rawhide. A third kind is broader and shorter, with an oval entry at the fore end and a trailing, shorter after end. The fourth set are almost circular, with a stumpy beaver-like trail end.

In walking the shoe is slightly raised and carried partly over and ahead of its fellow, and when the step is completed the swell of the centre of the frame of the rear shoe lies close to the inward curve of the hinder part of the leading shoe. The principal snowshoe clubs of Canada are those of Montreal and Quebec. The time record for snowshoeing is faster than the ordinary cross-country runs. The hundred-yard dash takes a little over 12 seconds; the mile, 5 minutes 40 seconds.

SNOWY OWL. A large owl (*Nyctea nyctea*) which inhabits the circumpolar region and appears irregularly in winter in more temperate regions southward. It has no horns, and the male is sometimes almost immaculately white, while the female is barred more or less heavily with dark-brownish slate. Its habits are similar to those of other large owls (q.v.), except that it usually nests on the open ground of the tundra, on the side of a hill or near some projecting bowlder. It lays 5 to 10 round white eggs. In Arctic America it feeds mainly upon ptarmigan, lemmings, and ducks.

SNUFF. See TOBACCO.

SNUFF TAKERS. See CONSCIENCE WHIGS.

SNY'DERS, FRANS (1579–1657). A Flemish animal and still-life painter. He was born at Antwerp and studied under Pieter Brueghel the Younger and Hendrick van Balen, joined the Painters' Guild in 1602, and after a journey to Italy settled in Antwerp in 1609. His talents won for him the admiration of Rubens, who frequently engaged him to paint fruit, game, and other accessories in his pictures; in turn Rubens, Jan Bockhorst, and occasionally Van Dyck often contributed the figures to the canvases of Snyders. As a painter of hunting episodes, scenes of violent action, and combats of animals, Snyders stands as very nearly the equal of Rubens in breadth and vigor of execution, and in richness of composition; though inferior to Rubens as a colorist. His pictures are seen in all the famous galleries of Europe, that of Madrid possessing 22. There are five in the Stockholm Museum; 14 at the Hermitage, St. Petersburg, mostly still-life; six at Dresden; and six at Munich, including his masterpiece, "Two Lions Pursuing a Roebuck." A subject similar to the last named is in the Metropolitan Museum, New York.

SOANE, sōn, SIR JOHN (1753–1837). An English architect, born at White Church, near Reading. In 1788 he was appointed architect to the Bank of England, which remains the best example of his work. He was elected to the Royal Academy in 1802 and became professor of architecture there in 1806. While lecturing he began the Soane Museum, which he presented to the British nation with an endowment. It contains a valuable collection of pictures, casts, and antiquities. His written works include *Designs for Public Improvements in London and Westminster* (1827) and *Designs for Public and Private Buildings* (1828).

SOAP (AS. *sāpe*). A term generally employed in chemistry to describe the metallic salts of the higher fatty acids. In commerce it has a more limited application, being confined to the water-soluble potassium and sodium soaps and to the water-insoluble salts of such heavy metals as lead, magnesium, and aluminium. The former are extensively used as detergents and also in a limited way as bases for various dyestuffs and sometimes for medical purposes. The sodium compounds of fatty acids, being generally efflorescent, harden on exposure to air and hence are known as hard soaps. But the potassium compounds absorb water under the same conditions and consequently tend to liquefy and are called soft soaps.

The fats generally used in soap making include tallows and greases of animal origin, lard oil, palm oil, olive oil, cottonseed oil, corn oil, coconut oil, stearin, red oil (crude oleic acid), etc. The alkali lyes are prepared by dissolving caustic soda or potash in water to the desired strength, or (more often the case in large establishments, at least with the caustic-soda lyes), they are made by dissolving carbonate of soda in hot water and then adding the requisite quantity of quicklime for causticizing, boiling and allowing the mass to cool, when the clear lye is drawn from the top. The solution obtained is often strengthened by evaporation or by addition of more solid caustic alkali.

The soaps manufactured at present may be classified as follows: (1) rosin or laundry, settled soaps; (2) toilet soaps, including settled, half-boiled, transparent, and floating varieties; (3) marine soaps; (4) medicated soaps; and (5) manufacturing soaps.

The materials required in manufacturing settled soaps include tallow (alone or mixed with grease and oil), caustic-soda solution (18°–22° Baumé), and pickle (saturated salt solution). The operation is carried out in large sheet-iron kettles, circular or square, heated by two steam coils lying on the bottom of the kettle. One coil is perforated with small holes and delivers free steam in fine jets (the open coil); the other serves to heat the contents of the kettle, but allows no escape of steam (the closed coil). The various operations are known as stock change, rosin change, strength change, and finish-stock change. The stock (i.e., the fatty material) is pumped in liquid state into the kettle, and partly spent lye from a previous operation is added, the open coil being used as a heater. A portion of the stock being always somewhat rancid, it unites at once with the lye to form soap, the soap in turn, with the aid of the live steam, emulsifying the rest of the fat. The open coil is now shut and the closed coil used. From time to time strong fresh lye is added, until the contents of the kettle are homogeneous, have a characteristic gummy appearance, and run in long strings from a wooden paddle dipped in the hot liquid. Pickle is then added, until the soap becomes insoluble (grained) and floats on the surface. The contents of the kettle, on cooling, separate into two layers, the granular imperfect soap floating on the brine. The latter, which contains a certain amount of glycerin, is drawn from the bottom of the kettle and worked for glycerin and salt.

To the soap remaining is added fresh strong lye and rosin to the amount of 50 to 100 per cent of the stock originally used. This mixture is heated by the closed coil until the rosin is saponified, and then the kettle is salted out as before. This completes the rosin change. On standing, a lye separates which contains a little glycerin not extracted in the previous process; this lye, too, is worked for glycerin and salt. The next operation (the strength change) is introduced in order to insure complete saponification. For this purpose fresh strong lye (at least 22° Baumé) is added and the mass kept gently boiling for several hours in the grained condition, strong lye having the same effect on soap as pickle—it renders the soap insoluble. At the conclusion of this operation the kettle contents are allowed to cool and settle, and the drawn-off lye, which is not exhausted as in the previous operations, is used to start a new saponification in the stock change. The grained soap is finally reheated and enough cold water added to cause it to pass into solution (close). At this stage the heat is turned off, and the kettle contents slowly cool down and stratify in three layers—the pure soap on top, next an impure dark soap called nigre, and finally a small quantity of strong dark lye too impure for further use. The process of making settled soap without rosin is the same, except that the rosin-change operation is left out. Many soapmakers use very small quantities of rosin in making toilet soaps, believing that this tends to "pitch the nigre," i.e., clarify the product.

Rosin soap is allowed to cool in the kettle to about 65° C. (150° F.) and then run into the crutcher, a horizontal iron cylinder provided with a shaft bearing paddle blades. These revolve and thoroughly mix the soap, yielding a product uniform in texture and color. In this operation it is customary to make various additions—carbonate of soda to soften hard water, silicate of soda to harden the soap and prevent too rapid wasting, and other substances, some of doubtful utility. After crutching the warm mixture is run into large iron frames or molds and cooled. When the soap is hard the sides of the frame are removed and the soap is cut into slabs and bars with a steel wire. After a short drying operation the soap is pressed and ready for use. An ordinary rosin soap freshly made has the following composition:

Fatty and rosin acids	66.24 per cent
Free alkali	0.36 per cent
Combined alkali	6.82 per cent
Water	28.00 per cent

Settled toilet soap is not crutched, but run at once into frames. When hard the soap is cut by wires into thin bars, which are dried on racks in a warm well-ventilated room, and when the moisture is reduced to about 10 per cent the slabs are cut into fine thin chips or shavings and dried once more. The required perfume and coloring matter having been added, the chips are fed into a roller mill, coming out in thin crêpelike sheets. These are passed through again and again until the mass is homogeneous. The thin sheets then pass into the plotter, a revolving screw press which is gently heated and delivers the soap in long slender bars. The bars are cut into short lengths and pressed into cakes by suitable dies. Often settled and half-boiled soaps are mixed in the mills, but, as a rule, the finer toilet soaps are made exclusively from settled soap, entirely free from glycerin. Since 1910 the saponification of fats has been carried on with lime, or a mixture of lime and soda, resulting in a lime or lime soda soap and an increased yield of glycerin. The resulting soap is subsequently decomposed by boiling with soda ash lye (Na_2CO_3) and yields an excellent quality of soda soap and an insoluble residue of calcium carbonate.

Half-boiled soap is an evident misnomer, no higher temperature than that necessary to melt the fatty materials (50°–65° C. = 120°–150° F.) being used in the process. The operation is usually carried out in small cast-iron jacketed kettles, in which the fat, which must be of good quality and usually consists of tallow or tallow and coconut oil, is liquefied by heat. An exactly calculated quantity of strong lye (36°–40° Baumé), consisting of soda alone or mixed with a small amount of potash, is now gradually added and the mass vigorously stirred with a wooden paddle. When emulsification is complete and saponification is well under way, the mass is ladled into an iron frame and allowed to stand for several days, during which time the fatty matter is completely saponified, cools down to the normal temperature, and hardens. The frame may now be stripped and the soap cut and pressed in the usual manner.

Transparent soaps are made by remelting half-boiled soaps with the addition of a small quantity of alcohol, some additional glycerin and cane sugar or glucose. This operation leaves the soap as a transparent jelly-like mass, which is cut up and allowed to stand until the alcohol has evaporated. The bars are then planed down, again cut, and pressed into any desired shape. Of late years it has been the custom of various manufacturers to introduce some form of saponified rosin into this class of soaps to increase lathering quality.

Floating soaps were originally made wholly from coconut oil. Now such soaps are extensively made by incorporating with the soft warm mass of any soap enough air to reduce the specific gravity below that of water, the operation being usually conducted in a jacketed kettle provided with a screw stirrer. As a rule, floating soap is made from a mixture of tallow and coconut oil, which is half boiled, with mixed potash and soda.

Marine or *salt-water soap* is a half-boiled mixture made from pure coconut oil, with potash and soda lye and an addition of salt and carbonate of soda. The United States navy specifications call for a soap of the following composition: the fatty matter shall consist of pure coconut oil only; water should not be present to an extent of more than 55 per cent; and free alkali (NaOH) shall not exceed 0.5 per cent; carbonated alkali (Na_2CO_3) may be present in quantities varying between 2 and 3 per cent; foreign mineral matter should not exceed 0.5 per cent. Such a soap will wash freely in salt or fresh water because of the solubility of the alkali salts of lauric acid (a fatty acid present in coconut oil) in solution of salt. This soap does not keep well, decomposition of the salts taking place during drying, which liberates free fatty acid and makes the soap rancid.

Soaps made from olive oil with soda or mixed potash by the half-boiled process are known as Castile soap, a recognized standard. Such soaps are often adulterated with cottonseed oil.

Marseilles soap is a settled olive-oil soap made with rather more soda than necessary for saponification and then boiled down until the excess lye is strong enough to cause a precipitation of the soap. The mottled varieties receive an addition of copperas solution before boiling down. During the long-continued boiling operation the iron partially oxidizes and remains suspended in the hot mass, producing the characteristic blue, green, or red mottling.

Soft potash soaps are now rarely made, the soft soaps found in the market being soda soaps that contain an excess of water.

Naphtha soaps consist of mixtures of soda soaps with or without rosin and kerosene or some similar grade of hydrocarbon. They are usually quite alkaline, due to the sodium carbonate necessary for holding the hydrocarbon in the mixture.

Medicated soaps are merely mixtures of pure neutral soaps with various remedial agents or with carbolic acid, formaldehyde, etc. The term "antiseptic soap" is misleading, a pure settled soap being aseptic by itself and hardly anything being capable of improving this quality. Pure olive-oil soap is used in medicine both internally and externally. It may be used as a laxative in the form of pills or as an enema in children for the same purpose or a plug of soap may be inserted in the rectum. Soap is also valuable as an emergency remedy in poisoning by the mineral acids. Externally soap is valuable as a stimulating liniment in psoriasis, lichen, eczema, and other chronic affections of the skin.

Manufacturing soaps, such as the wool and silk scouring soap, consist of neutral compounds of olive or lard oil with potash. It is very essential that these soaps should be neutral and freely soluble. A strongly alkaline soap would injure the delicate fibre and at the same time not prove so efficient a detergent. Other special soaps for textile purposes have benzine, carbon tetrachloride, etc., incorporated in them, often in the form of an emulsion. They are used for dry cleaning.

The most important of the water-insoluble soaps (soaps or salts of the alkaline earths and heavy metals) are aluminium soaps, used in waterproofing compositions and in leather substitutes; and lead, zinc, iron, nickel, cobalt, and chromium soaps, used in paints, colored varnishes, and as driers.

Theories of the Detersive Action of Soaps. Berzelius' theory formulates the dissociation and subsequent formation of an acid soap which forms the suds and free alkali uniting with any greasy matter present. This is the generally accepted theory to-day. On the other hand Rotondi, who made a careful experimental investigation of the subject, maintained that soaps decompose in solution, not into acid soaps and free alkali, but into acid soaps and basic soaps, the latter being precipitated from solution by common salt without losing any alkali, while acid soaps are completely soluble in hot solutions of basic soaps. The basic soaps, according to Rotondi, have the power to emulsify, but not to saponify (unite chemically) with fatty bodies, and it is to this emulsifying power that the detergent value of soaps is due. Recent experiments conducted with fabrics impregnated with emulsifiable but not saponifiable materials, such as kerosene oil, seem to confirm Rotondi's opinions. Soap also cleanses by reducing surface tension and so concentrating on surfaces that adhering particles are removed. See Fats; Lauric Acid; Oil; Oleic Acid; Olein; Palmitic Acid; Palmitin; Stearic Acid; Stearin; etc.

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SOAPBARK TREE (*Quillaja saponaria*). A medium-sized tree belonging to the family Rosaceæ, native of Peru and Chile and cultivated in other countries. The bark contains saponin and yields a lather with water. In a powdered form the bark is used in cleaning fine fabrics, especially woolens. It is also employed in mineral waters, shampoos, etc., to produce foam. A tincture of the bark is used in medicine.

SOAPBERRY (*Sapindus saponaria*). A West Indian tree, 25 to 30 feet tall, of the family Sapindaceæ, occurring also in southern Florida. Its pulpy fruit, which contains saponin, is used instead of soap in washing—a use apt to injure linen. With the exception of *Sapindus drummondi* a tree 30 to 40 feet in height, found in the southern United States from Florida to southern Kansas, the genus is tropical or subtropical. The fruits contain shining black, very hard nuts, formerly used for making buttons. See Sapindaceæ.

SOAP BUBBLES. Many important applications of the mechanics of liquid surfaces can be studied very conveniently by means of soap bubbles and soap films. The fundamental property of such surfaces is that they always contract as much as possible. Thus a bubble contracts until the process is stopped by the pressure of the enclosed air. The formula connecting this pressure with the radius of the bubble is $p = \frac{4T}{r}$ where T is a constant measuring the "surface tension" of the liquid. (Inside a drop, the pressure is $\frac{2T}{r}$. A bubble has *two* contracting liquid surfaces, and so the pressure is twice as great as in a drop.) By measuring the diameter of a bubble and the pressure upon the air within, the surface tension of the film can be measured. Naturally the pressure in a small bubble is greater than in a large one because the curvature of the surface is greater. This is shown if two bubbles of different sizes are joined as in Fig. 1, when it will be observed that the partition film p is always convex into the larger bubble A, being pushed to that form by the greater pressure in the smaller bubble B. In air quiet and free from dust two bubbles may be rested against each other (Fig. 2, a) like two elastic balls, but if a stick of sealing wax be rubbed to electrification and brought near them they will coalesce (Fig. 2, b). One bubble may be blown inside of another (Fig. 3, a). Then electrification will cause it to fall through the outer bubble to the form Fig. 3, b. Soap-bubble films on wire frames arrange themselves in a manner well to confirm and illustrate the laws of the composition and equilibrium of forces. A wire frame (Fig. 4, a) with a thread tied upon it is instructive. If it is dipped in soap solution and a complete film put on it the thread will move freely about in the film, but if the film on one side of the thread be broken the film on the other side will pull the thread to the form b. If the thread have a loop in it the form c may be obtained and the open ring will move freely about in the film. A good solution is made of fresh oleate of soda with a little glycerin, or Castile soap may be used. Great care must be exercised to keep the solution free from dust, but it must not be filtered. Consult C. V. Boys, *Soap Bubbles and the Forces which Mold them*, in "Romance of Science Series" (London, 1900). See Capillarity; Interference.

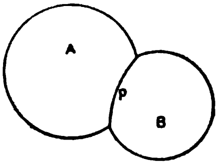

Fig. 1.

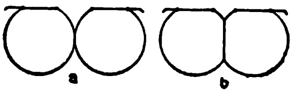

Fig. 2.

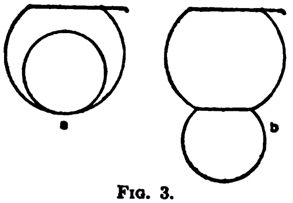

Fig. 3.

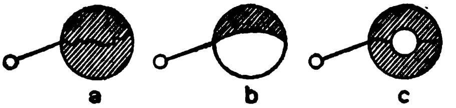

Fig. 4.

SOAPFISH (so called from the unctuous skin, due to smooth scales and an excessive flow of mucus). 1. A West Indian fish (*Rypticus saponaceus*), related to the sea bass and locally called jabon and jaboncillo. It is of small value. 2. See Lizard Fish.

SOAPSTONE, Steatite, or Talc Rock. A rock composed essentially of the hydromagnesian mineral talc, but never chemically pure, owing to the presence of varying quantities of other minerals, such as mica, chlorite, amphibole, pyroxene, etc. Soapstone is a massive rock, of bluish-gray to green color, and soft enough to be readily cut with a knife. It is a secondary rock, derived from the alteration of magnesian silicate minerals by metamorphism. Soapstone, though durable, is undesirable for building purposes because of its dark color. On account of its softness, insolubility, and heat-resisting qualities it is widely used, these uses including wash or laundry tubs, electric switchboards, insulators, table tops, and, in the case of the harder varieties, stair treads.

SOAPWORT (*Saponaria*). A genus of plants of the family Caryophyllaceæ. *Saponaria calabrica* is a favorite garden annual. Common soapwort, bouncing Bet (*Saponaria officinalis*), is found on roadsides and banks of streams in many parts of Europe and America. Both root and leaves contain saponin and are sometimes employed for washing; the bark of the root, however, is apt to redden white articles. Some species of *Gypsophila*, and allied genus, are called soaproot and contain saponin. Thus the Egyptian soaproot (*Gypsophila fastigiata*) and the Spanish soaproot or jabonera (*Gypsophila vaccaria*), which are in commerce, have been employed for washing from time immemorial, and the roots, not having a dark rind, can be used upon white articles and upon fabrics that will not bear the action of soap. A number of species of *Gypsophila* are grown in gardens as ornamentals.

SOBAT, sô-bät′. A tributary of the upper Nile. Its headwaters rise in western Abyssinia and the upper Sudan, and it flows northwest, joining the Nile in about lat. 9° 30′ N. (Map: Africa, H 4). Its length is about 700 miles, and it has been ascended by gunboats over 200 miles. Several of its tributaries are also navigable. Its union with the upper Nile forms the White Nile, a name derived from the characteristic color of the Sobat waters.

SOBIESKI, sô′bê-ĕs′kê, JOHN. See JOHN III SOBIESKI.

SOBK, or **SEB′EK** (Gk. *Σοῦχος*, *Souchos*). An Egyptian deity, represented either in the likeness of his sacred animal, the crocodile, or as a man with a crocodile's head. At Ombos he was combined with the sun god Re, in the Libyan nome he was regarded as a manifestation of Osiris, but in the Fayum (q.v.) his worship especially flourished. There dwelt the incarnation of the god, the sacred crocodile Souchos, fed and ministered to by priests of its cult. After death the body of the sacred reptile was carefully embalmed and was laid away in one of the crypts of the Labyrinth (q.v.). The worship of Sobk extended far down into the Roman period, and the god is mentioned in Fayum papyri as late as the third century A.D. See EGYPT, *Ancient Religions*.

SOCAGE, sŏk′âj (AS. *sōc*, inquiry). A tenure of lands in England by which a tenant or owner of land is obliged to render certain fixed services or pay a fixed annual rent to the lord of whom the lands are held. The distinguishing feature of this form of tenure was its certainty and definiteness. Some land was so held before the Conquest, but it was not a common tenure until about the reign of Edward I. Tenure by free and common socage formerly prevailed in the United States, but has now been abolished by statute in most States, as in New York.

Where an estate held in socage descended to an infant under the age of 14 the guardian of the infant was known as a guardian in socage. See GUARDIAN; REAL PROPERTY; TENURE.

SOCIAL BRETHREN CHURCH, THE. A religious body, represented chiefly in the States of Arkansas, Illinois, and Missouri. It was formed in 1867 by members of different churches, whose views diverged as to certain points of doctrine and discipline. A book of doctrine and discipline was published in 1887. In the 10 articles of the Confession of Faith, the doctrines of the Trinity, the authority of the Holy Scriptures, redemption, and regeneration are defined substantially as they are understood by the evangelical churches. Baptism and the Lord's Supper are regarded as ordinances that were made binding by Christ and were instituted for believers only. The members number about 1000. In addition to the regular preachers, exhorters, stewards, and ordained deacons are recognized. Consult H. K. Carroll, *The Religious Forces of the United States* (New York, 1912).

SOCIAL CONTRACT, or **SOCIAL COMPACT**. Terms used interchangeably by many writers and having reference to a theory of the origin of human society. The theory was first systematically enunciated by Hobbes in the seventeenth century, but received its fullest development at the hands of Rousseau towards the middle of the eighteenth. It was discussed with much force also by Thomas Hooker and John Locke. The theory assumes that society is not a natural institution, but the result of convention among men. It assumes the existence of a presocial state in which men were in a state of nature without rights or obligations and subject to no law except the law of nature. Hobbes's view of a state of nature was that of a condition in which all men were at war with one another. Locke differed somewhat with Hobbes in his view of the state of nature, holding that it was one of perfect freedom, but limited by the fact that a man must perform every action in subservience to the law of nature. He did not regard it as a state of license or a condition of perpetual warfare. He recognized the individual right of property in the presocial state. Similarly Rousseau maintained that presocial men were not warlike, but averse to combat, if not actually timid. According to any view of the nature of the presocial state the life of man was beset by many difficulties. To escape from these, men agreed to surrender certain of their so-called rights and to form a covenant for the protection of other rights. Each therefore entered into a contract with all by which he agreed to divest himself of the natural liberty of hindering his fellow men in their efforts to obtain the same right. Rousseau's contribution is especially important, historically considered, for he held that sovereignty resided not in a ruler but in the community. Certain leaders in the American and French revolutions were strongly influenced by this doctrine.

The theory of the social compact as a means of accounting for the origin of existing institutions is now generally considered to be a legal fiction. The application of the theory as the starting point in the evolution of the state presupposes a highly developed state life, which is never consciously present in the minds of primitive individuals. Such a consciousness is attained only by historical development. Anthropology has proved that the presocial savages described by the advocates of the social-contract theory were totally incapable of conceiving the idea of contract as a means of state organization. From the historical point of view, however, especially as it affected the ideas of certain leaders in the American and French revolutions, the doctrine is important for the idea of a contract entered into by men involved a denial of the divine origin and rightfulness of the existing (monarchical) system.

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SOCIAL DEBTOR CLASSES. A term that has come into use in the literature of pauperism and criminology, and to some extent in the literature of social reform, to designate all of those elements in a modern population that either prey upon society or obtain from its bounty more than they give back in useful work. Radical reformers who insist that most of the misery of the defective and degenerate is caused by social injustice deny that the classes designated as social debtors are such in fact, and say that if the term has any meaning at all it can most appropriately be applied to the idle rich who live on accumulated property and render no definite service to the community. See Charities; Charity Organization Society; Degeneracy; Dependents, Defectives, Delinquents; Mendicancy; Socialism; Social Settlements; Sociology.

SOCIAL DEMOCRACY. See Socialism.

SOCIAL EVOLUTION. See Evolution.

SOCIAL INSECTS. See Insect.

SOCIAL INSURANCE. Insurance of workingmen against sickness, accident, old age, unemployment, including relief of widows and orphans. Owing to the inability or the unwillingness of the working classes to insure themselves against loss of income from these various causes, the state imposes upon them the duty of paying premiums or taxes, in return for which they are entitled to the insurance benefits. In most cases the full cost of such insurance is not laid upon the beneficiaries, but is distributed and placed partly upon the employer or upon the local community and the state.

The principle of workmen's compensation or insurance against the financial losses from industrial accidents has been adopted in all the European countries except Turkey, in most of the British colonies, and in some of the South American countries. Insurance of workmen is either through accident insurance proper or through the so-called workmen's compensation laws.

The German accident insurance law is perhaps the best example of foreign legislation. It was enacted in 1884, and subsequently extended till now it covers workmen and salaried employees, the latter up to $1250 yearly earnings, in industry, mining, manufacturing, transportation, and agriculture. Any one injured in the course of his employment in these occupations is entitled to the benefits as follows. In case of death compensation includes a funeral benefit and pensions for dependent survivors. The funeral money is equal to one-fifteenth of the annual earnings of the deceased with a minimum of $12.50. A pension of 20 per cent of the annual earnings of the deceased is paid to the widow till her death or her remarriage: 20 per cent is paid to each dependent child under 15 years of age; but in no case may the total of pensions paid to survivors exceed 60 per cent of the annual earnings. In case of the remarriage of a widow the pension is commuted to a single payment amounting to three times the annual earnings of the deceased. If the pensions paid to the widow and children do not equal 60 per cent of the annual earnings, further pensions may be granted up to a maximum of 20 per cent for dependent heirs in the ascending line, and up to 20 per cent for brothers and sisters and heirs in the descending line in so far as they were dependent on the deceased at the time of the accident. In computing the amount of the pensions only one-third of the excess of annual wages over $450 is counted in the earnings in the meaning of the law.

Compensation for disability includes free medical and surgical treatment and a pension based on the degree of disability. For total disability 50 per cent of the daily wage is paid up to the end of the fourth week, after that 66⅔ per cent as long as disability lasts. In case of complete helplessness the pension may be increased up to the full "annual earnings." For partial disability a pension is paid corresponding roughly to the decrease in the earning power suffered by the injured workman.

The law is administered largely through compulsory associations of employers. An association is formed for each major employment; it levies an assessment each year to cover actual (current) cost of pensions for the preceding twelvemonth; it prescribes safety regulations and sees to their enforcement; it has power to penalize an establishment which has unusual accident rate or which does not conform to a specified standard. In the exercise of these functions it is supervised by the Imperial Insurance Office. By these means the economic burden of accident insurance is made equal to all employers in the same trade, the interest of the workmen is safeguarded in minimizing the risk of accident, and it is made for the interest of all employers to introduce the best safety appliances because of the saving in cost. The associations decide in first instance whether an injured workman is entitled to a pension and to what amount. Appeal without cost is permitted to the workmen to boards in the Higher Insurance Offices on which boards both employer and workmen are represented.

Under the system of making the employer responsible for the cost of accidents and placing upon employers' associations the responsibility of inspection of machinery, safety rules, and accident prevention in general, the rate of fatal accidents decreased in Germany from 0.77 per 1000 insured in industrial corporations in 1886 to 0.59 in 1911. Accidents causing permanent disability decreased from 0.73 per 1000 insured in 1887 to 0.64 in 1911. The cost of insurance decreased notably in many industries as a result of a decrease in the frequency of accidents. The assessment in bridge construction (other than iron) decreased from 3.07 per cent of the wage cost in 1895 to 2.32 per cent in 1908. The cost of accidents in railroad construction in 1908 was only half the rate in 1890; the cost in electrical-apparatus factories has likewise been cut in two.

The entire cost of accident claims is laid upon the employing corporations with the exception of the medical and sick benefits, which during the first 13 weeks are paid for by the sickness insurance funds. It is estimated that the workmen in contributing two-thirds to the sickness insurance funds pay about 8 per cent of the cost of accident insurance.

The following table shows the population, wage earners, and the number of those insured against accident in the principal European countries.

COUNTRY	Date	Population	Wage earners	Insured against accident
Austria	1909	27,800,000	10,000,000	3,710,000
Finland	1909	3,000,000	500,000	100,700
France	1911	40,000,000	10,000,000	4,250,000
Germany	1911	65,000,000	16,700,000	24,600,000
Great Britain	1911	45,200,000	14,000,000	13,000,000
Hungary	1909	21,000,000	3,200,000	1,160,000
Italy	1911	34,700,000	10,500,000	1,800,000
Luxemburg	1910	260,000	55,000	36,701
Netherlands	1909	5,900,000	1,500,000	500,000
Norway	1910	2,400,000	400,000	381,800
Rumania	1911	7,070,000	250,000	180,000
Russia	1910	145,600,000	6,500,000	2,400,000
Sweden	1910	5,500,000	1,000,000	250,000
Switzerland	1910	3,800,000	800,000	700,000

The main features of the accident-insurance laws of other countries are similar to the provisions already noted in the German legislation. Variations in scope, benefits, administration, etc. occur. Agricultural labor is not entitled to the benefits of insurance in most European countries outside of Germany and Great Britain. Russia excludes transportation and the building trades. There is usually a minimum number of employees, varying from 5 to 15, which an establishment must employ to be subject to insurance. In most European countries full medical benefits are granted. For total disability the pension is usually 50–60 per cent of the wages; in Germany it is 66 per cent, in the Netherlands 70 per cent, and in Switzerland 80 per cent. The cost of minor accidents is met in Germany, Austria-Hungary, and Russia by the compulsory sickness insurance system. In granting compensation for death Great Britain, Belgium, Italy, Denmark, and Spain pay a lump sum instead of a pension to the widow. The whole cost of insurance is laid upon the employer except in Austria, where the workmen contribute directly 10 per cent to meet the expenses.

Workmen's compensation laws have been adopted in 25 of the United States. They are modeled more or less upon English and German legislation. The first law of those now in force on the subject of compensation was the Federal Act of 1908 applying to employees in certain departments of the national government. Three of the early State laws have been declared unconstitutional—that of Maryland passed in 1902, the Montana Law of 1909, and the New York Compulsory Law of 1910. Subsequent laws may be classified in three groups: 1. Purely permissive laws, such as the acts of Massachusetts and of New York (1910) which allowed employers by contract with their workmen to make special arrangements for compensation to avoid their common-law liability; these remained a dead letter. 2. The so-called elective laws permitted the employer to elect whether he would pay premiums to the State insurance fund under the compensation system or would submit to a suit at common law with the usual defenses of contributory negligence, negligence of a fellow servant, and assumption of risk removed. The object of this method is to avoid the constitutional difficulty. Massachusetts, Illinois, New Jersey, Michigan, Wisconsin, Kansas, New Hampshire, and many others have adopted this system; in the first four mentioned a majority of employers have elected to come in under the compensation plan. 3. Compulsory compensation laws have been adopted in Washington, New York (1913), Ohio, Arizona, and California.

The scope of these laws is much more restricted than in European legislation. Many apply only to the extrahazardous occupations. Most of the laws exclude domestic service and agricultural labor. The benefits paid are usually 50 per cent of the wages of the injured person in case of total disability, often with a maximum limit of $3000 to $5000, and usually with maximum and minimum limits of weekly payments. Funeral expenses are provided in case of death with a pension or a lump-sum payment for the widow. Adequate provision is made for hospital and medical care in but few cases.

The New York Law of 1913 is one of the most liberal in the benefits given. It allows two-thirds of the wages of the injured employee for total disability during the continuance of disability; for temporary total disability an upper limit of $3500 is set. For permanent partial disability two-thirds of the wage is paid for specified periods for different injuries, e.g., for loss of hand 244 weeks, arm 312 weeks, foot 205 weeks, eye 128 weeks, etc. For temporary partial disability the employee receives two-thirds of the difference between his former average weekly wage and his present earning capacity during the continuance of disability; the total cost must not exceed $3500. The weekly compensation must not exceed $15 a week nor be less than $5 a week, except that in case of loss of hand, foot, etc. it must not exceed $20, and in case the full wage of an injured employee is less than $5 he receives only the full weekly wage. In case of death funeral expenses up to $100 are allowed. A widow receives 30 per cent of the average wage of the deceased during her widowhood, with two years' compensation in a lump sum in case of remarriage. Ten per cent is added to the pension for each child under the age of 18 and is paid till he reaches that age. The total pension received by the survivors must not exceed two-thirds of the wage. If there are surviving children but no surviving wife, each child under 18 receives 15 per cent of the wages of the deceased. Grandchildren or brothers and sisters under 18, parents, or grandparents may receive a pension of 15 per cent if dependent upon the victim at the time of the accident and if pensions to other survivors do not equal the maximum of two-thirds of the wages. Medical aid, etc., must be provided by the employer for a period of 60 days.

The cost of German accident insurance varies from $0.10 to $14.92 (wrecking operations) per $100 of wages paid. An average rate for hazardous industries is approximately $3. The rates in Germany for six hazardous industries are compared in the table with the rates as charged under the old New York Employers' Liability Law and under the Workmen's Compensation Law.

These figures indicate that the true cost of compensation, if the cost in Germany under mutual associations of employers can be considered as approximating the true cost, should not mean a very great increase over the present charges in these industries. For all industries the cost of adequate compensation may be estimated to be about twice the charge of employers' liability.

A second division of social insurance is insurance against sickness. This is much less widespread than workmen's compensation or accident insurance laws. The following table shows the European countries which have adopted compulsory sickness insurance and the approximate number of persons insured, as well as those countries in which a large proportion of workmen are insured voluntarily through their mutual-aid societies.

INDUSTRY	N. Y. Employers' Liability Law	Workmen's Compensation	German Assessments
Carpentry............	$1.75	$5.00	$2.32
Bridgebuilding (iron)...	4.50	12.50	4.21
Quarries (stone).......	2.00	7.50	3.18
Railways (steam)......	2.50	10.00	1.82
Tunneling.............	4.50	12.50	3.75
Housesmithing	2.00	6.25	1.36

COUNTRY	Date	Wage Earners	Compulsory Insurance	Voluntary Insurance
Austria........	1909	10,000,000	3,340,000	....
Belgium.......	1910	2,100,000	....	420,000
Denmark......	1910	500,000	....	666,824
Finland........	1909	500,000	....	43,261
France.........	1911	10,000,000	205,000	4,400,000
Germany.......	1911	16,700,000	15,000,000	....
Great Britain...	1911	14,000,000	14,700,000	....
Hungary.......	1909	3,200,000	900,000	....
Italy..........	1911	10,500,000	....	1,000,000
Luxemburg.....	1910	55,000	37,736	
Netherlands....	1909	1,500,000	....	500,000
Norway........	1910	400,000	400,000	....
Rumania	1911	250,000	*140,657	....
Russia.........	1910	6,500,000	*2,500,000	....
Sweden	1909	1,000,000	....	621,411
Switzerland.....	1910	800,000	....	*800,000

* Estimated.

Germany was the first country to introduce compulsory sickness insurance. Prior to the enactment of the law miners had been insured in their compulsory associations (1854), and the communes had been authorized as early as 1849 to compel journeymen and work assistants to join local sickness funds. There was a system of local parish sickness relief in Bavaria. To extend the benefits of insurance a law was passed in 1884 making insurance against sickness compulsory on all workmen in industry. The law now extends to workmen in mines, quarries, saltworks, factories, railroads, inland navigation, construction, commerce, post and telegraph service. Domestic servants and workers in the home industries were included by an extension of the law in 1914, but during the war this provision was suspended. Employees earning more than $500 per year are not required to insure. The cost is divided so that two-thirds is borne by the workers and one-third by the employers. There are several different kinds of sickness insurance organizations: local sick funds, establishment funds, building-trades funds, miners' funds, guild funds, mutual-aid funds, and the communal sickness insurance funds. Of these the first two are the most important.

The regular benefits include free medical attendance and medicines for the duration of sickness up to a maximum of 26 weeks, after which the case is taken care of by the invalidity insurance associations. Sick money, equal to one-half of the usual local daily wage of ordinary unskilled labor, is paid for every working day beginning with the third day of sickness. Instead of sick money and medical care the patient may be placed in a hospital. Most of the funds are required to give in addition a benefit equal to sick money for a period of six weeks for childbirth, if contributions have been paid for at least six months previous. Funeral money equal to 20 times the average daily wage is paid. Besides these regular benefits, which the funds are obliged to give, they may give in addition sick money for a year instead of for 26 weeks only, equal to three-fourths of the daily wage, payable for every day of sickness; they may give sick pensions to the dependents of an insured workman in case the workman is undergoing hospital treatment; hospital treatment may extend to a year, funeral money may be doubled, with a minimum of $12.50, and made payable in case of the death of a member of the family of the insured. Medical attendance may be given to members of the family, and the benefits in case of childbirth may be increased.

The contributions are levied by the local funds sufficient to meet the cost of the benefits offered by it. The cost may not exceed 6 per cent of the wages; an average cost is between 3 and 4 per cent. A large proportion of the funds offer more than the regular benefits. The workmen, who contribute two-thirds to the cost, are permitted to elect two-thirds of the members of the executive boards of the sick funds. Much criticism has arisen over the tendencies of these boards, many of which are distinctly social-democratic in composition. Each fund is allowed to make contract with the physicians of the locality for the performance of services to the insured workmen, and many controversies have arisen over the remuneration and selection of these favored physicians. Contracts with apothecaries regulate the supplying of medicines, etc.

Each insured person is sick on an average eight days per year, costing (average) $0.80 per day for sick money, medicines, medical care, etc.

Permanent sickness or invalidity is cared for under the Invalidity Insurance Law. See OLD-AGE PENSIONS.

The compulsory sickness insurance laws of the other European countries are modeled very closely upon the German law. Austria passed a law in 1888, Hungary in 1891; Norway followed in 1909, Servia in 1910, Great Britain in 1911, and Russia and Rumania in 1912. In Italy, the Netherlands, Belgium, and Sweden proposals are under discussion. In Great Britain recognition had to be given to the already existing friendly-aid societies, and they are made the organ of administration. Right of rejection of poor risks is permitted. A minimum membership of 5000 is required, as against 100 under the German plan. Rejected and uninsured persons are permitted to deposit savings in the post office to be utilized in case of sickness. The British system treats invalidity as a part of the insurance against sickness. Weekly contributions are required of workmen, employer, and state as shown in table on page 230.

In Rumania all the cost is placed on the employee. In Servia the contributions of employer and employee are equal. Russia divides the cost two-thirds for the worker and one-third for the employer, but places the entire cost of medical aid on the latter. Norway puts 60 per cent of the cost on the employee, 10 per cent on the employer, 10 per cent on the commune, and 20 per cent on the state.

PENSION CONTRIBUTIONS (GREAT BRITAIN)

SOURCE	For male persons	For female persons
Insured	4d.	3d.
Employer	3d.	3d.
State	2d.	2d.

In France miners are required to insure themselves against sickness, paying contributions up to 2 per cent of their wages, to which the employers add a subsidy equal to one-half of the contribution. Seamen and railroad employees are likewise required to insure. Except for these special laws, sickness insurance is left entirely to the workmen themselves. Railroad employees in Italy are required to insure.

Voluntary insurance against sickness is well developed in France, Italy, Denmark, the Netherlands, and Sweden. It is carried usually through the medium of mutual-aid societies or through the trade unions. A grave defect is frequently the lack of a sound actuarial basis. Approximately 10 per cent of the population in France, 5 per cent in Belgium, 25 per cent in Denmark, 10 per cent in Sweden, 3 per cent in Italy were voluntarily insured against sickness. In Spain less than ½ of 1 per cent are insured. The amount of the benefit granted is usually independent of the wages received. In France it is on an average about $0.30 a day, in Italy seven-tenths of the societies grant less than $0.20 a day. In Great Britain the benefits are substantially higher. Usually a time limit of from 4 to 26 weeks is placed on the receipt of the sickness benefit. In all these countries the mutual-benefit societies have been regulated by law and societies satisfying certain requirements have been granted privileges. In order to encourage the formation and development of these societies direct government subsidies have been given to recognized funds in Sweden since 1891, Denmark since 1892, Belgium since 1904, France since 1910, and in Switzerland since 1912. Denmark added a subsidy of one-fifth the revenues of the societies from dues with a maximum limit of $0.54 per member. The Swiss benefits are somewhat more liberal, those of France and Belgium rather insignificant. The subsidies have had a considerable effect in stimulating the growth of the societies in Denmark and Sweden. The chief elements of weakness are the limited membership and the small amount and duration of the benefits.

Sickness insurance is not very widespread in the United States. Many of the national and local unions have benefit features, and a small proportion give benefits for temporary disability. In the benefit funds, establishment and railroad funds, and in the unions a total of approximately 1,130,000 workmen are insured (1907). In the mutual sick-benefit associations including the fraternal organizations which made provision for sickness, 825,770 certificates were in force at the close of 1910 and $2,375,967 was paid out for claims. Besides these, in health and casualty companies, perhaps 200,000 workers are insured. Altogether approximately 2,000,000 workmen are protected against sickness in the United States.

Insurance against unemployment is comparatively undeveloped. The difficulties of determining when a man is unemployed as distinct from out on strike or lazy and of controlling the payment of benefits have deterred governments from attempting to insure against unemployment. The risk of unemployment is dependent partly upon personal qualities. Trade unions have given out-of-work benefits to their members. In Great Britain 1,500,000 members of unions out of a total union membership of 2,500,000 enjoyed the benefit of protection against unemployment. In Germany some 2,000,000 union members are protected through the unions. American unions have not developed unemployment benefit features, only $240,717 being distributed in out-of-work allowances in 1910. Trade-union control reduces the danger of malingering to a minimum, and in the same trade the risk of unemployment is more or less evenly distributed.

	No. funds	Workmen	Spent on Temporary Disability
National unions	19	375,000	$830,000
Local unions	346	100,000	200,000
Industrial benefit funds	35	55,000	250,000
Establishment funds	374	300,000	1,200,000
Railroad funds	31	300,000	2,000,000
Approximate totals	805	1,130,000	$4,480,000

The Ghent system of unemployment insurance, which was organized in 1900, is really a system of liberal subsidies to unions which give out-of-work benefits. Usually the subsidy equals 60 per cent of the original sum paid to the unemployed, but is not paid for more than 60 days in one year to the same person. Forty-three unions with 18,500 insured participated in the benefits in the city of Ghent; in eight years $130,000 was paid for 375,000 days of unemployment, $44,000 of which was given by the city.

A number of large municipalities in Belgium, France, Germany, and Holland have adopted the Ghent system; Belgium since 1907 gives a small subsidy to communal unemployment funds; France gives a small aid to unemployment associations; Norway and Denmark have national systems of subsidized insurance covering about 50,000 persons in Norway and 100,000 in Denmark. Under the Norwegian law one-half of the wage is the maximum limit of an unemployment benefit, and in Denmark the benefit varies from $0.13 to $0.54 a day. Altogether approximately 250,000 wage earners are insured under the Ghent system.

Great Britain is the only country that has established compulsory insurance against unemployment. The law applies to construction and engineering occupations only and includes 2,400,000 workmen. The employer and the employee contribute equally, five cents a week apiece, and the state adds a subsidy of 3⅓ cents. In case of unemployment the workman receives $1.75 per week for 15 weeks in any one year, provided he has to his credit five weekly premiums for every weekly benefit he claims. No benefit is given for the first week. The dues are all placed in a general fund. The unions are permitted to make use of the fund with the employers' and the state subsidies to continue their own out-of-work benefits at reduced cost. The employer may claim reimbursement of one-third of his own contributions for each employee continuously employed by him (40 weeks in the year). Each insured workman at the age of 60 may claim the return of the difference between his contributions and the amount drawn by him in unemployment benefits. In times of industrial crisis the benefits may be lowered to $1.25 a week and the dues may be increased by two cents a week for both employer and employee. The experience up to the outbreak of the war indicated that the receipts were more than enough to cover the expense. An indispensable feature of the law is the establishment of national labor exchanges, by which unemployment can be kept at a minimum, the fact of unemployment can be established, and the payment can be controlled. A man refusing to accept a position at union rates in another district is no longer entitled to his benefit.

A recent development in social-insurance legislation is provision for widows and surviving dependent children of workingmen. In connection with the compulsory old-age pension system of France (1910) death benefits are provided payable in three to six monthly installments of 50 francs each. Germany included pensions for survivors in the benefits offered under the new codification of the Insurance Law (1911). A widow who is or becomes invalid is entitled to a pension equal to 30 per cent of the invalidity pension which the contributions of her husband would have entitled him to receive, plus an Imperial subsidy of $12.50. A child under 15 receives 15 per cent of the father's invalidity benefit plus a state subsidy of $6.25. Additional children receive 2½ per cent of this benefit plus the subsidy. An average invalid widow's pension would be approximately $20 per year as compared with the average invalidity benefit of $40; an invalid widow with three children under 15 would be entitled to perhaps $37, or nearly as much as the father would have received in case of invalidity. The contributions to invalidity insurance were increased by an amount varying from one-half to three cents a week to cover the estimated additional expense.

Widows' or mothers' pension legislation has been enacted in 21 States in the United States. Pensions are given to widows or to wives of deserting, invalid, or imprisoned husbands for the care of dependent children. The object is to prevent the break-up of the home and the loss of home influence in cases where the family is worthy of preservation. The allowances are paid either wholly by the State or divided between the State and the county or city. Administration is vested in a special board as in Pennsylvania, or in the juvenile courts as in Illinois and Ohio, or in the poor-relief boards as in Massachusetts. The benefits are fairly liberal, e.g., $15 per month for one child and $7 for additional children in Ohio. In Illinois from July, 1911, to November, 1912, 512 families with 1723 children were aided at an average grant per family of $21.99 per month. Massachusetts gives aid of from $1 to $15 weekly. From Sept. 1, 1913, to May 1, 1914, 2209 cases with 6889 children in 140 cities and towns were assisted. A count of 1889 families on February 24 showed an average weekly allowance of $5.42.

Denmark passed an Act in 1913 which provided for special benefits to needy widows with children to be paid by the state and the local commune. These benefits are distinct from poor relief. An allowance of $27 a year as a maximum is paid for each child under two years of age; the maximum benefit is $21.60 for children from 2 to 12 and $16.20 for children aged 13 and 14.

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SO'CIALISM (from *social*, from Lat. *socialis*, relating to companionship, or association, from *socius*, companion, associate, from *sequi*, to follow; connected with Lith. *sekti*, Gk. *ἕπεσθαι*, *hepesthai*, Skt. *sac*, to follow, and ultimately with Eng. *see*). As the term is now used, socialism is an ideal economic system in which industry is carried on under social direction and for the benefit of society as a whole. It is contrasted with the competitive régime of existing society. The word "socialism" has been used to convey a variety of meanings and is only gradually assuming a definite significance, as a result of the careful analysis of generations of socialistic thinkers and their critics. Moreover, the ideal organization of socialism has to a great extent been influenced by actual industrial changes.

An earlier term by which socialism was known is communism (q.v.). Efforts to distinguish communism from socialism cannot be said to have been successful. Sometimes communism is used to refer to the voluntary organization of small bodies of men who have common property and who carry on production in common, sharing among themselves the fruits of their toil, as a rule, in such a way as to give each one an equal allotment of economic goods, but not of honors and consideration.

In this sense communism may be distinguished from socialism in that the latter implies a thoroughgoing reconstruction of society through political action, while the former calls upon men to separate themselves from general society and to form communal societies for themselves.

Socialism is sometimes called collectivism. Those who employ this term feel that their schemes of social reform are more likely to secure a hearing if called by some other name than socialism. For a time in the United States the term "nationalism," introduced by Edward Bellamy in his book *Looking Backward*, was synonymous with socialism.

The origin of the word "socialism" has been the subject of much discussion. It has been claimed that it was first used in 1840 by a French writer, Louis Reybaud, in his *Études sur les réformateurs contemporains ou socialistes modernes.* The word, however, was used in the early thirties in England, and the publications of the followers of Robert Owen show that it had become current before 1840. John Spargo, in the *Comrade* of March, 1903, traces the word "socialism" back to 1833.

In addition to the terms "socialist" and "socialism," we have the terms "social democrat" and "social democracy," very commonly used as synonymous. It was long supposed that these words were of German origin, but at least as far back as 1838 they were coined by Bronterre O'Brien, an early socialist, who took part in the Chartist agitation. The words were used by O'Brien in opposition to any aristocratic socialist schemes and in advocacy of democratic socialism.

The constituent elements of socialism and its most essential characteristic must next be examined. The lack of scientific accuracy in popular writings concerning socialism shows that this complex concept is not generally understood, although its formulation has become clear and precise enough, so that it should not be difficult to grasp its essential elements. Socialism implies, in the first place, a changed attitude towards property. Our economic life is dominated at the present time by private property, and in all cases, even where public property is largest in amount, it appears as an exception to a general rule. The world's work is carried on under the domination of private property. Socialism means that this process is to be reversed and that the world's work will ultimately be dominated by public property.

Accumulated wealth is divided by modern economists and socialists alike into productive goods and enjoyment goods. We have also a further distinction between accumulated wealth and income wealth, the annual product of toil, which may be used up each year. Now, as understood to-day, socialism means that the instruments of production shall in the main be public or collective property. While the most conservative socialists do not insist upon public ownership of all land and capital, they consider it essential that the chief kinds of capital and the greater part of the land should be collective property. Socialists formerly held that all land should be owned by society, but lately the most conservative socialists have been inclined to make concessions to small landowners who cultivate their property and to concede to them private ownership so long as they find it desirable. On the other hand, modern socialism has emphasized strongly private property in income. It is on this account that socialists frequently deny most strenuously that they are opposed to private property and claim that they wish to extend private property. They refer always to income. They wish each one to have his income and to have that under his control.

The first constituent element of socialism may therefore be stated to be a substitution of collective property in the great material instruments of production in the place of private property to such an extent that public property shall dominate the world's work. The second constituent element is private property in income and private property in those goods which are used for the sake of enjoyment and not for the acquisition of an income by rent or hire to others.

Modern socialists desire to disturb existing arrangements as little as possible in attaining the main end of socialism: the abolition of the private receipt of rent and interest, the incomes from private property. With collective ownership the income yielded by land and capital must also become collective. The purpose is the common enjoyment of the advantages yielded by land and capital, in order that there may be no income apart from personal effort and that the income yielded by personal effort may be increased. Socialists generally attempt to establish this view theoretically by the doctrine that all value is to be attributed to labor. The cruder forms of socialism have so emphasized manual labor as to imply an underestimation of intellectual services. With the rise of a higher class of socialistic thinkers, however, this crude view has lost its prominence. Socialists now generally fully understand that intellectual service is as important as manual labor, and they find a place for both in their plans for a future society.

Socialists and economists are alike agreed that production has become largely a social process and that the socialization of production increases day by day. What the socialists complain of is that, while production is a social process, the control of production is in the hands of private owners. They discover an antithesis between social production and individual control and demand accordingly that the socialization of production shall be accompanied by social or collective management. Modern socialism demands collective management of each industry, and it demands that all the industries should be associated together in order thereby to secure perfect system, harmony, and unity of effort. Because individual producers do not act together, but act each one for himself, the socialists reproach present society with planlessness, which they say gives us industrial crises and stagnation.

Finally, socialism means the distribution of income by some common authority. If organized society owns the instruments of production and conducts production, necessarily the product of industry in the first instance falls to society, as it does now to the individual owners and managers. Society must then in some way divide up the income which results from collective economic efforts, giving to each one his due share. Under socialism the great mass of men would be salaried functionaries of society, and the aim would be in one way or another so to adjust their salaries that in the aggregate they should equal the total wealth produced for consumption.

Formerly there was a greater inclination on the part of socialists than there is now to accomplish their ends by measures of compulsion. It was proposed that every one should be forced into the system of collective production and in return receive a subsistence. Modern socialism does not propose directly to force any one into the socialistic scheme. If any one is able to gain a livelihood by his private efforts, socialism is quite content that he should do so. He will not be able to gain an income from ownership of the chief instruments of production, as these will be public property. He may, however, own tools which he can use in production, if he can induce men to purchase his product. Socialism contemplates a public provision for education as at the present time, but it does not propose to throw any obstacles in the way of a man who desires to organize private schools. A public organization of medicine is contemplated by socialism, but the modern socialist does not see any reason why a physician who desires to engage in private practice should not do so, if he can find those who prefer his services to those of the public physicians.

Modern socialism is international and cosmopolitan. With the growth of the business unit and the cheapening of transportation, the economic ties binding men together have extended geographically until the whole world may be said to have become a single economic unit. It is natural that socialism, influenced by the development of economic society, should also have become international. A further reason for the international character of socialism is to be found in the fact that the leaders of socialistic thought, having called in question and having rejected the existing economic order, are also in the mood to call in question the advantages of the existing political order. They see few or no advantages coming to the workers from the national boundaries and arrangements which separate men. They desire fraternity among the toilers, but as a result of national differences they see the toilers fighting each other, and they make the claim that all wars take place at the expense of the laborer and for the advantage of a small military and industrial class, who derive therefrom on the one hand glory and on the other pecuniary profit. It is conceded, however, that certain wars, notably wars leading to territorial consolidation and wars against hopelessly reactionary states, may have a progressive tendency and be useful to socialism in the end.

The internationalism of socialism was one of the leading thoughts of Karl Marx (q.v.). The first noteworthy result of this internationalism was the organization in 1864 of the International Workingmen's Association (q.v.), which declared in the by-laws adopted in its first meeting that the emancipation of labor was a social problem, requiring the coöperation of the most advanced countries. Since 1889 the socialists have held international congresses once in three years, and in 1900 the International Bureau of Socialism was established at Brussels to serve as a common centre for socialism of all countries.

As socialism has grown in strength and become a political power, a more conservative and rational attitude towards nationality has been developed. Patriotism is no longer execrated as a device for blinding the workers to the evils of exploitation. Militant socialism is still far from the glorification of patriotism and does not seek anywhere to cultivate it, but its attitude might be described as at least neutral. The fraternity of workers the world over is still the dominant idea, although it seemed to suffer eclipse upon the outbreak of the European War in 1914, when the socialists of the several warring countries proved eager to take their part in military affairs. In the attitude taken towards the nation there is, however, a line of cleavage among the socialists. In every country there is a conservative or right wing of socialists who favor active participation in the national life and efforts to bring about improvement even in coöperation with older political parties.

The attitude of socialism towards the state has, during the hundred years of its existence, undergone a development in which we may discover several distinct stages. 1. In the first stage we have as leaders of thought Robert Owen, Etienne Cabet, Count Henri de Saint-Simon, and Charles Fourier (qq.v.). These socialists, with the exception of Owen, did not call particularly upon the state for assistance in their efforts to achieve socialism, preferring generally coöperation based upon voluntary principles. They believed that by establishing communistic settlements they could demonstrate to the world the advantages of socialism, and that very soon all men would join communistic associations which would then in one way or another be federated together. 2. Louis Blanc (q.v.) in the middle of the nineteenth century may be regarded as the one who more than any other founded political socialism. He held that socialists should seek to gain control of political power, and he appealed directly to the state for aid in the establishment of socialism. Ferdinand Lassalle (q.v.) in Germany took a quite similar position, emphasizing most strongly the establishment of coöperative industrial undertakings with the aid of subsidies from the state. 3. A third stage is found in the attitude of the followers of Karl Marx and Liebknecht. These look askance upon existing governments, and the orthodox Marxist is strongly inclined to oppose government ownership and operation of industries by the existing state, which is condemned for following capitalistic principles in the enterprises it manages. The German socialists have, then, no special enthusiasm for the state ownership and operation of the railroads in Prussia, and in the United States the municipal ownership and operation of public utilities is very frequently opposed by individual orthodox socialists. The programme of the socialists is, first, the capture of the existing organs of government by the wage earners, and then the inauguration of public ownership and operation of industries. 4. The fourth stage is represented by the conservative or extreme right faction of the socialists, who are willing to coöperate with existing parties in reforms which are in general harmony with the socialist programme, such as municipal ownership of public utilities and government ownership of railways. These socialists are called opportunists and in France possibilists. The Fabian socialists are the best illustration because they decide upon action in each case as it arises. Democracy is an essential part of political socialism. Political socialism is not merely socialism; it is socialism plus democracy, with an inclination to place democracy first. Democracy to the socialist does not mean the kind of government which prevails in the United States, but the kind of government which is completely controlled by the workers. Direct legislation is favored, and the initiative and referendum as agencies of direct legislation are very generally advocated. As a rule, if not universally, the plan for the operation of industries is election of foremen, superintendents, and managers by the wage earners.

Socialists take a view of the state which in some respects suggests the position of Herbert Spencer and other individualists. They hold that under socialism the functions of the state along many lines will be greatly diminished. Crime, they think, will very nearly disappear, and pauperism will entirely cease. Standing armies will be abolished and a popular militia substituted therefor. The functions of the law courts will also disappear, they maintain, with the abolition of private property in the instruments of production, which is the fruitful cause of litigation. The chief function of government will be found in the administration of industries. They have, therefore, a conception of the state so different from that of the present state that they dislike the expression "the state" and abhor "state" socialism. The word "official" is also objected to because it suggests present bureaucratic governments. The attitude of the orthodox socialist towards the state finds clear expression in the work of the German socialist August Bebel, *Die Frau und der Socialismus* (51st ed., 1910).

During the evolution of socialist thought which has just been sketched anarchism has become separated from socialism. (See ANARCHISM.) Among early socialists there were variations of opinions concerning government, and some, like William Godwin (q.v.), were inclined to take an attitude of radical antagonism to government as such. We thus find anarchistic tendencies in socialism along with tendencies of a very different and altogether antagonistic sort. The cleavage gradually became more pronounced. Pierre Joseph Proudhon (q.v.) is frequently spoken of as the founder of anarchism, and in him we find the doctrines of anarchy reaching such a development that probably more than any one else he is to be designated as the founder, although his views are not worked out so clearly and systematically as those of his followers. For the sake of convenience we may take Proudhon's book *What is Property?* and the date of its appearance, 1840, as the beginning of modern anarchism. The form of anarchism founded by Proudhon is that of complete individualism. This type of anarchism has had some development in the United States under the leadership of Benjamin R. Tucker (q.v.).

The anarchists of whom we hear most are of quite a different stripe, and their anarchism is, by way of distinction, known as anarchist communism. This school of anarchy was founded by Mikhail Bakunin (q.v.) and may be regarded as an outgrowth of the International Workingmen's Association, to which Bakunin belonged. Bakunin and Marx for a time worked together; they both regarded themselves as socialists, Marx calling himself a communist and Bakunin describing himself as a collectivist. Socialism and anarchism were not at first recognized as antagonistic principles, but the differences between them developed continuously. The anarchist communists held to the doctrine of associated effort and considered themselves as true communists and not as individualists. They are radically opposed to public authority and believe that with the abolition of the state men will spontaneously form coöperative associations which will voluntarily form federations for mutual aid. Like the socialists, the anarchists advocate a coöperative commonwealth, but they differ from the socialists with respect to the organization of that commonwealth and more especially in the methods whereby it is to be reached. The question of tactics has been largely instrumental in the growth of hostility between socialists and anarchists. Anarchists deny that the state rests upon any ethical foundation, and consequently there can be no wrong in opposing government and seeking its overthrow. Government to the anarchist means force and nothing more, and the question of resisting it is one of expediency only. If the anarchists believe that they have a superior force, they must necessarily attempt to overthrow organized government. Socialists, on the other hand, take no such attitude of antagonism towards the state, although they may think and do think that the socialist state will be something different from the present state. They hold, moreover, that changes must come about by evolutionary processes and are opposed to insurrectionary movements where other means are open. Marx and Engels condemned violent methods very early in their career, and, as socialists have taken a part in the work of government in the various countries of the civilized world, they have increasingly favored the maintenance of law and order, believing that their ends can be achieved by legal means. The socialist to-day is the strongest opponent of anarchism. It was the socialists, not the German government, who really drove Johann Most (q.v.), one of the leaders of communist anarchism, from Germany, and it is the German Social Democrats who practically extinguished anarchism in their country.

The attitude of socialism towards the family has varied, but now it has become a definite one of neutrality. Early socialists were inclined to assume a general position of radicalism with respect to all institutions of society, seeing more quickly and easily the disadvantages of any present social arrangement than its advantages. Moreover, the early socialists found the family to be the basis of the economic society which they attacked. Marriage in its present form seemed to them to carry with it the oppression of woman. It cannot be said that socialism ever had a distinct doctrine of the family, but until recent years it was inclined to what would be termed at least lax notions of the marriage tie, holding that the bond of union between man and woman should be love alone, and that when love disappeared there disappeared with it the reciprocal obligations of marriage. Socialists of the present time do not see any reason why they should have a peculiar view of the family, and they are not in this particular distinguished from other people.

The attitude of socialism towards religion has undergone a similar change. The Church as one of the institutions of existing society long appeared to the socialist to be a bulwark of oppression. Modern socialism, however, has separated the economic question from the religious question, and now everywhere regards religion as a "private matter."

Readers of current socialistic literature frequently find a sharp distinction drawn between what is termed Utopian socialism and scientific socialism. Socialism before the ascendency of Marx was very largely Utopian in character. The early socialist looked upon society as an artificial product and thought it possible to develop a scheme of society which, if introduced, would bring with it a real earthly paradise. It was thought that the very nature of man could be changed by a wisely devised scheme of socialism. Owen's most fundamental social doctrine was that circumstances form the character of man and that right circumstances would give us right-minded and right-acting human beings. In the latter part of the eighteenth century the idea of society as a growth with laws of its own had not been clearly grasped, and adherents of private property as well as communists believed in the possibility of the most fundamental changes by means of a revolution which could take place overnight. The result of this attitude was the elaboration of all sorts of fantastic schemes. Owen planned his communistic villages of two or three thousand, but the highest development of purely artificial plans is found in Fourierism (q.v.), with its phalanxes and phalansteries. The modern socialist plumes himself upon his science and has a lofty scorn for all Utopian socialism. He may admit that it had its historical meaning and have a certain toleration for it as something belonging to the past, but when he meets it at the present time he views it with even more contempt than does the ordinary economist.

An adequate treatment of the character of this alleged science which underlies socialism requires at least a brief examination of the socio-economic philosophy of Karl Marx, since it occupies a central position in the economics of socialism. The doctrines of Marx are still held in the main by the great body of socialists, and they underlie the platforms of socialist parties throughout the world.

Marx opens his work on *Capital* with an explanation of value. He finds that the element in economic goods which gives and measures value is labor. Labor has its exchange value, and this is governed by the cost of labor, and the cost of labor is determined by the subsistence of the laborer in accordance with his standard of life. The employer of labor pays in wages the cost of labor, but the laborer, according to Marx, produces more than this cost, and the difference between what the laborer produces and the wages of labor he designates as surplus value. This surplus value Marx regards as the source of all rent, interest, and profits. All value, according to the doctrines of Marx, is produced by labor and belongs to labor. Labor receiving, however, only subsistence wages, Marx holds that it is robbed of surplus value, which, through the processes of production and exchange, is transferred to the nonwage-earning classes. Marx maintains that it is only through socialism that labor can receive the full value which it produces, so that surplus value will disappear. This doctrine, while still accepted by perhaps the majority of socialists, is rejected by some and generally receives less emphasis than formerly.

The theory of Marx which just now is much more discussed is that commonly designated as "the materialistic interpretation of history." According to this theory history is made up of successive stages, in each of which the social organization is determined by the methods of production and exchange. The ideal factors in history, such as religion and ethics, are a mere reflection of the underlying economic phenomena. Socialists themselves have been inclined to qualify, and have qualified in all their agitation, this doctrine in such a way as to give a large place to the will of man. They hold that the development of society takes place in accordance with evolutionary laws, but that man himself is a part of the evolution and helps determine it. There is always, however, a marked distinction between this so-called scientific socialism and Utopian socialism, inasmuch as scientific socialism asserts that the will and desires of men can be effective only in so far as they act in harmony with the general tendencies of evolution.

It is important to notice, however, that, in accordance with the teachings of Marx, the evolution of society is such as to lead inevitably to monopoly. Marx believed that large-scale production has an advantage over small production; consequently that the large producers sooner or later must crush out the small producers, until each branch of production falls under monopolistic control. In the meantime the wage earners are brought together in ever-increasingly large numbers; they are, to use his own words, "schooled, united, and disciplined by the mechanism of the capitalistic processes of production." The inevitable result, he held, would be such a concentration of productive wealth and such great solidarity of the working classes that the system would break down of its own weight and the laborers would gain possession of the means of production.

It is to be observed that each stage in economic development has its own place. Feudalism was once a suitable social organization, but in time it had to make way for capitalistic production. Capitalistic production has performed a service which Marx recognized as clearly as a modern economist, but Marx held that capitalistic production has very nearly run its course and that it has rendered the chief services of which it is capable. Marx held that "along with each decrease in the number of magnates of capitalism there goes an increasing mass of misery and degradation." Belief in the increasing misery of the masses was an essential part of socialistic doctrine a generation ago, but it has to a great extent been abandoned. Intelligent socialists now clearly see that from the masses of men sunk in misery there can come no able and vigorous recruits for socialism. An important practical consequence is that socialists now are more favorably inclined to take immediate measures which elevate the masses, because they hold that thereby men will become better prepared for socialism.

Another theory of Marx finds expression in what is now termed class consciousness. It was, according to him, necessary that the wage earners should become conscious of themselves as a class in the community having interests of their own and that they should rely upon self-help and not upon the help of other classes for their emancipation. Socialists frequently make a distinction now between socialism as a system and socialism as a principle of action. This is a distinction made by Sidney Webb (q.v.), the intellectual leader of the Fabian socialists, and also by Edmond Kelly (q.v.). Kelly regards socialism, or, to use his own term, collectivism, as the method of attainment of justice rather than as a condition of society in which justice has been attained. He has little concern with collectivism as "an ideally perfect state of society," but he looks upon collectivism as a principle of action, pointing out a general line of growth which seems to him desirable and which he believes can be aided by intelligent effort.

Let us now turn to the criticism of socialism by economists. First of all, it should be noticed that no professional economist is a socialist unless it be the Italian Loria (q.v.). Socialists claim that the opposition of all economists does not signify anything as to the correctness of socialism. They maintain that economists are generally blinded by their self-interest, their professional interests requiring them to keep aloof from socialism. The economists, on the other hand, maintain that the rejection of socialism by economists signifies its rejection by science truly conceived.

Economists are not generally inclined to deny the evils in the existing economic order, but they believe that there is better prospect of improvement under this order than under socialism. They are social reformers, not socialists. They hold, first, that there is no law of evolution carrying us inevitably to socialism; secondly, that the prospects of social reform are sufficiently promising to warrant us in the maintenance of private property in the instruments of production and private management of production; and, thirdly, that socialism carries with it dangers and disadvantages sufficiently grave to warrant us in opposing it until it is clearly seen that great improvements are not compatible with the present social order.

In its details the reasoning of economists against socialism is as varied as the reasoning of socialists in its support. To Marx's labor theory of value economists oppose theories of value which differ in detail, but which agree in placing other forms of cost in coördination with labor in the determination of value. (See VALUE.) To the theory of class consciousness and class action on the part of wage earners as the only means of reform, economists oppose the doctrine that all classes in society must work together for social improvement.

Modern economists recognize the influence of economic forces in social evolution, and recently they have given generous recognition to Marx for his contributions to social theory. Very few economists, however, hold that economic causes alone underlie all social development and that the political and intellectual history of nations is a mere expression of a social organization resulting from the prevailing mode of economic production and exchange.

Socialism implies unified control of production, and economists believe that the disadvantages of such control outweigh the advantages. Economic theory still rests upon the assumption that competition is a principle of progress. Economists seek to point out means for the elevation of competition to higher planes and the removal of the evils which it carries with it, while retaining the principle itself.

The difficulties in the way of the socialization of agriculture are emphasized in opposition to socialism. There can be little doubt that when agriculture is mentioned one of the weakest points in socialism is brought to our attention. Manufacturing industries, commerce, and transportation might conceivably be carried on as public enterprises, but it has never been made plausible that agriculture can dispense with the individual care that is evoked by private interest.

Two other points only in the arguments against socialism can be considered in this place. The first is the danger to liberty. It is maintained by defenders of our present economic society that private property and private enterprise are necessary bulwarks of liberty and that, with these removed or impaired to the extent that they would be even by the most conservative socialism, those having control of the agencies of production would be given such vast power that liberty would be seriously threatened and indeed overthrown by tyranny. There seems to be strong ground for the belief that liberty is better protected in a society having the dualism which we know now, in accordance with which private property and private production on the one hand and public authority with limited public production on the other, are reciprocal checks and restraints.

Finally, it is urged that under socialism there would be revolutionary discontent. In a world like ours men must necessarily be discontented with what they receive as an outcome of economic production and with the treatment accorded to them in the processes of economic production. At the present time this discontent is directed towards a great many different persons and bodies. On the other hand under socialism the government would be blamed for all mistakes and misfortunes, and this concentrated discontent, it is held, would be revolutionary in character.

So much has been said about Christian socialism that this article should not be concluded without at least a brief reference to it. Christian socialism has had many different meanings. Where the leaders of socialism have been irreligious, Christian socialism has sometimes simply signified socialism plus religion. Now that socialists have come to place religion among private matters in which they are not directly concerned, less is heard than formerly about Christian socialism. Christian socialism has sometimes signified simply a recognition of the principle of social solidarity and a generous sympathy with those classes in society which are the least fortunately situated, more specifically with the wage-earning classes. About the middle of the nineteenth century a body of Christian socialists existed in England and attracted wide attention. They were led by men like Thomas Hughes, Charles Kingsley, James Ludlow, F. D. Maurice, and E. Vansittart Neale. Theoretically they opposed the principle of competition as a source of evil, and did so with great vehemence, and agitated in favor of coöperation in production and exchange. They attempted to organize society on a coöperative basis and succeeded in establishing a number of coöperative undertakings which enjoyed only a temporary prosperity and finally disappeared. They entered, however, into the coöperative movement in England, which had been theretofore largely supported by men acting under the influence of Owen, and they contributed very much to the success of English coöperation.

Socialism of the chair, or professorial socialism, is frequently mentioned, but this also is something as indefinite as Christian socialism. It is not socialism at all, but simply a recognition of grave evils in existing society, a determination to remove these evils, and the conviction that the power of the state must be used to bring about desirable changes. The term "socialism of the chair" originated in Germany and was applied in ridicule to the progressive economists who expressed sympathy with the aspirations of the wage-earning classes. Among the leaders may be mentioned A. Wagner and G. Schmoller (qq.v.). These held that economics is an ethical science and opposed the doctrines of the so-called Manchester school, which looked with little favor upon state action. The changes which have taken place among economists have been such as to lessen the differences among them with respect to economic improvement. Generally speaking, those who in the last decade of the nineteenth century were most inclined to call upon the state for help have become somewhat more conservative, while at the same time those who most strongly antagonized public action have qualified their opposition thereto. The course of events has convinced practically all economists of the importance of labor legislation and of the necessity of state intervention at many points. Professorial socialism, then, never was socialism, and at the present time it can hardly be said that it indicates a line of cleavage among economists.

Literature. The principal writers on socialism have been mentioned in the text, and their writings are mentioned in the articles dealing with them. The *Communist Manifesto* (London, 1848) is perhaps the most important single document in the history of socialism, and Marx, *Das Kapital* (3 vols., Hamburg, 1862, 1865, 1894), is possibly the most important single work. The works of Rodbertus and Lassalle are important historically. *Fabian Essays in Socialism* (London, 1889) is the best work presenting the conservative opportunist socialism. One of the Fabians, Sidney Webb, has written a work entitled *Socialism in England* (2d ed., ib., 1893), which best describes the advances of English socialism as seen by a Fabian. Kelly, *Government or Human Evolution* (vol. i, on Justice, ib., 1900; vol. ii, on Individualism and Collectivism, ib., 1901), gives the best presentation by an American author of socialism as a principle of action rather than as a system. Hyndman, *Economics of Socialism* (ib., 1896), is regarded as one of the best explanations of the economics of the Marxist school. Laveleye, *Socialism To-Day* (Eng. trans., ib., 1885), gives a sympathetic account of socialism by a progressive economist. Rae, *Contemporary Socialism* (new ed., London and New York, 1901), is a more critical account of socialism and, like the preceding, has much historical material. Kirkup, *History of Socialism* (new ed., London, 1900), is a more recent work than Laveleye's and perhaps even more sympathetic, going so far as to advocate a very conservative sort of socialism. Ely's *Socialism and Social Reform* (New York and London, 1894) is an attempt to analyze socialism carefully, to examine its strong and its weak features, and to present, as opposed to socialism, a programme of social reform. It has a bibliography. The same author's *French and German Socialism* (New York, 1883) is a brief historical presentation of socialism in these two countries. Consult also Woolsey, *Communism and Socialism: Their History and Theory* (New York, 1880); Spargo, *Socialism* (ib., 1906); Liebknecht, *Socialism* (Chicago, 1907); Hardie, *From Serfdom to Social Reformer* (London, 1907); Hunter, *Socialists at Work* (New York, 1908); Hillquit, *Socialism in Theory and Practice* (ib., 1909); McDonald, *Socialism and Government* (London, 1909); Skelton, *Socialism* (Boston, 1911); Belloc, *The Servile State* (London, 1912); Simkhovitch, *Marxism versus Socialism* (New York, 1913); Orth, *Socialism and Democracy in Europe* (ib., 1911).

SOCIALIST PARTIES

Politically organized socialism or social democracy is a movement which is coextensive with modern industrialism. Wherever a system of production is found which is perhaps somewhat loosely termed capitalistic, we find a Social Democratic party. In this article, however, attention will chiefly be given to the Social Democratic party of Germany, since in Germany that party is more highly developed and far more powerful than in any other country and has a position of intellectual leadership. Influences from the Social Democratic party of Germany, both with respect to theory and tactics, radiate throughout the entire industrial world. Social democracy is not a German movement, but a world movement, which has, however, its highest development in Germany.

Several reasons may be adduced to explain the preëminence of German social democracy. Wage earners in that country did not begin to share in political power until after the middle of the nineteenth century and so, having formed no political affiliations, were more easily induced to attach themselves to socialism, which had already been eloquently presented to them by Ferdinand Lassalle. Again, the hostility of the government to labor organizations had the effect of turning towards political action the energy that might otherwise have been expended in labor agitation. The third reason for the leadership of Germany is found in the fact that the great intellectual leaders of socialism have been Germans. Marx and Lassalle have already been mentioned, and we may also mention Rodbertus (q.v.), a man who belonged to the landowning class of Germany and who did not take part in socialist agitation.

German social democracy represents an amalgamation of two movements—one starting from Ferdinand Lassalle, the other from Marx and Friedrich Engels (q.v.). Before the time of Marx and Lassalle, Wilhelm Weitling (q.v.) had exercised a certain influence in Switzerland, Germany, and the United States, but the socialism which he advocated was of the French Utopian character and had little permanent influence.

The activity of Marx began in the forties and was continuous from that time until his death. In 1846 Marx belonged to a secret international communistic society called the Kommunistenbund. It was for this society that, with Engels, he prepared the Communist Manifesto. In 1848 Marx was active in Germany, where a number of labor unions had been established which, united into a federation, came under socialistic influence. The chief field of his activity was the Rhine Province, and it was there that Marx conducted his celebrated *New Rhenish Gazette* (*Neue Rheinische Zeitung*). The reaction soon triumphed, and Marx finally found his way to England, where he made himself in 1850 the head of a German communistic society, which however was short-lived.

We must now turn our attention to Ferdinand Lassalle, who is to be regarded as the real founder of the Social Democratic party, although it soon passed under the influence of Marx and Engels. The agitation of Lassalle began in 1862. In 1863, under his influence, the Universal German Laborers' Union (Der Allgemeine Deutsche Arbeiterverein) was founded in Leipzig. The membership was small, and the chief demand was for universal and equal suffrage, although it soon became plain that this was demanded simply as a step towards socialism. Lassalle's chief practical economic demand was for government subsidies to aid in the establishment of productive coöperative associations. Theoretically his arguments centred about the so-called iron law of wages: that wages under the capitalistic system of production naturally fall to a minimum, which barely supports the life of the laborer and his family. The practical demand and the theoretical argument of Lassalle have been rejected by the German Social Democrats, but his eloquence was instrumental in laying the foundation of the party. After the death of Lassalle, in 1864, the International

Labor Association (Internationale Arbeiterassociation) was established in accordance with the principles of Marx, and the Social Democratic Labor party (Socialdemokratische Arbeiterpartei) was founded in the same year. This party, under the leadership of Wilhelm Liebknecht and August Bebel (qq.v.), entered into opposition to the party established by Lassalle. The Social Democratic Labor party met in Eisenach in 1869 and became known as the Eisenach party. At the election for the Reichstag in 1874, when about 340,000 votes were cast, these were divided with approximate equality between the followers of Lassalle and those of Marx. In 1875 the two parties united and established what is known as the Gotha Programme, which was a compromise. The year 1878 witnessed two attacks upon the life of the German Emperor and then followed the Anti-Socialist Law, which repressed the public agitation of socialism. While the law was in force German socialist congresses were held on foreign soil and their literature was largely printed in Switzerland. The party increased in power, however, the chief result of governmental repression being the welding together of the different factions into a compact party. The Anti-Socialist Law (*Ausnahmegesetz*) expired on Oct. 1, 1890. A certain tendency to violence seems to have developed during this period, for at one of the congresses the expression to struggle for the attainment of ends "with all legal means" was changed to "with all means." The first public congress of the German Social Democracy, after the expiration of the Law of Exception, was held in Halle, Oct. 12–18, 1890. Liebknecht and Bebel dominated the congress and worked for a revision of the Social Democratic platform. This bore fruit the following year at the Erfurt Congress, where the Erfurt Programme was adopted. The peculiar ideas of Lassalle were entirely expunged, and the doctrines of Marx gained a complete triumph. The Erfurt Programme is at the present day the most important official utterance of social democracy and has a world-wide significance, serving as a fundamental basis for every social-democratic platform since adopted throughout the world. This programme reads as follows:

"The economic development of industrial society tends inevitably to the ruin of small industries which are based upon the workman's private ownership of the means of production. It separates him from these means of production and converts him into a destitute member of the proletariat, while a comparatively small number of capitalists and great landowners obtain a monopoly of the means of production.

"Hand in hand with the growing monopoly goes the crushing out of existence of these shattered small industries by industries of colossal growth, the development of the tool into the machine, and a gigantic increase in the productiveness of human labor. But all the advantages of this revolution are monopolized by the capitalists and great landowners. To the proletariat and to the rapidly sinking middle classes, the small tradesmen of the towns, and the peasant proprietors (*Bauern*), it brings an increasing uncertainty of existence, increasing misery, oppression, servitude, degradation, and exploitation (*Ausbeutung*). Ever greater grows the mass of the proletariat, ever vaster the army of the unemployed, ever sharper the contrast between oppressors and oppressed, ever fiercer that war of classes between bourgeoisie and proletariat which divides modern society into two hostile camps and is the common characteristic of every industrial country. The gulf between the propertied classes and the destitute is widened by the crises arising from capitalist production, which becomes daily more comprehensive and omnipotent.

"Private ownership of the means of production, formerly the means of securing his product to the producer, has now become the means of expropriating the peasant proprietors, the artisans, and the small tradesmen, and placing the nonproducers, the capitalists, and large landowners in possession of the products of labor. Nothing but the conversion of capitalist private ownership of the means of production—the earth and its fruits, mines, and quarries, raw material, tools, machines, means of exchange—into social ownership, and the substitution of socialist production, carried on by and for society in the place of the present production of commodities for exchange, can effect such a revolution that, instead of large industries and the steadily growing capacities of common production being, as hitherto, a source of misery and oppression to the classes whom they have despoiled, they may become a source of the highest well-being and of the most perfect and comprehensive harmony.

"This social revolution involves the emancipation, not merely of the proletariat, but of the whole human race, which is suffering under existing conditions. But this emancipation can be achieved by the working class alone, because all other classes, in spite of their mutual strife of interests, take their stand upon the principle of private ownership of the means of production and have a common interest in maintaining the existing social order.

"The struggle of the working classes against capitalist exploitation must of necessity be a political struggle. The working classes can neither carry on their economic struggle nor develop their economic organization without political rights. They cannot effect the transfer of the means of production to the community without being first invested with political power.

"It must be the aim of social democracy to give conscious unanimity to this struggle of the working classes and to indicate the inevitable goal.

"The interests of the working classes are identical in all lands governed by capitalist methods of production. The extension of the world's commerce and production for the world's markets make the position of the workman in any one country daily more dependent upon that of the workman in other countries. Therefore the emancipation of labor is a task in which the workmen of all civilized lands have a share.

"The German Social Democrats are not therefore fighting for new class privileges and rights, but for the abolition of class government, and even of classes themselves, and for universal equality in rights and duties without distinction of sex or rank. Holding these views, they are not merely fighting against the exploitation and oppression of the wage earners in the existing social order, but against every kind of exploitation and oppression, whether directed against class, party, sex, or race.

"Starting from these principles, the German Social Democrats demand, to begin with (i.e., of the present state):

"(1) Universal, equal, and direct suffrage by ballot, in all elections, for all subjects of the Empire over twenty years of age, without distinction of sex; proportional representation and, until this system has been introduced, fresh division of electoral districts by law after each census; two years' duration of the Legislature; holding of elections on a legal day of rest; payment of the representatives elected; removal of all restrictions upon political rights, except in the case of persons under age.

"(2) Direct legislation by the people by means of the right of initiative and of veto; self-government by the people in Empire, state, province, and commune; election of magistrates by the people, with the right of holding them responsible; annual vote of the taxes.

"(3) Universal military education; substitution of militia for a standing army; decision by the popular representatives of questions of peace and war; decision of all international disputes by arbitration.

"(4) Abolition of laws which restrict or suppress free expression of opinion and the right of meeting or association.

"(5) Abolition of all laws which place the woman, whether in a private or a public capacity, at a disadvantage as compared with the man.

"(6) Declaration that religion is a private matter; abolition of all appropriations from public funds for ecclesiastical and religious objects; ecclesiastical and religious bodies are to be regarded as private associations which order their affairs independently.

"(7) Secularization of education; compulsory attendance at public national schools; free education, free supply of educational apparatus, and free maintenance to children in schools, and to such pupils, male and female, in higher educational institutions, as are judged to be fitted for further education.

"(8) Free administration of the law and free legal assistance; administration of the law by judges elected by the people; appeal in criminal cases; compensation to persons accused, imprisoned, or condemned unjustly; abolition of capital punishment.

"(9) Free medical assistance, and free supply of remedies; free burial of the dead.

"(10) A graduated income and property tax to meet all public expenses which are to be raised by taxation; self-assessment; succession duties, graduated according to the extent of the inheritance and the degree of relationship; abolition of all indirect taxation, customs duties, and other economic measures which sacrifice the interests of the community to the interests of a privileged minority.

"For the protection of labor, the German Social Democrats also demand, to begin with:

"(1) An effective national and international system of protective legislation on the following principles:

"(*a*) The fixing of a normal working day, which shall not exceed eight hours.

"(*b*) Prohibition of the employment of children under fourteen.

"(*c*) Prohibition of night work, except in those branches of industry which, from their nature and for technical reasons or for reasons of public welfare, require night work.

"(*d*) An unbroken rest of at least thirty-six hours for every workman every week.

"(*e*) Prohibition of the truck system.

"(2) Supervision of all industrial establishments, together with the investigation and regulation of the conditions of labor in the town and country by an Imperial labor department, district labor bureaus, and chambers of labor; a thorough system of industrial sanitary regulation.

"(3) Legal equality of agricultural laborers and domestic servants with industrial laborers; repeal of the laws concerning masters and servants.

"(4) Confirmation of the rights of association.

"(5) The taking over by the Imperial government of the whole system of workmen's insurance, though giving the workmen a certain share in its administration."

It is possible to state in a very few words the most essential facts in the history of social democracy in Germany, since the adoption of the Erfurt Programme. One of the main subjects which have agitated the party has been the attitude towards the peasant proprietors, the small farmers, and this same question has agitated social democracy in France and the United States. The support of the small proprietor is essential to the success of social democracy. A programme of confiscation of all land would arouse the hostility of the small farmer. The most conservative wing of the party, therefore, advocates concessions to small farmers, proposing to permit them to hold landed property even under socialism. G. H. von Vollmar, member of the Reichstag and a leader among the Bavarian Social Democrats, is foremost among those who advocate concessions of this sort. This conservative programme, however, has never been officially adopted. Eduard Bernstein, who has already been mentioned as a leader of the conservative socialists, was elected to the Reichstag from Breslau in February, 1902.

So large a party must participate in practical politics in order to live and must therefore have reforms to urge for the immediate future. We have thus, along with the statement of general principles, the so-called immediate demands. This separation of the social-democratic platforms is found in all countries.

Considerable emphasis has been given to the immediate demands, but it is a mistake to suppose that the ultimate goal of complete socialism has been at any time lost sight of. All the leaders have this in mind, but doubtless there are many acting with the Social Democratic party in Germany, as elsewhere, who are chiefly interested in immediate demands.

In late years much discussion has been carried on in the party councils on the subject of militarism and war. On principle the Social Democratic party of Germany, as of other countries, is opposed to militarism. According to the accepted theory the chief cause of modern wars is economic. The struggle of capitalism for markets leads to conflicting Imperialistic ambitions, hence to war. Defensive warfare is accepted, however, as justifiable, and so also is warfare of a "progressive tendency," e.g., wars tending to consolidate fragmentary population groups into unitary states, or wars against reactionary states. The action of the German Social Democrats in supporting the extraordinary taxation for military purposes and in loyally supporting the government upon the outbreak of the Great War is explained on the ground that the war is considered, both defensive and progressive, as against Russia.

The vote of the Social Democratic party and the number of members elected to the Reichstag since the foundation of the German Empire are given in the following table:

ELECTION IN	Total number of Social Democratic votes	Percentage of total number of votes cast	Members elected
1871	124,655	3.0	2
1874	351,952	6.8	9
1877	493,288	9.1	12
1878	437,158	7.6	9
1881	311,961	6.1	12
1884	549,990	9.7	24
1887	763,128	10.1	11
1890	1,427,298	19.7	*35
1893	1,876,738	23.3	44
1898	2,107,076	27.18	†56
1903	3,011,114	31.75	81
1907	3,251,000	27.0	‡43
1912	4,250,399	35.0	110

* In the by-election in the twenty-second district of Saxony, held in 1892, a thirty-sixth member was elected.

† Later elections to supply vacancies gave the Social Democrats two additional members, making 58 in all.

‡ Later by-elections raised the number to 54.

One or two comments upon the vote cast are needed. The vote fell off in 1881, owing to the severe repressive measures following the Anti-Socialist Law. In 1890 the Social Democratic party became the largest in the German Empire, casting about 20 per cent of the votes. With some 15 parties in Germany, this is less significant than in a country with two great parties, but, nevertheless, it means a great deal. Another point to be considered is that the socialists do not have a number of representatives in the Reichstag corresponding with the number of votes cast. This is due to the way the electoral districts are arranged, whereby the Conservatives (largely made up of landed proprietors and other favored classes) and Agrarians elect a much larger number of members relatively.

The official organ of the Social Democratic party is the daily *Vorwärts*, of Berlin, of which also a weekly edition, called the *Socialdemokrat*, is published. *Die Neue Zeit*, a weekly magazine published at Stuttgart, is the so-called scientific organ of German social democracy, discussing questions of principles. Both these organs represent the dominant Marxian socialism. The more conservative opportunism is represented by the *Socialistische Monatshefte*, published in Berlin. Special mention may be made also of two illustrated comic papers, which advocate social democracy, viz., *Der Wahre Jacob* and *Der Süddeutsche Postillon*. See WAR IN EUROPE.

Austria. In Austria we find a very different condition of things from that which exists in Germany. Social democracy was later in gaining a foothold in Austria, and its growth has been far slower. The situation in Austria is complicated by the race question. The Social Democrats of the German-speaking territory are organized in the Austrian Social Democratic Labor party, while Bohemia and Moravia support the Czech-Slav Social Democratic party. Each has its independent national organization.

Hungary. A labor party strongly influenced by the followers of Lassalle was formed in Hungary in 1868. The Marxians gained the upper hand during the following decade, however. but during the eighties the anarchists were a disturbing factor. They have, however, been reduced to insignificance, and social democracy is making advances in this Kingdom as elsewhere. During the last decade of the nineteenth century the agitation was extended to the agricultural classes.

Denmark. In Denmark the influence of the social democracy is comparable to that of the same party in Germany, but, owing to the minor rôle of Denmark in world politics, the party has attracted little attention. The social-democratic agitation began in the early seventies, but it was under dishonest leadership, and the result was a collapse and temporary reaction. During the past 10 years, however, there has been a very rapid growth of social democracy under Marxist leaders. In 1898 the Social Democrats polled approximately 32,000 votes, electing 12 deputies. At the election in 1903 the Socialists elected 16 members, polled 55,479 votes, and almost wiped the Conservative party out of existence. In 1910 the party cast 98,721 votes and elected 24 deputies, and in 1913 it cast 125,330 votes and elected 32 deputies. The daily organ in Copenhagen, called the *Social Demokraten*, is said to have a larger circulation than any other paper in Denmark. One of the notable features of social democracy in Denmark is its participation in the trades-union and coöperative movements, the latter of which has made very rapid progress.

Norway. The social-democratic agitation in Norway has made slow progress, and it has not as yet played a prominent part in political life. In 1909 the Socialist party polled some 90,500 votes in the Storthing elections and elected 11 representatives. In 1913 the number of representatives elected was 23.

Sweden. In Sweden social democracy has made considerable progress in recent years and has exercised marked influence upon the labor movement. The Social Democratic party was formally organized in Sweden in 1899. The programme was Marxist in character and closely resembled that of the German Social Democracy. In the 1914 elections to the National Legislature the Social Democratic party secured 87 seats out of 630.

Switzerland. In Switzerland, owing to the success of political and social reforms, the social-democratic agitation has found a barren field. In 1911 the socialists elected 15 members of the National Council, and in the Legislative Assembly of Basel were represented by 43 members out of 130. The Social Democrats have, however, exercised considerable influence upon other political parties.

Italy. The poverty and ignorance of the masses of the Italian population and the impulsiveness of their character seemed to favor at first the growth of anarchism rather than of socialism. Under the influence of Bakunin an anarchistic agitation was started in 1872.

The social-democratic agitation began in the seventies, but it became powerful only during the last decade of the nineteenth century, having gradually succeeded, with the help of the government, in superseding anarchism, which is still a troublesome factor. The socialistic vote rose from 76,400 in 1890 to 175,000 in 1900 and 338,865 in 1909 and the number of deputies from 5 in 1893 to 40 in 1909 and 77 in 1913. The socialist press consists of one daily newspaper, *Avanti*, and a large number of periodicals appearing less frequently. A monthly, *La Critica Sociale*, and a fortnightly, *Il Socialismo*, are among the most prominent of these periodicals. *L' Asino*, a satirical weekly, has a circulation of 100,000 copies.

In Italy, as in so many other countries, we find two tendencies among the socialists: the opportunist tendency, favoring compromise measures and seeking coöperation of nonsocialists; and the orthodox Marxian tendency, uncompromising, pursuing the ultimate goal, and with little faith in reform measures which imply the continued existence of the present industrial society.

Spain. Social democracy effected an organization in 1882. In the last two decades the Social Democratic Labor party has made progress, and it has advanced, while anarchism, which first gained a foothold in Spain about 1870, has on the whole receded. The number of votes increased between 1891 and 1901 from approximately 5000 to over 25,000. In 1910 Pablo Iglesias, a veteran socialist agitator, was elected to the Cortes as one of the representatives of Madrid, polling 40,791 votes.

Holland. The early socialist agitators in Holland came from Belgium and founded a section of the International Workingmen's Association in 1868. The present socialist activity is directly connected with the agitation begun in 1879 by Ferdinand Domela-Nieuwenhuis, who founded a socialist society, which soon fell under anarchist influence and showed a strong inclination to favor extreme and violent measures.

The more conservative socialists organized a Social Democratic party upon a Marxian basis in 1894, and this party has gradually gained a dominant position among socialists, the old organization led by Domela-Nieuwenhuis having dwindled to insignificance; the anarchistic element has been practically extinguished.

The socialists elected 7 members of Parliament in 1901. The socialist vote was 39,000. In 1905 the vote increased to 65,743 and in 1910 to 82,494. The parliamentary representation remained at 7 until 1913, when it increased to 15.

Belgium. A socialistic association was founded in 1866, and a labor party with a mixed socialistic and anarchistic programme was established in 1868. The International Workingmen's Association had sections in Belgium, but in 1872, when the schism between the socialists and anarchists took place, the Belgian sections joined the anarchists under Bakunin. The modern social-democratic movement in Belgium may be said to date from 1876, when party groups were organized under a physician, Dr. DePaepe, who was a convert from anarchism. The present party, called Parti Ouvrier Belge, was formally established in 1885. In 1893 great socialist demonstrations took place, and a general strike was inaugurated with the purpose of securing universal suffrage. This effort was successful; and universal but unequal suffrage was granted to all males over 25. Some of the voters, on account of educational or property qualifications, now have two or three votes. A general strike involving 400,000 workers was conducted in 1913 for the purpose of ending the abuse of plural voting. It wrested from the government a pledge to take suffrage reform under consideration. In the election which took place in 1894 the socialists polled 335,000 votes and elected 32 members of the National Parliament. In 1902 the number of socialist votes cast was, in round numbers, 476,000 and the number of deputies elected 34. In the elections of 1912 the Liberals and socialists acted together, in a majority of the constituencies; accordingly the actual socialist strength is not determinable, but 241,895 socialist votes and 794,238 liberal-socialist fusion votes were cast. The socialists seated 39 deputies out of a total of 186.

The social democracy in Belgium of course collapsed upon the invasion of that country in 1914, but its history is interesting and important because of several peculiarities. First may be mentioned the close connection with the trades-union movement. This, however, was not such a distinguishing feature of Belgian social democracy as was its connection with the coöperative movement. The socialists in Belgium had started numerous coöperative establishments which had achieved a remarkable success. More than 200 of these became affiliated with the Socialist party, thus bringing it into connection with the daily economic life of the masses. The two chief coöperative establishments were the Maison du Peuple of Brussels and the Vooruit in Ghent. The Maison had a membership of 25,000 and property exceeding in value 2,000,000 francs. These were great retail establishments, resembling the modern department store. The masses showed that they were closely attached to these coöperative stores, through which the socialist agitation was actively carried on.

There are several strong socialist periodicals in Belgium having a large circulation. The official paper published in Brussels is *Le Peuple. L'Echo du Peuple*, an evening issue from the office of *Le Peuple*, is also an official organ. A monthly review called *L'Avenir Social* is published.

France. The Socialist party in France did not gain any considerable following until after 1890. Its late appearance is doubtless due to the frequent revolutions in that country and its disordered and unsettled condition, which rendered it more favorable for anarchistic and revolutionary movements. With the firm establishment of the Republic and the lapse of a generation since the last revolution, the relatively ordered and legal means of modern social democracy have found a more fruitful soil and anarchistic tendencies have been pressed into the background. The early Utopian socialism was practically dead in 1860. The International Workingmen's Association gained some influence in France during the uprising of the Paris Commune, which, however, was only partially socialistic. The International Association did not, however, exercise any considerable influence and soon disappeared. So far as it continued to exist, it fell under anarchist influences under the leadership of anarchists like Elisée Reclus and Prince Kropotkin. A socialist paper published by a group of students made its appearance in 1876, and three years later Jules Guesde, who formerly had been anarchistically inclined, founded a Socialist Labor party in France. He was soon joined by a former comrade in anarchy, Dr. Paul Brousse. In 1889 the total socialist vote was only 91,000 in round numbers out of a total of 6,847,000 votes; two years later the vote rose to 549,000, or nearly 9 per cent of the total vote cast. This vote includes those who voted for the so-called Socialist Radicals, who, while having strongly socialistic leanings and generally acting with the socialists, may not be regarded as full socialists, inasmuch as they do not accept the entire socialist programme. In 1893 the socialists increased their strength in the French Assembly threefold, the number of deputies rising from 15 to 50. It thus became in that year a great political party. In 1902 the socialist vote was 805,000, electing 48 deputies; in

1906, 877,999, with 54 deputies elected; in 1910, 1,125,877, with 76 deputies. In 1914 the organized socialists elected 102 deputies. There were in addition 30 independent socialist deputies.

The next great event in the history of French socialism was the appointment of A. Millerand to a cabinet position as Minister of Commerce under Waldeck-Rousseau in June, 1899. This was the first time in the world's history that a socialist had attained such a prominent position in government. The acceptance by Millerand of this position gave rise to fierce dissensions within the socialist ranks. His opponents held that he had placed himself outside the control of the party by participating in the actual administration of a capitalistic government. Millerand's position, however, was sustained by Jean Léon Jaurès (q.v.). The national congress, however, backed by the international congress, discountenanced the acceptance by socialists of ministerial position, and by a new rule automatically excluded from the party Millerand and Briand, who accepted cabinet portfolios. Upon the outbreak of the Great European War the rule was ignored, and even the veteran opponent of ministerial participation, Jules Guesde, accepted a post in the ministry.

The socialist party in France has been disturbed throughout its history by factional strife. In 1905 the various factions were united, but it remains true that a large part of the adherents of socialist doctrine remained outside of the organization. The principal socialist publication of France is *La Petite République*, a daily with an enormous circulation. There is also a daily paper, *L'Action*, socialist, antiministerialist, and violently anticlerical. It has a large circulation. A monthly called *La Revue Socialiste* seeks to do an educational and scientific work among the French socialists like that which *Die Neue Zeit* aims to accomplish in Germany. *Le Socialiste*, the weekly organ of the Parti Ouvrier Français, and *Le Mouvement Socialiste* are also important periodicals.

Russia. For a half century most radical and revolutionary agitation of one kind or another has been carried on in Russia, and the two most familiar names among the international leaders of anarchism, Mikhail Bakunin and Peter Kropotkin, are those of Russian exiles. Early in the second half of the nineteenth century this agitation took the name of nihilism (q.v.), which was a kind of political anarchism rather than economic anarchism. One aim which has in the past been prominent in Russia among radical economic reformers is to connect social and economic reconstruction with the Russian agricultural village called the mir (q.v.). It has been hoped by these leaders that Russia could pass directly from the early stage of economic development into socialism, without passing through modern capitalism as an intermediate stage. During the past few years, under the leadership of George Plekhanoff, a resident of Switzerland, Marxian socialism has made some progress. The socialists, having no field for political activity, turn their attention to labor agitation, and it is said by them with apparent truth that the great strikes in Russia during recent periods have to no inconsiderable degree been an outcome of modern social democracy. The socialists played an important part in the revolutionary activities of 1905 and following years, and at one time it is asserted 30,000 members of the party were political prisoners. In the second Duma (1907) 132 socialists were elected out of a total of 440. In the 1912 Duma elections only 8 Social Democrats were returned.

The entire socialist activity is secret, and no names of Russians living in Russia can be mentioned. The agitation in large part proceeds from foreign countries, and the socialist literature is smuggled into Russia and secretly circulated. Russia is regularly represented at the International Socialist Congress.

England. While socialist ideas probably have as much influence in England as in any country, and possibly even a greater influence, they find expression rather in a molding of the thought of other political parties than in any distinct socialist party. The chief power of socialism has been seen in the social reforms which have been accomplished in England during the past 20 years. There are at present three organizations in England which may be regarded as at once political and socialist. There is first the Fabian Society (q.v.), whose members aim not only to carry on a propaganda for socialist thought, but to promote the election of socialists in any way which may seem most feasible at the proper time and place. It is essentially an opportunist organization in its practical tactics. There is next the Independent Labor party, formed in January, 1893, the object of which is "the collective ownership and control of the means of production, distribution, and exchange." Finally, there is the Social Democratic Federation, among whose adherents H. M. Hyndman (q.v.) and H. Quelch are prominent. This latter organization represents Marxist socialism in England and is the oldest body, dating from 1881. In this connection special mention must be made of the Labor Representation Committee, which seeks to promote "the representation of the interests of labor in the House of Commons."

The socialists claim that they had about 50,000 votes in 1900. In 1910 the entire socialist vote in England was 373,000. The parliamentary representation was 40. In local elections socialists have frequently been successful, and for some time the London County Council has been to a very appreciable extent under the influence of socialists. It may be said that the greatest trade unions have to some extent been brought under the influence of socialism. This is seen in the adoption by the Trade Union Congress at Belfast in 1893 of a resolution demanding collective ownership and operation of industries—in other words, pure socialism. This can be interpreted to mean more than it really does. It indicates a disappearance of avowed hostility to socialism on the part of trade unionists; it shows that the name "socialism" is no longer feared and that it meets with a certain sympathy. The trade-union movement has in England become in the main indifferent to active socialism, but may be described as having mild socialist inclinations.

Hyndman and Quelch have been mentioned as leaders of the Social Democratic Federation. E. Belfort Bax may also be mentioned as prominent in this group. The *Social Democrat*, a monthly journal, and *Justice*, a weekly, edited by Quelch, are organs of the Social Democratic Federation. Connected with the Fabian Society are such names as Mr. and Mrs. Sidney Webb, G. Bernard Shaw, and Edward R. Pease. The organ is the *Fabian News*. Keir Hardie and J. Ramsay Macdonald are prominent names among the members of the Independent Labor party, the organ of which is the *Independent Labor Party News*, which, like the *Fabian News*, is a monthly periodical. Robert Blatchford, the editor of the *Clarion*, is without special affiliations for any one of these three groups.

Canada. A Canadian Socialist party was organized in 1901. It was narrowly Marxian in creed and never attained any considerable following. In 1911 a Social Democratic party was formed which had a membership of about 3000 in 1912. There is also a Labor party, much under socialist influence. It has one representative in the Dominion Parliament.

The United States. Although communism (q.v.) gained an early foothold in the United States, it exercised practically no influence upon the movement now represented by the Socialist parties. American socialism proper begins with the German influence. As a result of the political disorders of 1848 many men of learning and character went to America from Germany as refugees. There were radicals among them who took the leadership in the establishment of communism of a new type in America. Among them we may mention Wilhelm Weitling (q.v.), a German tailor, who started a German newspaper called *Die Republik der Arbeiter*, and organized an Arbeiter Bund. He was essentially a Utopian socialist, and had plans for the establishment of a communistic settlement, and was for a time connected with one in Iowa. Nevertheless, his thought was more in line with modern socialism. Weitling lived until 1871, and was at the last somewhat interested in the Internationale of Marx. Next, mention may be made of the German gymnastic unions (Turnvereine), which, in the early days, were avowedly Socialist. The first socialist Turnverein was established in New York in 1850. The Turnvereine formed an organization called the Socialist Gymnastic Union (Socialistische Turner Bund), and in 1850 the name Socialist Gymnastic Union was adopted. Since the Civil War the socialistic character of the Turnvereine has very largely but not entirely disappeared.

In 1857 a club of communists was formed. In 1868 the followers of Lassalle held a meeting, the purpose of which was to establish a Social Democratic party, and an organization was effected in New York City. In 1869 the party became affiliated with the International Workingmen's Association. Several sections of the Internationale were formed in the United States, and in 1872 the seat of the Internationale was transferred to New York City. Scattering sections existed here and there for a few years. The National Labor Union formed a party called the Labor Reform party in 1868, and the socialists supported this, but its life was of short duration. The socialists formed a Social Democratic Workingmen's party at a convention held in Philadelphia in 1874, and in 1877, at a convention in New Jersey, they adopted the name Socialist Labor party, which is still preserved. The party for a long time had much trouble with the anarchists. The convention of the Socialist Labor party in 1881, in New York City, witnessed a rebellion of the anarchists against the party, and one of the anarchist leaders, Justus Schwab, started a paper called the *Anarchist*. Johann Most went to America in 1882 from London, having previously been expelled from the Social Democratic party of Germany. The agitation of Most produced a crisis, and in 1883, in the convention at Baltimore, the socialists decided not to connect themselves in any way with the anarchists, who had effected an organization at Pittsburgh in the same year.

The next important events in the history of the Socialist Labor party are connected with the candidacy of Henry George in 1886 for the mayoralty of New York City and in 1887 for the governorship of New York. George was nominated by what was called the United Labor party and ran against Abram S. Hewitt and Theodore Roosevelt. The votes received by the three candidates were as follows: Hewitt, 90,552; George, 68,110; Roosevelt, 60,435. The Syracuse convention of the Union Labor party, 1887, when George was nominated for the governorship of New York, repudiated socialism. This formed an epoch in the history of American socialism, and in 1888 the Socialist Labor party decided to have no affiliations thereafter with any other party, but to nominate an independent ticket and vote for that without compromise and without any bargains with other parties or factions of parties. It is from this time that organized political socialism has made progress in the United States.

We must next take up the introduction of distinctively American influences into political socialism in the United States. Dr. Daniel De Leon has long been one of the most influential factors in the Socialist Labor party. Although not an American by birth, he was trained at Columbia University. Laurence Gronlund (q.v.), a Dane by birth but naturalized in the United States, wrote his *Coöperative Commonwealth* in 1884, and this helped spread socialism among native-born Americans. Edward Bellamy (q.v.), of long American ancestry, wrote *Looking Backward* in 1888. Bellamy's socialism was, as has already been stated, called nationalism, and the clubs organized were called nationalist clubs. As a distinctive factor nationalism soon ceased to exist. The specific work which Bellamy accomplished was the Americanization of socialism, in the sense that he helped the American people to understand its significance and won over a great many to its support. In 1893 the *Coming Nation* was established at Greensburg, Ind., by J. H. Wayland. Wayland was for a time influenced by the older so-called Utopian socialism and helped establish Ruskin, in Tennessee, a short-lived communistic settlement. Later he moved to Kansas and there established the *Appeal to Reason*. It is now published at Girard in that State. The establishment of the American Railway Union in 1893 and the Pullman strike in the following year are epoch-making in the history of American socialism. Early in 1897 Eugene V. Debs announced his conversion to socialism, and he and Victor L. Berger of Milwaukee were largely instrumental in establishing the Social Democratic party. After 1899 there were dissensions in the Socialist Labor party, terminating in a serious split. The socialists who left the old party joined forces with the rival party and formed what is now known as the Socialist party, except in Wisconsin and New York State, where, for legal reasons connected with the laws concerning the ballot, it is still called the Social Democratic party. Recently there has been organized by Pennsylvania socialists a new Socialist Labor party, which hopes to effect a union of all socialist parties.

It is interesting to trace the vote received by socialist parties beginning with 1888, when an independent ticket was nominated in New York City and the resolution was adopted to form no alliances with other parties. In this election the vote received was 2068. In 1890 in New York State alone the party received 13,331 votes. In 1892 the socialistic vote of Connecticut, Maryland, Massachusetts, New Jersey, and New York was 21,159. In 1894 the party extended its influence to the Middle States and in Connecticut, Iowa, Massachusetts, Missouri, New Jersey, New York, Pennsylvania, and Rhode Island received 33,133 votes. In 1896 the number of votes was 36,564. In 1898, in eighteen States, the Socialist Labor party received 82,204 votes, and the Social Democratic party, which was organized in 1897, 9545 votes, largely in Massachusetts, making a total of 91,749. In the presidential elections of 1900 the Socialist party received 97,730 votes and the Socialist Labor party 33,450, making a total of 131,180. In 1902 State and congressional elections the Socialist party received 229,762, and the Socialist Labor party received 53,763, making a total of 283,525. The Socialist Labor party vote declined to 29,000 in 1912. The progress of the Socialist party is indicated by the presidential vote for 1904, 402,321; 1908, 421,520; 1912, 901,361.

The first socialist elected to Congress was Victor Berger, from Milwaukee, 1910. In the 1912 elections he was defeated, but in 1914 another socialist, Meyer London, was elected from New York. Sporadic victories in local elections have characterized the history of the party since 1898. The most significant of these was the Milwaukee elections of 1910, which placed the administration of the city entirely under socialist control. In 1911, and again in 1915 a socialist was elected mayor of Schenectady.

It may be mentioned that W. D. P. Bliss established an American Fabian Society at Boston in 1895. This society published the *American Fabian*, which continued to exist for several years, but has disappeared. The Society of Christian Socialists, also under the leadership of Bliss more than any other man, was organized in Boston, April 15, 1889. The tendency in recent years has been for the Socialist party to absorb all these minor organizations.

Political socialism has little influence upon organized labor in the United States, but here also the influence is growing rapidly. The Knights of Labor (q.v.) were in so far socialistically inclined that some of the planks in their platform were in general line with socialist thought. So far as there was socialism in the rank and file of the Knights of Labor it was sentimental and impulsive rather than the result of deliberate thought. Doubtless, however, the agitation which the Knights of Labor have conducted helped to prepare the soil in the United States for socialism. Socialism has a strong hold on the Industrial Workers of the World (q.v.).

The socialists have the support of a large and increasing number of periodicals. The Socialist Labor party press consists chiefly of the daily, weekly, and monthly *People*, of New York City. The Pennsylvania branch of the Socialist Labor party has as its organ the *Socialist Standard* of Pittsburgh. The principal newspapers supporting the Socialist party are the official organ, the *American Socialist*, published at the national office in Chicago; the *Worker*, the *Comrade*, the *Call*, and the *Volkzeitung* of New York City; the *Cleveland Citizen*, of Cleveland, Ohio; the *American Labor Union Journal*, of Butte, Mont.; the *Social Democratic Herald*, of Milwaukee, Wis.; the *Coming Nation*, of Rich Hill, Mo.; the *Appeal to Reason*, of Girard, Kans.; and the *Chicago Socialist*. Especially noteworthy is the *International Socialist Review*, which is the organ of scientific socialism in the United States. Of foreign journals should be mentioned the *Socialistische Monatshefte* (Berlin) and *L'Avenir Social* (Brussels).

SOCIAL LEGISLATION. A term used to designate the growing body of laws designed to remedy evils incident to or intensified by modern industrialism. It is also frequently used, in a broader sense, to include laws for social amelioration in other directions. See SOCIAL INSURANCE; WORKINGMEN'S INSURANCE; OLD AGE PENSIONS.

SOCIAL PSYCHOLOGY. The science of those modifications of consciousness which result from the reciprocal relations of individuals in a community. As used at present the term includes only human groups or societies. Social psychology finds no new mental processes, but it examines a host of new functions which the individual consciousness fulfills by virtue of its relation to other minds more or less like itself. This branch of psychology is to be distinguished from the science of sociology, which deals with the formation, structure, and development as well as the practical betterment of society. Sociology studies society objectively as an organization with certain laws of growth and change. Social psychology, on the other hand, regards the phenomena of society subjectively, i.e., it studies the springs of action which determine the movements of society and also the conscious modifications which individual minds produce in one another. It inquires into the state of mind in a mob and the causes which produce it; the mental disposition of the criminal and the motives which lead him to criminal acts; the mental characteristics of different peoples and races; the effects of climate and of scenery upon the temper of a community; the analysis of imitation, of invention, and of suggestion, and the part that these factors play in developing and maintaining society. The problem of social psychology may be regarded either genetically or statically. One may trace the development of society by the interpretations of language, religion, myths, customs, arts, and laws in various stages from the earliest primitive peoples down to the present time. Such an investigation yields both psychological and sociological results. The problem which is of interest to the social psychologist concerns the modification of perception, idea, feeling, emotion, sentiment, and action which is traceable directly to the social environment, and the reciprocal effect of these mental formations upon the community as a whole. One may also take society as one finds it at present and analyze the mental factors which control the complex interrelations of men. See CUSTOM; LANGUAGE; LAW; MYTHOLOGY; SOCIOLOGY.

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SOCIAL SCIENCE. See SOCIOLOGY.

SOCIAL SCIENCE ASSOCIATION, AMERICAN. A society for the study of social questions. It was organized in Boston, Mass., in 1865 and meets annually in such cities as may be selected. Its work is classified in five departments: education and art, health, trade and finance, social economy, and jurisprudence. Its membership is about 1000, of whom 30 corresponding members are distinguished sociologists of England and continental Europe. The association publishes the annual *Journal of Social Science.*

SOCIAL SERVICE, AMERICAN INSTITUTE OF. An American educational and research society, organized in New York, in 1898 by Josiah Strong and William H. Tolman. Its object is social and industrial betterment. Its method is to place human experience on file so as to make it available for all who wish to profit by the experience of others. Its functions are: (1) to gather facts bearing on social conditions, and whatever is being done to improve them; (2) to interpret these facts by learning their causes and effects; (3) to disseminate the resulting knowledge in every possible way for education of public opinion. Awards for exhibits in social economy have been received at international expositions as follows: Grand Prix, Paris, 1900; Grand Prize, St. Louis, 1904; Grand Prix, Liége, 1905; Grand Prix, Milan, 1906.

SOCIAL SETTLEMENTS. The name given to those houses, situated in the poorer districts of certain great cities, where educated men and women live that they may come into contact with the poor and better the conditions of that class. The social-settlement movement represents an attempt to establish closer relations between the higher and lower social classes, with the aim of giving to the poor opportunities for culture, while securing for the rich a broader view of life through closer contact with the people. Many settlements have become outposts for other institutions, social observatories, and statistical laboratories. The movement originated in the enthusiasm of certain Oxford students, influenced by the philosophy of Dr. Arnold and Frederick D. Maurice and by Thomas Hill Green, who felt the need of a better understanding of the life of the people.

In 1867 Edward Denison, a wealthy student, began to work in the parish of St. Philips in Stepney. Early death prevented him from carrying out his plan of establishing homes similar to the present settlement. In 1875 Arnold Toynbee, then tutor at Oxford, spent his summer in Whitechapel, where he became a leader among workingmen. He too met an early death, but his influence was so strongly felt that the first settlement was named after him. Toynbee Hall was founded in 1884 by Rev. Samuel A. Barnett, in whose parish Toynbee had worked. The movement spread rapidly, and by 1890 there were promising university settlements in London, Glasgow, and Edinburgh. In the United States Hull House (Chicago) and the College Settlement in New York City were opened in October, 1889. The Neighborhood Guild of New York, a forerunner of the settlement, now took on this new form as the University Settlement. The revised bibliography (see below) lists 44 settlements in Great Britain, 101 in the United States, one regular settlement and several institutions with settlement activities in Paris, one in Berlin, and several in Holland. The movement has even spread to Japan, India, and New South Wales. The larger settlements are usually managed and supported by regularly incorporated associations. A head worker, who receives a salary, is engaged. The expenses are met by money raised in various ways. Buildings and special equipments are obtained by gifts. In order to create independence a nominal fee is charged for some classes. A characteristic feature of the settlement is residence, more or less temporary, on the part of the workers, both volunteer and paid. Except the head worker and occasionally an assistant, the residents, however, pay their expenses.

The activities may be summed up as follows: 1. Physical. Gymnasium, baths, military drill, baseball, basket ball, and playgrounds are provided. Efforts are made to improve the sanitary conditions of the neighborhood. Many settlements have summer homes. 2. Educational. As an educational agency the settlement maintains circulating libraries, reading rooms, and home libraries; lectures; musical instruction; art instruction; classes for those who desire business training and law, for those whose education has been neglected, or for foreigners to learn English; for the study of literature, history, and economics; for industrial training, including domestic service, kitchen gardening, dressmaking, etc. 3. Æsthetic. Special picture exhibits and concerts are given, and pictures are loaned. Encouragement is given to the growing of plants and to other methods of beautifying individual homes. 4. Religious. Religious instruction is usually avoided, although Sunday talks, concerts, or open discussions are frequent. A few settlements—as the Chicago Commons or Oxford House—aim to exert a religious influence. 5. Philanthropic. In this field the settlement aims to coöperate with existing organizations. Relief is very seldom given except as a personal matter. A dispensary, a day nursery, or an employment bureau is, however, frequently attached to a settlement. Flower distributions are made, and the University Settlement in New York coöperates with a model pawnshop and a legal-aid bureau. 6. Social. Numerous clubs are established for adults—debating, athletic, and political clubs; dramatic and literary clubs; and all manner of clubs for girls and boys. Women's clubs and mothers' meetings are common.

Additional features are the stamp savings bank for children, coffeehouses, the publication of a newspaper or bulletin, and the promotion of boarding clubs, especially for working girls. Some settlements are especially interested in work with children or boys; others try to reach families or men or to Americanize a foreign element. Some are distinctly homes; others are institutional. The settlement workers are interested in the labor problem, and the settlement is often a headquarters for economic discussions or occasionally a meeting place for labor organizations. Civic interests are stimulated, and residents sometimes hold positions on State and municipal boards. From time to time investigations are made from the settlement, and scholarships are sometimes given to further such work. See HULL HOUSE; TOYNBEE, ARNOLD; UNIVERSITY EXTENSION.

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SOCIAL WAR (Lat. *bellum sociale*). A desperate struggle between Rome and her Italian allies (*socii*), which lasted for two years (90–88 B.C.). The races of Central Italy—the Samnites, Pælignians, Marsians, and Lucanians—had long been bound to Rome by a forced allegiance without enjoying Roman citizenship. The hardy mountaineers chafed under this handicap and when, in 90 B.C., their Roman champion, M. Livius Drusus (q.v.), was murdered for his attempted reforms, they rebelled against Rome, and aimed at a confederation of all Italy to crush the power of Rome. The union was to be called *Italia;* its capital was to be Corfinium, in the Pælignian country, under the new name of Italica, and its government was to be a republic administered by two elective consuls. Their armies were successful for a time, and Rome met reverses; but, by giving her coveted citizenship to those allies who remained loyal and promising it to such as would return to allegiance, she succeeded in breaking the strength of the revolution. But, though the Italians lost their independence, they gained their original demands, for they were enrolled in eight new Roman tribes and soon became assimilated to the Roman body politic. From the part borne by the Marsians in this struggle it is often called the Marsian (Marsic) War.

SOCIAL WORK AT KRUPP FOUNDRIES. See KRUPP FOUNDRIES, SOCIAL WORK AT.

SOCIÉTÉ DES CONCERTS DU CONSERVATOIRE, sŏ′syȧ′tȧ′ dȧ kôɴ′sȧr′ dụ kôɴ′sȧr′vȧ′twär′, LA (Fr., the society of the concerts of the conservatory). See CONCERTS DU CONSERVATOIRE.

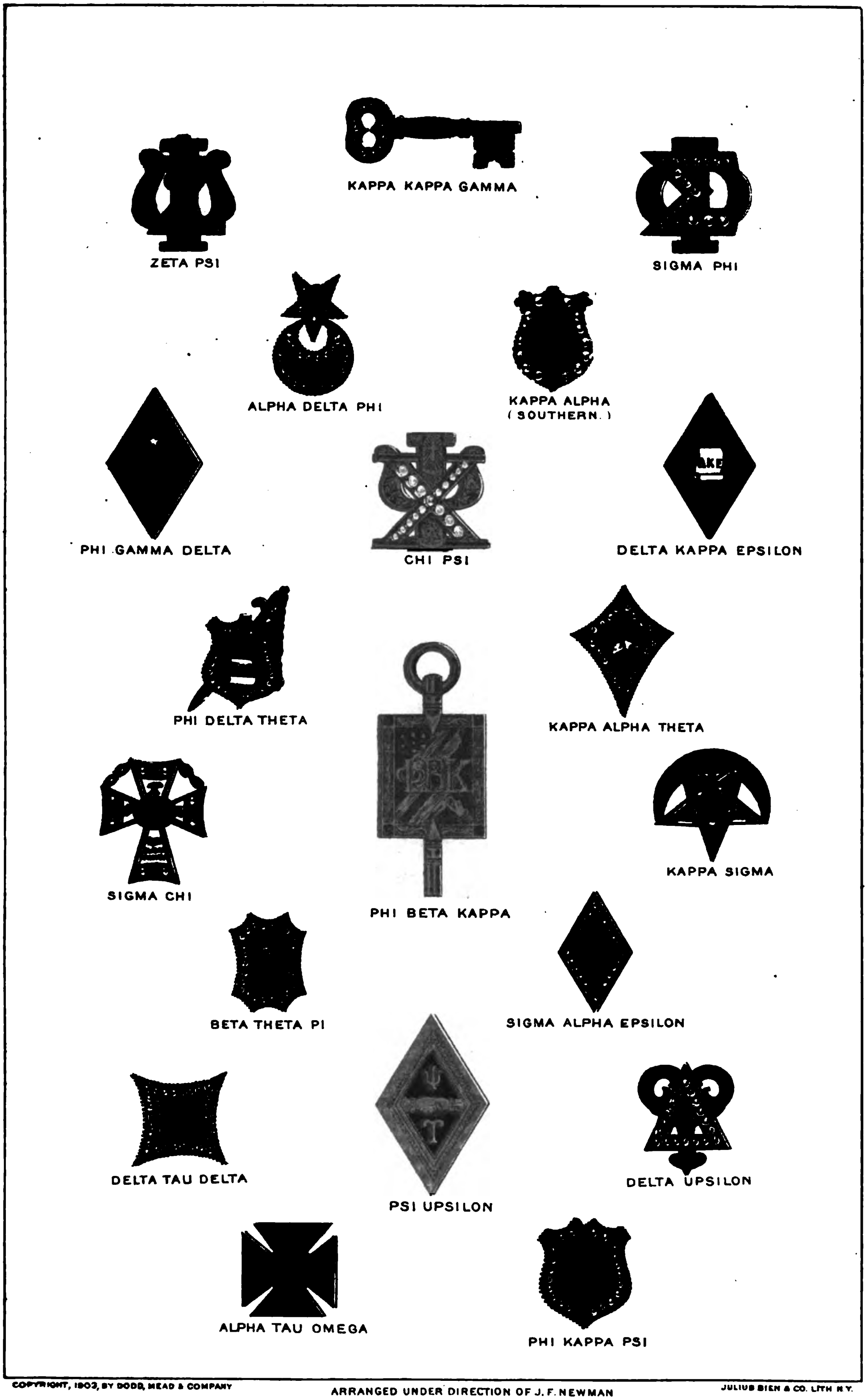
SOCIÉTÉ EN COMMANDITE, äɴ kŏ′mäɴ′dēt′ (Fr., limited liability company), or LIMITED PARTNERSHIP (see PARTNERSHIP; LIMITED LIABILITY). An expression used for at least two centuries in France as the name of a partnership in which one may advance capital without taking charge of the business or becoming liable as a true partner for its debts. The term owes its origin to the old meaning in the commercial nomenclature of France of the word "command," which was applied to one person authorizing another to transact business for him. The working partner had a *commande* from him who merely advanced capital. This form of partnership existed in Louisiana while it was a French dependency and was continued after it became a part of the United States; but New York was the first common-law State to adopt this institution. That was done in 1822, and now limited partnerships are authorized by statute in most of the States. They do not exist in England.

SOCIETIES (Lat. *societas*, from *socius*, companion, associate). Organizations of individuals for the attainment of a common end through common action. Probably the oldest forms of organization are the cult societies, which are found among many primitive tribes, as, e.g., the Duk-Duk (q.v.) of the island of New Britain in the Pacific, or the Mumbo Jumbo societies of west Africa. These are mainly religious in character, with certain political characteristics, and possessing a ritual and the feature of secrecy. Far advanced are the religious societies of the classic world, like the Eleusinians of the Greeks or the priestly colleges of the Romans. Further still we have the organizations which arose with the Christian Church and which aside from the purely monastic aggregates included associations formed for secular purposes (see BROTHERHOODS, RELIGIOUS), as the care of sick (See HOSPITALERS), building of bridges (see BRIDGE-BUILDING BROTHERHOOD), protection of pilgrims, and a combination of some of these duties as exemplified in the great orders (q.v.)—the Templars, or the Knights of St. John of Jerusalem (qq.v.). Preëminent among societies formed for the defense of faith stands the Society of Jesus (see JESUITS).

Political organizations begin early and take the form of public associations working for their purposes in the open (e.g., the Anti-Corn Law League), or secret associations wherever the objects or methods of the societies are regarded with disfavor by governments or are hostile to government. The latter type would include the great revolutionary societies which have played an important part in European affairs, especially since the beginning of the nineteenth century. See BURSCHENSCHAFT; CARBONARI; FENIAN SOCIETY; NIHILISM; YOUNG ITALY; ETC.

The primitive cult societies were largely social in their nature, and social organizations constitute at present an important class of societies. Such are clubs (q.v.) and college fraternities (see FRATERNITIES, AMERICAN COLLEGE), wherein there is no further aim than the bringing together a number of individuals of congenial tastes. Or the interests of the association may centre in some one line of amusement or single pastime, as with athletic organizations, sporting clubs, etc. (See ALPINE CLUBS.) Where the element of sociability is supplemented by some attempt at self-instruction in art, etc., we have the large class of musical societies, choral, literary, or art societies, etc. Noted for broadness of scope in combining social, educational, and religious elements is the Young Men's Christian Association (q.v.). The social element is overshadowed by a common professional interest in the class of organizations known specifically as learned societies, embracing every field of science and liberal learning. (See, e.g., ACADEMY; HISTORICAL ASSOCIATION, AMERICAN; INSTITUTE OF FRANCE; ROYAL SOCIETY; ETC.) Of great importance, in the United States especially, are the fraternal organizations combining sociability and mutual assistance rendered either in an informal way, as among the Freemasons (see MASONS), or in a more definite form, as by life, sickness, and accident insurance, as practiced by various other organizations. As typical of the great class of benevolent and fraternal societies, see ELKS, ORDER OF; ODD FELLOWS, INDEPENDENT ORDER OF; PYTHIAS, KNIGHTS OF; ETC. Finally, mention must be made of a class of societies devoted to the amelioration of social conditions and directing their efforts to the advancement of the general welfare or to the cure of some spe-

COLLEGE FRATERNITIES



KAPPA KAPPA GAMMA

ZETA PSI

SIGMA PHI

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PHI GAMMA DELTA

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BETA THETA PI

SIGMA ALPHA EPSILON

DELTA TAU DELTA

PSI UPSILON

DELTA UPSILON

ALPHA TAU OMEGA

PHI KAPPA PSI

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BADGES OF REPRESENTATIVE AMERICAN COLLEGE FRATERNITIES.

cific evil in society. For the first type, see Boys' Clubs; Charity Organization Society; Workingmen's Clubs; Workingwomen's Clubs; etc. The second include the various temperance societies in the United States. See Temperance; Woman's Christian Temperance Union. See also Patriotic Societies.

SOCIETIES FOR ETHICAL CULTURE, The. The first society for Ethical Culture was formed in New York City in May, 1876, by Prof. Felix Adler and several associates. The purpose of the movement was to provide a centre for persons who had lost their attachment to the traditional creeds and desired to aid in promoting the moral development of the individual and of society. A second society was formed in Chicago in 1882, a third in Philadelphia in 1885, and a fourth in St. Louis in 1886. A few years afterward the first society in London was organized by Dr. Stanton Coit. Other societies have since been formed in England, Germany (where there are 16), Austria, Italy, and Japan. The most important of these societies are those in the United States, England, and Germany. The societies in America seek less to gain adherents than to establish their principles and perfect their organization. Not affirming any creeds and not hostile to any, the Society for Ethical Culture teaches that moral ends are supreme above all human ends and interests and that the authority of the moral law is immediate and not dependent upon religious beliefs or philosophical theories. Meetings are held on Sundays and are devoted to addresses with exclusion of audible prayer and all forms of ritual. Special importance is attached to the ethical training of children, and important schools have been established in New York and other cities. The New York Ethical Culture School was the first to introduce manual training as a regular branch of the curriculum in elementary schools. Young men's societies, women's conferences, Sunday ethical classes, and the like come within the sphere of activity of the societies. The membership of the societies in the United States in 1915 was about 2500. Dr. Felix Adler has been president of the New York Society since its organization.

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SOCIETY (from Lat. *societas*, from *socius*, a companion). A naturally formed group, as a tribe, a village, a nation, organized to achieve the common good—a community, a commonwealth. The basis of society is mental agreement and pleasure in association. An entire population occupying a defined territory becomes, through developing communication and assimilation, increasingly like-minded. Through developing coöperation, cultural, economic, legal, and political, it becomes highly organized. Such a socially developed and organized population is a natural society, and it is within a natural society that all lesser or subordinate societies appear, as incidents of its evolution. These are of two broadly distinguished kinds, the component and the constituent. The component society is a group in which both sexes and all ages dwell together. The name is indicative of the fact that all the larger natural societies, like modern nations, are compound, having been produced by the federation of smaller component groups. The constituent society is an association of selected persons, formed to carry on a particular work. It represents the principle of division of labor, of specialization. The name is expressive of the fact that society as a whole is constituted of such specialized associations. Collectively they are the social constitution. They include all societies for amusement, religion, education, philanthropy, business, the promotion of justice, and political activity. See Sociology.

SOCIETY. An assemblage of plants growing in a common habitat under similar life conditions. Some ecologists regard societies and associations as plant communities of equal rank and use the terms as synonyms, but the more recent and better usage seems to be to regard the societies as subdivisions of the associations. See Ecology.

SOCIETY ISLANDS, or Tahiti Archipelago. A colonial possession of France in the south Pacific, consisting of an archipelago of 11 islands, extending from 16° to 18° south lat., and from 148° to 153° west long. (Map: The World, Western Hemisphere, L 6). It is divided into the Leeward and Windward groups, the former including the islands of Raiatea, Huahine, Tahaa, Borabora, Maupiti, Tubuai, and a few smaller islets, and the latter group comprising Tahiti (q.v.), Moorea, and a few others. Total area, estimated at 637 square miles, of which Tahiti covers about 600. The population is estimated at about 15,000. The islands are volcanic, mountainous, and surrounded with coral reefs which form coast lagoons. The highest peak, on the island of Tahiti, has an elevation of over 7000 feet. The climate is hot and moist, but not unhealthful. The flora is luxuriant and especially rich in trees. Bananas grow in abundance and a very nutritious species (*fei*) is abundant in altitudes of from 3000 to 5000 feet. The fauna is rather poor. The chief agricultural products are coconuts, bananas, sugar, and vanilla. Only a small part of the agricultural land is tilled, and the colony is in a general state of backwardness. The exports are mainly copra, mother-of-pearl, vanilla, and fruits. Administratively, the group forms the chief of the French establishments in Oceania.

The discovery of the Society Islands dates probably from 1606, when they were visited by the Spaniard Pedro Fernández de Quiros. Although several explorers visited the group before Captain Cook, it is chiefly the latter who gave to the world the first detailed description of the islands. At the time of Cook's visits (1769, 1773, 1774, and 1777) the islands were under the rule of minor chiefs exercising both civil and religious authority in the several islands or in the several districts of Tahiti. Partly as an outcome of the visits of Cook and other explorers to Papeete, which placed firearms and metal implements in the hands of the chief of that district, that petty ruler acquired the sovereignty over the whole archipelago and laid the foundation of the royal house of Pomare. The islanders worshiped the four great gods of the Polynesian cultus with human sacrifices on temple pyramids (*marae*) and were particularly observant of the tabu; in the early years of the last century they were converted to Protestant Christianity by the London Missionary Society, the first effort of the beginning of foreign missionary attempt at evangelization. The natives are of a stately and fine Polynesian type. They are kind and very mild, and were readily inclined to adopt Western civilization. The discoverers found that they built comfortable dwellings. In 1788 the island of Tahiti was visited by the *Bounty*, and soon after became the place of refuge for the mutineers of that vessel, some of whom were subsequently taken to Great Britain by the *Pandora*. The rivalry between the French and English missionaries led to the interference of France in 1838 and to the subsequent official annexation of the group in 1880. Consult: Meinecke, *Die Inseln des Stillen Oceans* (Leipzig, 1875–76); Brassey, *Tahiti* (London, 1882); Bässler, *Neue Südseebilder* (Berlin, 1900).

SOCIETY OF AMERICAN ARTISTS, The. An organization of painters and sculptors, founded in New York City in 1877 and consolidated in 1906 with the National Academy of Design. During the nearly 30 years of its existence the Society served a useful purpose along the lines intended by the founders. So many of its best men, however, became identified with the National Academy that in 1907 it was deemed wise to unite the organizations. Its principal prizes were taken over and have since been administered by the Academy. See National Academy of Design.

SOCIETY OF AMERICAN AUTHORS. A society incorporated in May, 1892, in New York City, for the purpose of assisting authors in their dealings with publishers and generally improving the condition of the craft. It publishes a bulletin, *The American Author*.

SOCIETY OF FRIENDS, The Religious. See Friends.

SOCIETY OF JESUS. See Jesuits.

SOCIN, sō'tsin, Albert (1844–99). A German Orientalist, born at Basel and educated there and at Geneva, Göttingen, Leipzig, and Berlin. He traveled much. In 1876 he was appointed professor of Semitic languages and literature at Tübingen, and in 1890 at Leipzig. He published: *Die Gedichte des 'Alkama alfahl'* (1867, with translation); *Arabische Sprichwörter und Redensarten* (1878); *Arabische Grammatik* (1885: 5th ed., 1904; Eng. trans.); *Die Inschrift des Königs Mesa von Moab* (1886), with R. Smend; *Zum arabischen Dialekt von Marokko* (1893); *Der arabische Dialekt der Houwâra* (1894), with Stumme; *Diwan aus Zentralarabien* (1901). Socin collaborated also in Kautzsch's translation of the Old Testament (1890), and in Gesenius's *Handwörterbuch über das alte Testament* (Buhl's 12th ed. of 1895).

SOCI'NUS. The Latinized form of the name of two Italian Protestants of the sixteenth century, celebrated as the founders of the liberal sect called Socinians, and precursors of the modern Unitarians. Both men were born in the Tuscan town of Siena, the elder, Lelio Sozzini (Lælius Socinus), in 1525, the younger, Fausto (Faustus), nephew of the preceding, in 1539. Lelio applied himself to the study of Greek, Hebrew, and Arabic, that he might better understand the Scriptures. There is a disputed tradition that he was a member of an heretical society at Vicenza, at the age of 21, and that he fled to escape persecution. It is certain that the society was compelled to disband. Socinus visited France, England, and Holland, and met many Protestant leaders, including Calvin. He finally settled in Zurich, where he died in 1562. Though claiming the right of free theological inquiry, he never professed anti-trinitarian views.—Faustus Socinus, after an unsystematic education, went in manhood to Basel for religious study, thence to Transylvania, where anti-trinitarians were numerous, especially among the nobility, and finally (1579) to Poland, ultimately the centre of his influence. As a theological disputant, writer, and preacher, Faustus exhibited zeal and ability, but he encountered opposition from Roman Catholics and Protestants alike, through his attacks upon fundamental Christian doctrines. His position was that, although the Bible was authoritative and the gospel history miraculous, no doctrine contrary to reason or to moral progress should be retained. This led him to modify the current teaching respecting the nature of man, sin, and the deity of Christ. He held that certain parts of Christian faith were above reason and yet were to be accepted, and that Christ possessed a superhuman nature and character, but that the extrascriptural terms used of him in theology, like "person" and "substance" are unwarranted. After disputation with several Protestant leaders, Socinus was charged with sedition and forced for a time to withdraw from Cracow. His views finally aroused such antagonism that popular outbreaks occurred, in which Socinus was shamefully handled. His last days were spent in retirement in the village of Luclawice, where he died in 1604. His influence was very strong in shaping the theology of the Unitarian church in Poland.

Bibliography. Among the most important writings of Faustus Socinus are his *De Jesu Christo Servatore* and *De Statu Primi Hominis ante Lapsum*. In the former he discusses the person and work of Christ; in the latter, the doctrines of sin and grace. The *Racovian Catechism* (1605), a formal and elaborate statement of Socinian theology, was based largely upon outlines which he had made. The *Works* of Socinus are printed in the *Bibliotheca Fratrum Polonorum*, vols. i, ii (Amsterdam, 1656). Consult also: Rees, *The Racovian Catechism* (London, 1818); O. Fock, *Der Socinianismus nach seiner Stellung in der Gesammtentwickelung des christlichen Geistes* (Kiel, 1847); Bonet-Maury, *Des origines du christianisme unitaire* (Paris, 1882); H. M. Beard, *The Reformation of the Sixteenth Century in its Relation to Modern Thought* (London, 1883); J. H. Allen, *History of the Unitarians* (New York, 1894); Adolf Harnack, *History of Dogma*, vol. vii (Eng. trans., Boston, 1899); Albrecht Ritschl, *Christian Doctrine of Justification and Reconciliation* (Eng. trans., Edinburgh, 1902); A. C. McGiffert, *Protestant Thought before Kant* (New York, 1911). See Unitarianism.

SOCIOLOGY (from Lat. *socius*, companion, associate + Gk. -λογία, *-logia*, account, from λέγειν, *legein*, to say). The science of society, comprehending the analysis and classification of social facts, the scientific description and history of society, and the explanation of society in terms of simpler phenomena. Sociology is conveniently divided into general and special sociology. General sociology is the study of the universal and fundamental phenomena of society. It investigates the facts and correlations found in all societies, the types of society, and the stages of social development. It seeks to discover the general laws and the causes of social evolution. Special sociology consists of the entire group of social sciences, including culture, history, economics, jurisprudence, and politics, each of which deals minutely with some one phase of social organization, social activity, or social development. Sociology includes social statistics, and so much of history as may truthfully be said to repeat itself, i.e., those constant facts of coöperation, institutional life, and social welfare which recur in all communities and in all ages. The methods of sociology are inductive. Its chief dependence is upon comparative historical studies and upon statistics. It draws largely upon psychology also for data and for principles of explanation.

HISTORY

The philosophy of social relations is one of the most ancient parts of human wisdom. The sacred books and the laws of Egypt and of Babylonia, of Palestine, and of Greece abound in empirical maxims of domestic and public economy, social justice, and statecraft. In the *Republic* and the *Laws* of Plato, and especially in the *Politics* of Aristotle, we have the beginnings of a scientific classification of social facts, and a number of important generalizations. In the writings of Aquinas and Dante, of Machiavelli and Vico, of Bodin, Althusius, Spinoza, Hobbes, Locke, Hume, and Rousseau, we have acute interpretations of social phenomena in terms of human nature, i.e., of motives. Montesquieu (q.v.), in *L'Esprit des Lois*, laid the foundations of an interpretation in terms of external conditions or environment, and this interpretation was further developed in a few special directions by the Physiocrats. In none of these writings, however, were scientific methods of investigation strictly followed, and in none of them after Aristotle did there appear the conception of a comprehensive social science. They were penetrating studies of special phases of social phenomena, not explanations of society as a whole.

The conception of a comprehensive social science we owe to Auguste Comte, who invented for it the objectionable name "sociology." Comte regarded society as a perfect unity and protested against the attempt to investigate religious, economic, or political phenomena apart from one another, as necessarily misleading. His chief interest, however, was to include the study of society within a scheme of positive philosophy, from which all theological conceptions and speculative methods should be eliminated.

The concept of a general sociology left little impression upon scientific thought until Herbert Spencer wrote *The Study of Sociology* (1873), and made the "principles of sociology" an integral part of his system of "synthetic philosophy." Spencer's system is an explanation of society in terms of evolution. He regards society as an organism, which undergoes integration and differentiation. This social organism conditions the life of the individual. In the struggle for existence social groups, like individuals, come into conflict. Fear, born of conflict, for countless ages is a controlling emotion. Dominated by fear and its sister passion vengeance, men precipitate conflicts which are not forced upon them by necessity, and which often assume the proportions of war. Character is molded to militarism. Cruelty and treachery towards enemies is a virtue. Submissive obedience to authority is exacted, and the whole social organization is pervaded by coercion. From the fear of the living have arisen a ceremonial and a political control, and from the fear of the dead, growing out of the belief that the spirit, surviving the body as a ghost, continues to interfere in the affairs of the living, has arisen a religious control. The ceremonial, political, and religious systems are the regulative mechanism of society. Captives taken in war, or whole populations reduced to serfdom, constitute the sustaining system. Militarism consolidating small groups into petty states, and these into nations, achieves social integration; but by widening the area within which peace prevails it brings about its own decline. The transition from militarism to industrialism, thus made possible by social integration, transforms human nature and social institutions. Spencer's system is a coherent scientific whole, yet it lacks one important feature of a growing science. It does not develop and apply any distinctive method of investigation.

Such a method had already been contributed by Quetelet, the Belgian statistician, who in his valuable works set forth the one method of research by which the study of social phenomena will in time be brought to that exactness which characterizes older sciences.

Thus far, however, systematic treatises on sociology have been devoted almost wholly to the further exploitation of general concepts, and little progress has been made toward correlating these with statistical method. Sociological systems may be classified as physiographic, biological, psychological, and ethnographic. The physiographic systems attempt to explain all social evolution in terms of the action of environment upon character, conduct, and institutions. Many of the so-called economic interpretations of history also belong in this group, while others fall into a different class. In strictness we ought to distinguish between an organic economy, meaning thereby the whole scheme of adjustment between organism and environment, and an industrial or business economy, a comparatively late development of human evolution. Social evolution is an incident of organic economy; industrial economy is an incident of social evolution.

What may be called the biological-organic conception of society presupposes more or less of the physiographic, but it does not accept the usual account of the influence of environment upon the community as adequate. Granting that social processes are in the last analysis to be accounted for by the relations of organism to environment, including competing organisms, the biologists raise the question of the nature of society itself, and answer that society is a compound organism, having its own anatomy and physiology, its pathology also, and assume that these are the true subject matter of social science.

In like manner the psychological conception of society presupposes the physiographic explanations, and it does not deny that in a general sense society may be regarded as organic. But it prefers Spencer's word, superorganic, because it insists that social relations are essentially facts of mind. Consequently it denies that society is explained until we know how the mental operations of individuals are combined in the common sentiments and opinions and expressed in the collective will of the community.

To the ethnographic systems of sociology belong those interpretations which emphasize the ceaseless struggles among tribes, nations, and races, and find ultimate explanations of social integration and differentiation in conquests and absorptions of the weak by the strong.

An obvious criticism upon these systems is that they take society already existent for granted. They do not account for the origins of society as such. The immediate antecedents of all social relations are facts of the psychological order. But these facts, of course, are themselves conditioned by biological and physiographic relations. It appears, therefore, that sociological theories should start from psychological premises, but that the correlation of all processes with the character of the physical environment should be recognized throughout. This is attempted by Franklin H. Giddings. (See *Bibliography*.) He derives all social phenomena from the like responses of a plural number of individuals to the same or like stimuli. Habitual like response constitutes mental and moral resemblance. Those who are mentally and morally alike become aware of their similarity. Awareness of resemblance beginning in mere feeling or sympathy, but becoming perceptive and rational, is called the consciousness of kind. Those who share the consciousness of kind develop their like responses to stimuli into a concerted volition which becomes a practical coöperation for useful ends, and systematic coöperation develops into the more or less enduring forms of social organization. This chain of processes has antecedents in the density and composition of the population, which, in turn, are determined by the character of the physical environment. Certain regions maintain homogeneous populations only. Others attract heterogeneous populations, the composition of which determines the possibilities of common response to stimuli.

SYSTEMATIC SOCIOLOGY

Systematic sociology is naturally divided into four parts, viz.: (1) The critical examination of data, methods, and problems, including the delimitation of sociology from other sciences; (2) descriptive sociology, an analysis and classification of contemporaneous social facts, with generalizations concerning social processes; (3) historical sociology, a study of the evolution of society from animal groupings and the communities of primitive men down to the civilized nations of modern times; (4) theoretical or explanatory sociology, an attempt to derive from the description and history of society and from the general principles of evolution a theory of social causation.

Critical Examination. Some of the chief topics falling within the first of these divisions of systematic sociology have been touched on in the foregoing account of the history of the science.

Descriptive Sociology. A few words of analysis of the subject matter, viz., social phenomena, may fitly introduce an account of the second division, descriptive sociology. A fact of the physiographic order is the starting point. Throughout the universe as known to man, objects of like kind are commonly grouped or segregated in space, and not scattered in a disorderly distribution. This is more particularly true of living organisms, all species of which have their respective geographic areas, and within these their favorite habitats or haunts. Plants of any given variety are usually found massed in particular places. Animal organisms are commonly found in swarms, bands, or flocks. Human beings live in hordes, tribes, and nations.

From this purely physical fact we pass in the analysis of society to facts correlated with mental activity, and then to facts psychological. Of all the resemblances which may be observed in the units or individuals constituting a normal aggregation of living creatures, the two of chief importance are (1) morphological and physiological similarities produced by common descent and interbreeding, and therefore correlated with degrees of kinship; (2) similarities of nervous organization and mental activity which may or may not be closely associated with degrees of kinship. On the functional side the most general phase of like nervous organization is a like responsiveness to the same stimulus or to like stimuli. Under the same or like circumstances two or more animals or human beings of like nervous organization behave in like ways.

Human beings who intellectually as well as sympathetically apprehend their common nature find pleasure in communication and acquaintance. They discover that, responding to the same impulses, they form common purposes and can work together for common ends. Systematic coöperation thus arising holds men together in those relatively permanent relationships which constitute social organization. Social organization reacts upon the welfare of the community, furthering survival and individual happiness.

A complete description of society should comprise the following parts: (1) An account of the social population regarded as a physiographic phenomenon, an aggregation of organic units determined by the situation and resources of its habitat. (2) An account of the mental qualities and the conduct of the social population; its subjective resemblances and differences; its types of intellect and character; its antipathies and sympathies; its purposes, its choices, its collective will. These phenomena together are the social mind. (3) An account of the social organization which the social mind creates, and through which its purposes are achieved. (4) An account of the social welfare resulting from the policies which the social mind has approved, and from the normal functioning of the social organization.

1. *The Social Population.*—An account of the social population must always be prefaced by a physical description of the territory occupied, although, strictly speaking, this is no part of sociology proper. This necessity has been recognized by the United States Census Bureau.

Since the census of 1890 an account of the dominant geographical features of the national domain has been included in the reports, and the distribution of population with reference to these features and to altitude, drainage basins, rainfall, and temperature, has been shown. Still more important would it be to show the distribution of population with reference to natural resources, viz., agricultural fertility, mineral wealth, commercial and industrial opportunities.

Density of population is determined by the combination of two factors, viz., the birth rate and the migration rate. No community of large dimensions is a purely genetic aggregation, maintained wholly by its birth rate. It is at the same time a congregation, a group brought together in part by the incoming of individuals or families born in other parts. Genetic aggregation itself is more or less complicated by variation, and this, in combination with the results of migration, gives rise to a composition of the population of elements more or less unlike. The physical differences thus comprised include organic variation, differences of age, the difference of sex, and the degrees of kinship. The degrees of kinship include consanguinity, or the nearest degree of blood relationship; propinquity, the somewhat remoter degree of neighboring communities that have much intermarried; nationality, the kinship of those who from their birth have been of the same speech and political association; potential nationality, or nationality in the making; ethnic race, glottic race, chromatic race, and cephalic race.

These compound race terms are used to avoid confusion. Ethnic race includes those nearly related nationalities which speak closely related languages and exhibit common psychological characteristics. For example, the Teutonic race includes the Saxon-English, the Dutch, the Germans, and the Scandinavians, all related nationalities. The glottic race is a yet broader kinship which includes those related ethnic races which at some remote period had a common culture and spoke the same language, as, e.g., the Aryan glottic race, which includes the Teutons, the Celts, the Latins, and the Slavs. Chromatic race is that remote degree of relationship which includes all glottic races of the same general color of the skin and type of hair. Cephalic race is that most remote degree of kinship which is manifested in peculiarities of cranial structure. There are various gradations from the dolichocephalic, or long head of the negro, to the brachycephalic, or broad head of the Mongol.

The influence of the physical environment is seen in the degrees to which a population is heterogeneous, no less than in the degree of density. Naturally isolated regions, and regions that offer no great temptation to immigration, remain relatively homogeneous. Agricultural regions remain more homogeneous in population than mining regions or points of commercial or industrial opportunity. Regions of great agricultural fertility which share also in other advantages have usually in the world's history become heterogeneous in population through armed invasion and conquest. Sooner or later, whatever the admixture of nationalities and races, a large degree of amalgamation takes place in every population through intermarriage. While external influences may be tending to make a social population composite, its own internal forces work towards homogeneity and unity.

2. *The Social Mind.*—The evolution of the social mind is determined by those physical facts of the density and composition of a social population which condition its subjective life. The more homogeneous a population is the more certainly will its individuals be moved by common impulses. Heterogeneous populations have varied interests, which is another way of saying that they respond to differing stimuli.

The like responses from which social activities are developed are temporary or habitual, and the stimuli of temporary like responses include nearly all of the initial causes of association. Where the stimuli are persistent and lead to habitual conduct the whole nervous organization is molded accordingly. Mental and practical resemblances are created. The stimuli presented by external nature create types of emotion and of intellect. The stimuli of economic opportunity, leading to activities of utilization, create types of disposition. The stimuli which impel men to adapt themselves to their environment, when they have failed to adapt the environment to themselves, create types of character. Types of emotion, intellect, disposition, and character in their various combinations make up the various types of mind.

The various mental and moral types found in any large population of civilized men have been produced by varying degrees of responsiveness to differing stimuli, and in their turn they determine the degree to which the whole population, or large sections of it, can share a common impulse. The more highly differentiated a population is into intellectual and character types the fewer are the stimuli which can move all to common purpose and action.

The causes of assimilation are conflict, toleration, and imitation. Gabriel Tarde has undertaken to derive the entire social process from imitation. He recognizes in society, and in the universe at large, conflicts of action, as well as repetitions or similarities, and in his important work, *La logique sociale*, he develops the social aspect of a process of adaptation, whereby conflicts of action and repetitions of action are reconciled. This is to identify all similarities or repetitions of action with imitation. It would seem to be more accurate to recognize both original (or simultaneous) similarities and repetitious (or sequent) similarities, and to identify imitation with the latter only. Moreover, inasmuch as it is through the establishment of sequences of similarity that adaptation or adjustment is brought about, imitation must necessarily be identified with adaptation. All of these processes are seen in perfection in a society of mixed elements. Conflicts sometimes result in the subjection of the weaker, sometimes in an equilibrium of strength, which is the basis of toleration, and sometimes in good feeling and imitation.

Given, now, similarities of mind and character in a population, and a consciousness of kind, conditions are present for the formation of agreeing purposes, a concert of wills, and coöperation. Together these processes may be called concerted volition. The degree of resemblance, the consciousness of kind, the character of the stimuli, determine the extent of concerted action. This may be a temporary concerted volition, such as is seen in festivals, crusades, strikes, panics, insurrections, and political campaigns, or it may be a relatively enduring coöperation. Coöperation grows by indistinguishable gradations out of momentary like responses which may begin accidentally, as, e.g., when bystanders run simultaneously to a person hurt or in trouble. The consciousness of kind is necessary to supplement such beginnings by making it evident to each of the participating individuals that they are working towards the same end, and that they are sufficiently alike to work together successfully. There must, however, be yet another factor. The purpose achieved by the combined action must be of mutual benefit, and the utility must be perceived.

Coöperation is public or private. It is public when all individual members of an entire natural society act together with one purpose and authority, either because all have the same desire, or because one or a few take the lead and others acquiesce or obey. An entire natural society viewed as coöperating is a state. When only a part of the social population responds to the same stimulus, and engages in coöperation without the participation or command of the state, although not without its tacit or implied consent, the coöperation is private or voluntary. Coöperative activities, whether public or private, are of four kinds, viz., cultural, economic, moral or legal, and political. The order in which these activities have been named is the order of their genesis and evolution. Seemingly, but not in reality, this order denies the primitive, fundamental character of economic relations. Betrayed by a misconception of cultural activities, many sociologists have placed them wrongly in the series. Their true nature and history can be understood only when we remember the distinction already mentioned between organic and industrial economy. The organic economy of the world of vegetation shades into the instinctive economy of animals, and that in turn into the rational economy of mankind. For ages before it becomes an industrial or business economy, the practical life of man in his struggle with the forces of nature is a ceremonial economy, consisting chiefly of magic, incantations, and formal rites. Language and manners begin among the lower animals as products of their efforts to appropriate the bounty of nature and of their struggles with hostile natural forces and with one another. Animistic ideas, the plastic and poetic arts, religious ideas and practices, originate in primitive human society, in attempts to understand and to master or propitiate the powers upon which man's life and comfort depend. They are all a part of the primitive economy.

It is out of these primitive economic activities that systematic industrial and commercial activities constituting the modern business economy are developed.

Coöperation in the development of moral thought and activity, including juristic activity, which is the public development of moral activity, has antecedents in both cultural and economic interests, but it also has characteristic stimuli of its own, chiefly injuries and wrongs.

Political coöperation on its public side is the governmental activity of the state. Private political coöperation includes all such lawful activities as the functions of political parties, and the conduct of campaigns, and such unlawful activities as insurrections and revolutions. Among the stimuli of political coöperation are superior power, to which enforced obedience is yielded, the impressive power of a strong personality manifested in leadership, and danger from foes. These are familiar causes that come readily to mind, but others less obvious are as important. Among them are those definite aims which political action seeks to achieve. They include the preservation of the group, its safeguarding, the maintenance of a certain character or kind in the population (an aim revealed, e.g., in the immigration laws), and certain ideals of the preferred distinction or attainment of the community, as, e.g., power, or prosperity and splendor, or justice, or liberty and enlightenment. Approximate political ends, or means to the attainment of the remoter ends just named, also are stimuli of collective action. Among them are the permanent possessions of the community, especially its territory, and policies in respect of population, or in respect of the habits, customs, and activities of the people.

Political coöperation itself, as distinguished from its stimuli or causes, is always a policy of some kind. Policies involve social choices, and these involve social valuations. The various ends which political action seeks to achieve are more or less useful to the community and such utilities are variously valued. Highest in value are ranked those objects for which the society exists, viz., the concrete living individuals who compose the community, the social type or ideal, and the attainment of the community. Lower in the scale of values are placed all those political relations and possessions which are but means to the attainment of social ends.

When the like responses of many individuals have developed through the consciousness of kind into concerted volition, the total resemblance thus established may be called like-mindedness. According as instinctive, sympathetic, dogmatic, or critical elements predominate does concerted volition vary in character from an almost instinctive action up through impulsive and contagious action to formal or fanatical action and ultimately to deliberative action. Like-mindedness, as a whole, may therefore be described as instinctive, sympathetic, dogmatic, or deliberative. Instinctive like-mindedness is found only in those ignorant populations in which the ideo-motor type of mind predominates. Sympathetic like-mindedness, widely prevalent in all nations, is characterized by impulsiveness, suggestibility, susceptibility to the stimuli of emblem and shibboleth, imitativeness, and contagious emotion. Association in crowds is highly favorable to its genesis. Among the chief forms that sympathetic like-mindedness assumes are revivals, panics, riots, and insurrections. Dogmatic like-mindedness is marked by dogmatically held belief, deference to authority, and fanatical action. It finds expression in zealous agitations, strong partisanship, and reliance on governmental power to regulate private conduct. Deliberative like-mindedness is characterized by inductive research, discussion, freedom of speech and of meeting, and rational action. It substitutes evidence for irrational modes of proof, and it is creative of the highest institutional activities.

The chief social bonds vary according to the situation, size, and composition of the population, its degree of mental and moral homogeneity, and the dominant stimuli of its activities. In small and comparatively isolated populations, ethnically and mentally homogeneous, there is a strong consciousness of kind, and the community is held together largely by acts of imitation and kindness. In the small and heterogeneous community, as a mining camp, e.g., where men, strangers to one another at first, congregate in the pursuit of economic wellbeing, the sympathetic elements of the consciousness of kind, and imitation, are relatively unimportant factors. Conflict, sharp and decisive, between man and man brings about a general condition of toleration and spontaneous justice, gradually supplemented by good will and helpfulness. In such a community there is always spontaneous allegiance to daring leadership and it becomes a social bond of great strength. Contagious emotion also is often a bond supplementing the others.

In a compound population, so made by invasion and conquest, the bond that ties the social system is the power of the conquerors and the submission and obedience of the conquered. The permanence of this bond depends upon that physiographic concentration and practical cohesion of the conquerors which insures the maintenance of their sovereignty. If the character of the country and the stimuli of economic opportunity and of opportunity for adventure are such that the invaders become dispersed, various personal efforts to establish sovereignty result in the creation of those untrustworthy bonds of intrigue and conspiracy which are made to appear of universal importance in the chapters of Machiavelli's *Prince*, and generally in the records of turbulent times. With the establishment of equilibrium through conflict, which eliminates excessively unlike and unequal elements from the population, conspiracy gives place to relations of contract, which thenceforward remains an important, or even the chief, social bond. Finally, in a complex population of highly differentiated elements which are undergoing assimilation, and which are already mentally alike in the important respect that they cherish common ideals, especially ideals of liberty and enlightenment, the chief social bonds may come to consist in fidelity, honesty, and social service.

Thus it appears from descriptive sociology that many of the theories of the origin and nature of society which appeared in political philosophy from the days of Aquinas and Dante down to those of Rousseau were within limits true. The sympathy or fellowship theories of the early Christian writers are true of small homogeneous communities. The natural-justice theories of the early legal writers are true of small heterogeneous communities. The sovereignty theories which found full expression in the writings of Bodin are true of the compound communities formed by invasion and conquest. The intrigue and conspiracy theories of Machiavelli are true of compound populations which have been reduced to disorder by the disintegrating influence of chronic conflict. Society in this condition is the "state of nature" of Hobbes, while the state of nature of Locke and Hooker exists when the elements of the population are sufficiently alike to live in toleration, if not in sympathy. Given conditions of toleration and natural justice, the creation of a higher social order through good understanding and contract may always be looked for.

3. *The Social Organization.*—The social organization is the outcome of two conditions, viz., (1) permanent relations of domicile and coöperation, and (2) the approval and sanction of such relations by the general will. Social organization is therefore an expression of like-mindedness in the population. Peculiarities in its development are partly accounted for by the passion of like-minded people to make the community more and more homogeneous in mental and moral qualities, and partly by a growing appreciation of the value of unlike-mindedness as a means of variation and progress.

The forms of organization are (1) the private and the public, (2) the authorized and the unauthorized, (3) the unincorporated and the incorporated, (4) the component, and (5) the constituent. Authorized forms are institutions, and an institution may be defined as a social relation that is consciously permitted or established by adequate and rightful authority, i.e., in the last resort, by sovereignty. The social composition is that grouping of individuals by dwelling place which makes up the series of component societies named below. A chief characteristic of the social composition is the commingling in each group of both sexes and all ages, and the consequent ability of each component society to perpetuate itself and live an independent life if it were cut off from all the rest of the world.

Component societies are of two great types, the ethnic or tribal, and the civil or demotic. Ethnic societies are almost purely genetic aggregations. A real or fictitious blood relationship is their chief social bond. Civil societies are partly genetic, but also largely congregate associations. Each consists of individuals bound together by habitual intercourse, mutual interests, and coöperation, emphasizing their mental and practical resemblance, and giving little heed to their blood relationships. Ethnic societies may be metronymic or patronymic. A metronymic group is one in which all relationships are traced through mothers. A patronymic group is one in which all relationships are traced in the male line through the fathers. The series of component groups in ethnic society is: family, horde, tribe, confederation. The horde is a small aggregation of families, usually a wandering camp, comprising 25 to 100 persons in all. The tribe is a community created by the consolidation of hordes, or by the growth and differentiation of a single horde, occupying a defined territory, speaking one language or dialect, and conscious of its unity. The confederation is a number of tribes united for war or other purposes, but maintaining a social organization on the basis of kinship, and therefore not developed into a true civil state. In civil society the composition series is: families, hamlets, villages or parishes, towns, communes or cities, counties or departments, kingdoms, republics or other commonwealths, federal states or empires.

The combination of small into large groups is made possible by the broadening consciousness of kind and the passion to perfect a mental and moral homogeneity throughout a widening area. This passion has both a sentimental and a practical aspect, the latter being found in a relatively greater security and the diminution of conflict through the extension of mental agreement.

The social constitution embraces all those specialized and correlated associations which carry on diversified social activities. Each has a defined object in view, and its members are selected with reference to their interest in its purpose and their ability to contribute to its realization. The social constitution is made possible by the differentiation of ideas and habits.

Constituent societies, like component, are ethnic or civil. In tribal communities the constituent society is usually not entirely differentiated from the component. The family, or the tribe, or a segment of one or the other, does duty in discharging some special function which, in civil society, might be performed by an association quite separate from the component group and specially organized for the purpose. The most interesting partially differentiated organization in tribal society is the clan. The clan is constituted of those persons who are descended from a common ancestor or ancestral group in a single line, through the mother or through the father. It is therefore only half of a natural group of consanguinii. Its functions are cultural, economic, and juridical. It preserves traditions, it owns common property, and enforces rights and obligations among its members, especially in matters of marriage and vengeance. The clan is known by various names in ethnology and in history, more familiarly by its Roman name *gens* (q.v.).

Often in tribal society is found a brotherhood of related clans which is called, from its Greek form, the *phratry*. The tribe, primarily a component group, is a military organization, and the confederation is a political organization.

Besides these component-constituent groups there are in tribal society certain special associations, almost always secret in their organization and functions. The most important are religious secret societies.

In civil society the household, the incorporated village, the municipality, the county, and the state are all component-constituent groups. They are purposive associations with definite functions, each approximately but not completely identical with a compound group. The state, e.g., the supreme political organization, is never precisely identical with the commonwealth or the nation regarded as a component society, since the latter always includes inhabitants who are neither voters nor even citizens in the state. As in ethnic, so in civil society, the associations which are completely differentiated from the social composition are voluntary organizations. They include cultural associations, the most important of which is the Church; economic associations, the most important of which are business corporations; moral and juristic associations, the most important of which are philanthropic organizations; the political associations, the most important of which are the great political parties.

The stability of organization depends upon a recognition by the community that organization must benefit the organized, and that in a highly specialized social constitution expert knowledge is of vital importance.

4. *The Social Welfare.*—In studying the social welfare we investigate the social functioning. The sum of the ends for which society exists is social welfare. Such ends are approximate or ultimate. The immediate results of efficient social organization are certain general conditions of well-being, in which all members of the community may share. They include the security of life and property which the political system maintains; the liberty and the justice which it is the business of the legal system to maintain; the material well-being which is created by the economic system; and the knowledge and the command over nature which are created by the cultural system. Collectively these proximate ends are public utilities. The ultimate end of society, as Plato and Aristotle so clearly recognized, is the perfection of personality, the creation of the social man. In the evolution of the social personality all phases of the life of the individual are affected. Vitality, mentality, morality, and that special aspect of morality which may be called sociality, are broadened and strengthened, or they are diminished, by the relations which man bears to his fellows. No two individuals are affected by social conditions in quite the same way or degree, and therefore the population is differentiated, in respect of these matters, into classes.

The primary distribution of the population according to vitality is into physically normal persons and defectives, and the normal are conveniently graded into the high, the medium, and the low vitality classes. In the high vitality class are those individuals who have a high birth rate, a low death rate, and a high degree of bodily vigor and mental power. This class is found chiefly in the well-to-do agricultural sections of the population. The medium vitality class roughly corresponds to the business and professional men of the large towns and great cities. The low vitality class is created chiefly by unsanitary conditions in great cities, but it is found also in an ignorant, uncleanly part of the rural population. The defective include the blind, the deaf and dumb, and the congenitally deformed.

The supreme achievement of society and the final measure of the success or failure of any state is its contribution of great personalities, great creations of art, great thoughts and ideals, to that universal society which embraces all mankind and endures through the ages of history. Measured by this standard some petty city states, like Athens and Florence, have been among the supreme examples of social evolution.

Historical Sociology. In historical sociology we again study the phenomena of the social population, the social mind, the social organization, and the social welfare, but on a larger scale. We inquire into the evolutionary origins of society and we find that long before man appeared upon the earth social relations had become established in the animal world, and that man undoubtedly began his career with an endowment of social instinct. Social relations and mutual aid influenced natural selection, and thereby affected the whole course of animal evolution. Association in its beginnings, therefore, was zoögenic. Through a further development of association, language, animistic ideas, arts, and religions came into existence, and the animal mind was converted into the human mind, and the animal body into the human body. This stage of evolution was anthropogenic. A higher evolution of the consciousness of kind created tribal instincts and customs, and gradually built up the highly complex system of ethnic society. This was ethnogenic association. Finally, through the recognition of mental and practical resemblance irrespective of kinship, civil or demotic society came into existence. The demos or people, as distinguished from the tribe, appeared, and with it civilization.

In animal societies all the essential phenomena of a social population may be observed, but those of the social mind are of the most rudimentary sort. There is no social organization beyond the slight beginnings of family life and a loose formation of bands or flocks.

In anthropogenic association the phenomena of the social mind begin to assume importance. Language is a product of association and reacts upon it. Vocal signs become conventionalized through imperfect imitation. The power of conceptual thinking, correlated with the evolution of language, is correlated also with association, for every true concept is a product of more than one mind. Conceptual thinking and self-consciousness enormously multiply the possible responses to stimuli and bring into the consciousness of kind all its higher reflective elements.

The great problems of ethnogenic association are those of the genesis of family, clan, tribe, and confederation; of the priority of relationship through mothers over relationship through fathers; and of that gradual disintegration of organization based on kinship, by the growth of an essentially feudal association based on personal allegiance, which prepared the way for civilization.

The primitive family, we may now feel reasonably sure, was an unstable pairing arrangement, usually of short duration. From this form were differentiated polyandry (q.v.), polygamy (q.v.), and monogamy. (See FAMILY; MARRIAGE.) The steps by which the clan was formed perhaps cannot be quite clearly traced. Primitive man counts relationships in one line of descent only. This fact accounts for the exclusion from the kindred of one-half of all those persons who are equally near in blood. The development of the tribe and the confederating of tribes is a consequence chiefly of warfare, which often brings weak groups under the domination or protection of the strong, or leads related tribes to combine against their common foe. When new tribes are formed by the subdivision of one that has grown too large for subsistence on the tribal domain, families from each clan of the older tribe may go into the new tribe. In this way a cluster of tribes may be closely related in blood and speak dialects of a common language, conditions highly favorable to confederation and subsequent evolution as a nation.

Tribal confederations that have become civil states have undergone a further evolution, however, which has destroyed many of the characteristic features of tribal organization. To begin with, the metronymic system is superseded by the patronymic. The transmission of property and office from father to son thus made possible leads to the differentiation of certain families as of superior rank. If a primitive agriculture has been supplemented by pastoral industry, wealth in cattle becomes one of the chief temptations to engage in tribal wars. Chieftains as leaders of successful expeditions receive an exceptionally large number of stolen cattle and the privilege of pasturage on the border lands of tribal territory. They obtain also as retainers and herdsmen the broken and ruined men of other tribes, whose clans have been destroyed and whose future position in society is secured only by their allegiance to a powerful protector. From such beginnings a rude tribal feudalism develops, which encroaches steadily upon the earlier kinship system. Evidences of this stage of evolution are found in various bodies of barbarian law, but especially in the Irish and Welsh codes.

When a confederation of tribes becomes thoroughly consolidated by war or otherwise, the chieftaincy of the confederation, having become hereditary, may develop into a kingship through the uniting into one of the offices of chief military leader, supreme judge, and high priest.

At this stage the ethnic society is on the point of passing over into civilization. If it is tempted by the pressure of population upon the means of subsistence to migrate to a more productive region, and, after conquering the occupiers of a coveted territory, reduces them to task work and establishes itself permanently on the soil, it undergoes a further development of feudal organization, and in the course of time begins to include as members of the settled clans and tribes any newcomers who come to reside among them.

Civilization once established develops through three stages, which are well marked so far as the structure, policy, and activities of society are concerned, but which to some extent overlap and run into one another chronologically. The breakdown of the kinship system, and the intermingling of men of diverse origin at centres of industrial and commercial activity, are presently followed by the beginnings of assimilation and amalgamation. When this process is perceived, the possibility of creating a new ethnic unity on a broad scale—the unity of a people, one in language, in religion, and in standards of conduct—is seized upon, and a passion for homogeneity begins to express itself in certain great policies. The attempt is made by military campaigns to bring into one political organization adjacent peoples nearly related in blood, in language, and in tradition, and to annex any territory which may form with that already occupied a geographic unity. The militarism thus developed is of itself a powerful unifying agency, and it is supplemented by policies of religious unification, and by harsh systems of sumptuary legislation and of criminal law.

When the work of nation making by policies of unification has been completed, the first stage of civilization yields to a second, which is a result of the liberation of energies no longer demanded in military activity. Commerce, travel, and learning receive a new impulse. The comparative study of peoples and institutions leads to criticism and discussion. The authoritative régime is subjected to review; it begins to disintegrate under impeachment and resistance. Rationalism and liberalism create the great institutional products of civil liberty and constitutional law. Men no longer care as of old for perfect mental agreement; they encourage the growth of independence and variety. This is the age of progress, of the liberal-legal civilization.

Presently, however, wide liberty, divergence of mental type, and the multiplication of differing interests begin to threaten social cohesion. Powerful and unscrupulous men abuse their liberty, using it to take an unfair advantage of others and to curtail the liberties of the weak. Freedom of enterprise and of contract are followed by an enormous increase of wealth and of population. But the wealth is concentrated in relatively few hands and increasingly large numbers of workingmen find that they are not receiving a proportional share of well-being. Growing inequality places the severest strain upon the social system, and compels the community to limit liberty in some measure by equality. Political and legal equality come first, but measures of economic equality also are demanded, and great educational enterprises try to achieve an equality of cultural opportunities. This is the modern democratic movement, and the third stage of civilization.

Explanatory Sociology. This department is as yet in a very incomplete state of development. So far as the physical side of social evolution is concerned, it exhibits the same phenomena of integration, differentiation, and increasing definiteness of organization that material bodies undergo. The cause also is the same, viz., the equilibration of energy between bodies overcharged and contiguous bodies undercharged. There is such an equilibration between a population and its environment, and all the energy that society is enabled to expend it derives from the bounty of nature, supplemented by industrial activities. There is such an equilibration of energy between strong and weak states and between strong and weak races. The transformation of the weak by the strong can never cease until equilibrium is established. The transformation need not be a military conquest, however, or even an economic exploitation. So far as physical law is concerned, it may equally well be an uplifting of the weak to higher planes of sympathy and intelligence by the hands of the strong. The extent to which the process may thus be philanthropic depends upon the growth of the consciousness of kind. Originally limited to the kindred of horde and clan, it has broadened into tribal and at length into a national consciousness. To-day it is becoming a human consciousness. In all this transformation every change obeys the laws of parsimony. Motion follows the line of least resistance and human activities try to achieve given results with the least expenditure of effort. It is only a corollary of this law that activity is conditioned by the consciousness of kind, since strangeness and antipathy are resisting conditions. It is only another corollary again that dogmatic like-mindedness develops out of sympathetic, and deliberative like-mindedness out of dogmatic; for the results achieved by the lower forms of concerted volition, viz., the instinctive and the sympathetic, are wastefully accomplished as compared with those achieved by the higher forms. These laws are otherwise formulated as the great laws of diminishing and increasing returns, long familiar to economic science, but equally true in the realm of social phenomena. When the lower forms of activity are carried far they begin to yield diminishing returns. When old channels of activity are obstructed energies break through into new channels, and for a time new adjustments yield increasing returns. By these laws we account for the substitution of reason for impulse, of deliberation for moblike action. The substitution is in a broad sense a natural selection. Social activities and forms begin unconsciously. In the course of time men, becoming aware of the social relations that have spontaneously developed, try to perfect them. They create institutions and carry out policies. The unconscious operations of nature now again assert themselves. Some of the products of man's invention, proving useful and promoting his welfare, survive. Others perish and are forgotten. Those social forms survive which, like organisms successful in the struggle for existence, yield on the whole increasing returns of useful conversions of energy.

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SOCKEYE. See Salmon.

SOCOR′RO. A town of the Department of Santander, Colombia, formerly its capital, 145 miles northeast of Bogotá (Map: Colombia, C 2). Its chief industries are the weaving of mantles and the manufacture of straw hats. Pop., 1912, 11,427. The town was founded in 1540 and after its destruction in 1681 moved to its present location. In 1781 a formidable revolt took place here, and in 1810 there was issued a formal declaration of independence from Spain.

SOCOTRA, or **SOKOTRA**, sō-kō′trȧ *or* sŏk′ō-trȧ. A British protectorate, an island in the Indian Ocean, at the entrance to the Gulf of Aden, about 147 miles east of Cape Guardafui (Map: Africa, K 3). It is 72 miles long and 22 miles broad. Area, 1382 square miles. The centre of the island is occupied by the Haghier chain, attaining nearly 5000 feet. The coasts are partly fringed by cliffs, mostly low. There is a long plain of drifted sand along the south shore. The valleys are well watered and rich in vegetation. The climate is hot and dry. The dry season lasts from May to October, during which time there is practically no rain in the lower parts of the island, and many rivers become dry. The flora is varied, with many aromatic species, as myrrh, frankincense, aloes, etc. There is little agriculture. The principal commercial products are ghee, aloes, and incense, which are exported to Bombay, Zanzibar, and Arabia. The natives keep extensive herds of goats and cows. The population is estimated at 12,000—a mixed race of Arabs and Hindus who are found along the coasts, and the Sokotri, who are also believed to be of Arabic origin and are confined principally to the mountainous districts. It was occupied by the Portuguese at the beginning of the sixteenth century. Since 1876 Socotra has been under the government of Aden, which pays a small subsidy to the Sultan of Keshin, to whom it belonged. It was formally placed under British protection by agreement with the Sultan in 1886, together with several neighboring islands. Native rule is maintained.

SOCRATES, sŏk′rȧ-tēz (Lat., from Gk. *Σωκράτης*) (469–399 B.C.). An Athenian philosopher. He received as a boy only the old-fashioned elementary education in music and gymnastics, but later familiarized himself with the education of the Sophists in rhetoric and dialectics, with the speculations of the Ionic philosophers, and all the culture of Periclean Athens. Plato represents him as veiling behind an ironical profession of ignorance an ingenuity and resourcefulness that made him more than a match for the most distinguished specialists. Xenophon, while affirming that Socrates held the proper study of mankind to be the moral life of man, adds that he was by no means unversed in the curious inutilities of mathematical and physical speculation. He followed at first the craft of his father, a sculptor, and tradition attributed to him a group of the three Graces draped, which Pausanias saw on the Acropolis. The greater part of his mature life, however, was spent in the market place, streets, and public resorts of Athens in conversation with all who cared to listen, or whom he could lure to render an account of their souls and submit themselves to his peculiar style of interrogation. In Plato and Xenophon he has no other occupation, except, of course, the civic duties of every free-born Athenian. He served as a hoplite with conspicuous bravery at Potidæa (432 B.C.), Delium (424), and Amphipolis (422). In 406 B.C. the chances of the lot made him a member of the senate of the 500 and presiding prytanis on the day when the illegal motion was offered to condemn to death by one vote the generals who had neglected or been unable to rescue the wounded after the naval battle of Arginusæ (q.v.). He refused to consent to the putting of the vote, defying the anger of the mob, even as a few years later he withstood the tyrants and refused to execute the command of the "Thirty" when they bade him assist in the arrest of an innocent citizen, Leon of Salamis. By his wife, Xanthippe, he had three sons. The tradition of Xanthippe as the scolding wife and typical shrew is ignored by Plato, who merely mentions her presence in the prison on the last day before and after the dialogue on immortality.

In the *Apology* or defense which Plato puts into his mouth on his trial, Socrates half seriously affirms that his peculiar way of life was a mission imposed upon him by God. The oracle of Delphi (the story presupposes that he was already well known), in response to the question of an enthusiastic rather than judicious disciple, had pronounced Socrates the wisest of men.

Conscious that his only wisdom was self-knowledge, the knowledge that he knew nothing, he proceeded to test those reputed wise at Athens, the poets, the statesmen, the artists. In each case the value of the specialist's particular talent was more than nullified by his inability to render a rational account of it, and the false conceit of a larger knowledge not possessed, and he inferred that it was his divinely appointed mission to force upon his fellowmen self-knowledge and conviction of ignorance as the first step toward self-betterment. Such a profession exercised for 30 or 40 years amid a gossipy and jealous population brought him more notoriety than popularity.

The effect was heightened by the startling contrast, to Greek feeling, between Socrates's exterior and the dignified and impressive demeanor to be expected of a great teacher and leader of men. The ungainly figure; the protuberant belly; the Silenus-like masque with bald head, prominent eyes, and wide, upturned nostrils; the beggarly garb; the vulgar instances and homely parables in which his wisdom disguised itself; the personal oddities of the man; his hour-long fits of staring abstraction; his ingenious art of cross-examination entrapping the cleverest into self-contradiction; the mysterious admonitions of his "Dæmon" or inner voice; the habitual asceticism of this barefoot philosopher, content with bread and water and one garment summer and winter, yet able on occasion to outdrink and outwatch and outtalk the boldest revelers and most brilliant wits of Athens—all these traits as felt by the inner circle of disciples and portrayed by Plato's art, only add piquancy to the demoniac personality thus half revealed and half concealed. But to the multitude they only made up a figure of comedy. In the *Clouds* of Aristophanes (423), the man whom we conceive as the antithesis of the Sophistic rhetoric and the founder of moral and mental as opposed to physical philosophy appears as the master of a "thinking shop" in which pale-faced disciples burrow into the bowels of earth, and where unscrupulous fathers can have their sons taught the art of making the worse appear the better reason, while Socrates himself aloft in an aërial basket "treads the air and contemplates the sun." The comedian is not bound to make nice distinctions. For Aristophanes, Socrates was an apt comic embodiment of the new learning which the conservative poet detested. Like the Sophists, he occupied the young men with something else than the care of healthy bodies, and he resembled the Sophists in the unsettling effect of his questioning of the established order. Plato, for artistic reasons, puts these attacks of comedy as manifestations of the popular prejudice in the forefront of the *Apology*. The immediate causes of Socrates' condemnation were probably the hostility aroused by his ironical comments on the democratic method of deciding great questions by the lot or the show of hands, and the distrust felt by the average man for the leader of the traitor Alcibiades, the tyrant Critias, and the Philo-Laconian Xenophon. In 399 a poet, Meletus, a demagogue, Anytus (a prominent democratic politician), and an orator, Lycon, presented a formal charge in the Court of the King (Archon): "Socrates is guilty of rejecting the gods of the city and introducing new divinities. He is also guilty of corrupting the youth." The first charge relates to the "Dæmonion," or divine something, often referred to by Socrates, about which a large and unprofitable literature exists. In Plato it is merely the voice of an inward spiritual tact always operating negatively as a check to actions, however trifling, opposed to the true interests of the soul. Other writers have reported it with superstitious, psychological, or pathological flourishes after their kind. Corruption of youth was the serious charge. The case came before a jury of about 501 members. Socrates declined (the story goes) the professional aid of the orator Lysias, and defended himself in a speech of which the spirit is preserved in the Platonic *Apology*, a masterpiece of art in its seeming simplicity. Condemned by a small majority, he took still higher ground when it came to fixing the penalty, and proposed, so Plato says, that it be maintenance in the Prytaneum (q.v.) as a public benefactor. At the solicitation of Plato, Crito, and other friends, he finally proposed to pay a fine. The jury naturally voted by an increased majority for the alternative penalty of death, which Socrates doubtless expected and was willing to accept as an appropriate crown of martyrdom and a release from the approaching infirmities of age. The rest is told in two immortal dialogues of Plato. The *Crito* shows us Socrates in the interval of respite caused by a religious festival and the absence of the sacred ship at Delos, resisting the importunities of his friends that he should escape by bribing his jailers, and so, as he says, in very deed teaching young men by his example to violate the law. The *Phædo* depicts the long final day spent with friends in conversation on the immortality of the soul, and, the last scene of all, "how bravely and cheerfully the first great martyr of intellectual liberty met his doom."

The self-control which he exemplified and the self-knowledge which he inculcated are the keynote of Socrates' philosophy. The basis of his ethics was the principle or paradox that all vice is ignorance, and that no man is willingly bad. In logic, according to Aristotle, two things may justly be attributed to him; inductive arguments and the quest for general definitions. But, as he left no writings, we cannot tell what system of thought, if any, he constructed on these presuppositions and by this method. We may divine that he was much more than the homely Johnsonian moralist of Xenophon's *Memorabilia*, and something less than the poetic dialectician and metaphysician of Plato. But we cannot know. Plato was a cunning dramatic artist, and the seeming simplicity of Xenophon's *Memorabilia* is no warrant of its historical fidelity. Ten years of adventure presumably separate Xenophon from the conversations which he professes to record. Both the *Memorabilia* and the minor Platonic dialogues doubtless contain many genuine reminiscences of the "real Socrates." But we cannot use them to construct a body of doctrine for him. The tremendous influence of his personality remains one of the great facts of history. Through the "complete Socratic" Plato and his pupil, Aristotle, he determined the entire subsequent course of speculative thought. The "imperfect Socratics," the founders of the other schools of ancient philosophy, drew their inspiration from partial aspects of his character. The Socrates who wore one garment summer and winter, walked barefoot on the snow, and exclaimed at the fair, "How many things there are that I do not need," became through Antisthenes the author of the Cynic way of life and the Stoic philosophy. The Socrates who was all things to all men was the model of Aristippus, the founder of the Cyrenaic (and Epicurean) philosophy of experience and pleasure. The ideal Socrates depicted in the Platonic *Apology, Crito, Gorgias,* and *Phædo* became, in the decay of the old religions, the chief religious type of the ancient world, and to such moralists as Epictetus, Seneca, and Marcus Aurelius the very embodiment and guide of the higher life.

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SOCRATES, surnamed SCHOLASTICUS (c.380 A.D.–?). A Greek Church historian, born and educated at Constantinople. He was by profession a lawyer. In his later years he traveled in Paphlagonia and Cyprus. His work on church history, 'Εκκλησιαστικὴ ἱστορία, appeared in seven books about 439. Intended as a continuation of the work of Eusebius, it covers the period 305–439 and for that period furnishes one of the three chief sources of church history (the other two being the works of Sozomen and Theodoret, qq.v.). The work deals particularly with the ecclesiastical disputes of the period. It appears in English in *A Select Library of Nicene and Post-Nicene Fathers of the Christian Church,* second series, vol. ii (New York, 1890–1904), edited by Philip Schaff and Henry Wace. For information on the life of Socrates consult the introductions to the Cambridge edition of his work by G. Reading (1720) and the Oxford edition by R. Hussey (1853), reproduced by W. Bright (1878). On his work consult F. A. Holzhausen, *De Fontibus Quibus Socrates, Sozomenus, ac Theodoretus in Scribenda Historia Sacra Usi Sunt* (Göttingen, 1825), and Franz Geppert, *Die Quellen des Kirchen historikers Socrates Scholasticus* (Leipzig, 1898).

SOCRATES, PRISON OF. The name popularly given to three chambers hewn in the face of the hill of Philopappus at Athens.

SODA (It. *soda,* soda), or SODIUM CARBONATE, Na_2CO_3. A white solid substance having a strong alkaline reaction and crystallizing with 10 molecules of water, $Na_2CO_3+10H_2O$. In commerce it appears both with and without water. Crystallized, hydrated sodium carbonate, also called "sal soda," is the common washing soda; sodium bicarbonate, or "acid" sodium carbonate, $NaHCO_3$, is the common cooking soda, an important constituent of all baking powders. The dry carbonate, Na_2CO_3, is used in enormous quantities in the manufacture of glass and soap. Native sodium carbonate, or "sodium sesquicarbonate," $Na_2CO_3.NaHCO_3+2H_2O$, is found to some extent in all dry regions, notably in Hungary, Egypt, and the deserts of Africa, Asia, and North and South America, but in no other country does it occur in greater quantities than in the region lying east of the Sierra Nevada Mountains. The mineral is known as *natron, trona,* or *urao.* Formerly most of the sodium carbonate of commerce was derived from the ashes of certain plants, chiefly barilla and kelp, but at the present time the quantity derived from all other sources is insignificant when compared with that manufactured from common salt.

Natural soda, which is the residue obtained by the evaporation of natural alkaline waters without the aid of artificial heat, occurs as white incrustations on the alkali plains; the most important deposits, however, are in the form of "sinks" or lakes without outlet, in which the leachings and drainings of the alkali plains have been collected and concentrated. In the United States the waters of three lakes alone, Albert Lake in Oregon and Mono and Owens lakes in California, are estimated to contain more than 118,000,000 tons of sodium carbonate and nearly 30,000,000 tons of sodium bicarbonate. Owing to the great distance from large eastern markets and the consequent high freight charges, this immense supply of raw material for the manufacture of the various sodium salts has not entered into successful commercial competition with the brine deposits of the eastern States. Soda ash is the most important of these products, while caustic soda ranks next. The total tonnage of the soda products in 1909 was more than five times and the value more than three times that in 1889. The quantities and values of sodium compounds produced in the United States during 1909, according to the Thirteenth Census, are given in the subjoined table:

PRODUCTS	Tons	Value
Soda ash	646,007	$10,361,756
Sodium bicarbonate	82,800	1,515,031
Caustic soda	112,152	4,230,954
Borax	20,154	1,766,910

Manufacture of Sodium Carbonate. Sodium carbonate is manufactured commercially by several processes, of which only two are of importance—the Leblanc process and the Solvay process, each named from its respective inventor.

The French Academy of Sciences in 1775 offered a prize for a method of making sodium carbonate from salt. Among the processes submitted was that of Nicolas Leblanc, which was of promising merit, and, being granted a patent in 1791, he began the manufacture on a commercial scale. The Leblanc process is regarded as the most important discovery in the entire range of chemical manufactures, and has furnished about one-half of the world's supply of soda. The fact that it produces both hydrochloric acid and bleaching powder as by-products has enabled it to survive competition, but the introduction of electrolytic processes, which also yield bleaching powder as a by-product, is a serious menace to its future.

The Leblanc process consists of three stages: 1. The conversion of common salt (sodium chloride) into sodium sulphate by the action of sulphuric acid, accomplished by the aid of heat in a reverberatory furnace. This stage is called the saltcake process, "salt cake" being the technical name applied to the sodium sulphate product. Two chemical reactions are involved in this stage, viz.:

$$NaCl + H_2SO_4 = NaHSO_4 + HCl$$
$$NaCl + NaHSO_4 = Na_2SO_4 + HCl.$$

2. The decomposition of the sodium sulphate, by means of calcium carbonate and coal, at a high temperature in a furnace, the result being a crude product known as "black ash," which consists of sodium carbonate, calcium sulphide, calcium oxide, calcium carbonate, and small quantities of other substances. The principal reactions taking place in this stage of the process may be expressed by the following chemical equations:

$$Na_2SO_4 + 2C = 2CO_2 + Na_2S$$
$$Na_2S + CaCO_3 = Na_2CO_3 + CaS.$$

3. The extraction of the sodium carbonate by treating the black ash with water to dissolve the sodium salt, which yields a solution called "tank liquor," containing also sodium hydrate. The crystals of sodium carbonate are obtained ultimately by evaporation, and, when calcined, yield the dry sodium carbonate of commerce, technically known as soda ash. The calcium sulphide remaining undissolved in the residues is treated for its sulphur content, and the hydrochloric acid produced in the first stage of the Leblanc process is saved for use partly as such, partly for making bleaching powder. In this manner from first to last there is practically nothing wasted except the calcium.

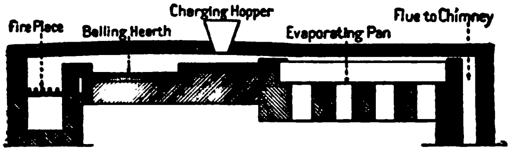

FIG. 1. LONGITUDINAL SECTION OF A BLACK-ASH FURNACE.

The transformation of the salt cake into black ash is generally carried out in a reverberatory furnace (Fig. 1), called a "black-ash" or "balling furnace." Usually 100 pounds of salt cake, 100 pounds of calcium carbonate, and 50 pounds of coal dust form a charge. The hand-worked furnace is a long reverberatory with a hopper in the roof through which the charge is dropped into the first hearth near the flue where the heat is not very high; after thorough drying and heating, the material is raked down onto the second or "balling hearth," where the temperature is usually about 1000° C., and thoroughly rabbled until it becomes a thick, pasty mass from which carbonic acid gas escapes freely. As soon as the salt cake is decomposed, the charge begins to stiffen and carbon monoxide (CO) is evolved, as is shown by jets of blue flame (the carbonic oxide is produced by the action of coal on the excess of calcium carbonate present). The charge is then raked into a ball and removed from the furnace to an iron truck, the escaping bubbles of gas causing the pasty mass to become porous. The shallow iron pan between the furnace hearth and the flue to the chimney is used for the evaporation of the tank liquor obtained by the lixiviation of the black ash in the third stage of the process. The furnace operation is quite difficult, and although the heavy tools are suspended by chains, the temperature is so intense that the quantity a man can handle at one time is limited to 300 pounds. In order to eliminate expensive hand labor and to work larger charges, revolving cylindrical black-ash furnaces are used; the common size, 18 feet long and 10 or 12 feet diameter, can treat as much as three or four tons of salt cake in two hours. The lixiviation of the black ash is accomplished in a series of terraced tanks each with a false bottom perforated with small holes. The uppermost tank is charged with black ash, and water added to cover the charge; the solution of sodium carbonate formed, being heavier than water, sinks to the bottom of the tank and is passed through the perforations, and is withdrawn by means of a pipe which delivers it to the second tank in the series, through which it passes to the third tank, etc. The operation is continuous, fresh water being added to the nearly exhausted ash in the uppermost tank to yield an unbroken flow of strong liquor. Good tank liquor contains approximately 23.5 per cent of sodium carbonate and sodium hydrate.

The Solvay process, or "ammonia-soda process," is based on the fact that hydrogen-ammonium carbonate, $(NH_4)HCO_3$, is decomposed by a strong solution of common salt, yielding sodium bicarbonate and ammonium chloride, as shown by the equation:

$$(NH_4)HCO_3 + NaCl = NaHCO_3 + NH_4Cl.$$

The brine is first saturated with ammonia gas, and the cooled ammoniacal liquor is subsequently charged in carbonating towers with carbonic acid gas under moderate pressure; the sodium bicarbonate, being much less soluble, separates and leaves the more soluble ammonium chloride in solution, from which the ammonia is subsequently recovered by treatment with lime. The sodium bicarbonate is converted into sodium carbonate by calcination, and the carbonic acid gas evolved is again utilized to carbonate a second quantity of ammoniacal brine. In this cycle of operations no sulphuric acid is required and no hydrochloric acid is evolved.

The reactions involved in the ammonia-soda process were known to a German chemist, Vogel, as early as 1822. They were patented by H. C. Dyar and T. Hemming about 1838, but the process was not perfected until 1873. In 1863 Ernest Solvay (q.v.), a Belgian manufacturing chemist, constructed the first successful plant, which has led to an enormous development of the industry.

Sodium Hydroxide, Sodium Hydrate, or Caustic Soda, NaOH. This is of importance next to sodium carbonate only, on account of its use in enormous quantities in refining fats and vegetable oils, and in the manufacture of soap. In appearance it is a white solid, strongly caustic and highly deliquescent. It is readily soluble in water, with evolution of heat, and by cooling a concentrated solution to 8° C., a deposit of crystalline sodium hydrate ($2NaOH + 7H_2O$) is obtained.

Sodium hydroxide is one of the strongest alkalies known. On a large scale it is manufactured by the action of milk of lime (calcium hydrate) upon a boiling solution of sodium carbonate, whereby calcium carbonate is precipitated, and sodium hydrate remains in the solution. The reaction is

$$Na_2CO_3 + Ca(OH)_2 = CaCO_3 + 2NaOH.$$

After the removal of the solid calcium carbonate the solution is evaporated, and finally yields the solid sodium hydrate. One of the chief sources of supply is the tank liquor, produced in the manufacture of sodium carbonate by the Leblanc process (see above). The tank liquor, containing essentially sodium carbonate and sodium hydrate, is heated to boiling and an excess of lime is stirred into the mixture. The sodium sulphide present in the tank liquor is oxidized to sodium sulphate by the combined action of air injected into the mixture and of sodium nitrate, which is added for the purpose.

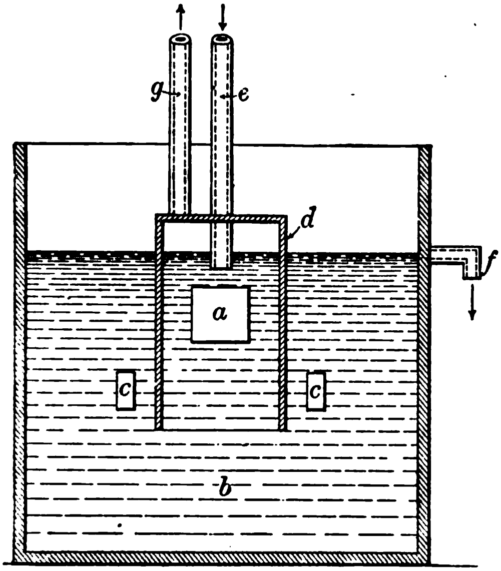

FIG. 2. DIAGRAMMATIC SKETCH OF THE "BELL" TYPE OF GRAVITY CELL.

Sodium hydrate has been manufactured to a considerable extent by the electrolysis of brine, also by the direct electrolysis of fused common salt. The two best known electrolytic processes are the Aussig "bell process" and the Acker process. The former has been under development at Aussig. The broad features of the method are illustrated in Fig. 2. In this diagram, *a* represents the anode, *b* the solution of common brine which forms the electrolyte, *d* the bell, and *c* the cathodes; *e* is the pipe through which fresh brine is supplied and *g* serves to carry away the chlorine gas. The caustic alkali solution overflows through the pipe *f*. A current efficiency of from 85 to 90 per cent is claimed and the strength of the alkali solution varies between 100 and 150 grams of caustic soda per liter.

In the Acker fusion process, which is employed at Niagara Falls, N. Y., the electrolyte consists of fused salt and the cathode of molten lead; a diagrammatic sketch of the cell is shown in Fig. 3. *K* represents the connections between the bus bar and the anodes *G*, *F* the cell walls, *H* the upper level of the fused salt electrolyte, which overlies the molten lead cathode *I*. A steam jet at the side of the cell circulates the molten lead cathode, and the decomposition of the lead-sodium alloy produced is accomplished in a separate vessel.

SODA WATER. A form of aërated water charged with carbonic acid gas and used either plain or in combination with various flavoring sirups and other materials as a beverage. The first use of fruit syrups with soda water is credited to Eugene Roussel, the proprietor of a perfumery establishment in Philadelphia, early in the nineteenth century. Somewhat later John Matthews of New York began the manufacture of soda water apparatus with a wooden generator, gasometer and pump, while the ornamental soda water fountain is said to be the invention of G. D. Dows, of Massachusetts. After being used extensively in the United States, selling at about $225 each, the soda water fountain was exhibited at the Paris Exposition of 1867, a date that marked the introduction of soda water in Europe. Ice cream soda water was a later development, being attributed to Robert M. Green, while the Philadelphia Centennial Exposition of 1876 saw not only the industry firmly established but the general use of soda water as a beverage. See AËRATED WATERS; BOTTLING.

SODDY, FREDERICK (1877–). A British chemist, born in Eastbourne, England. He studied at Eastbourne College, the University College of Wales, and Merton College, Oxford, and also under Sir Ernest Rutherford (q.v.) in Montreal and with Sir William Ramsay (q.v.) in London. He was demonstrator of chemistry in McGill University during 1900–02; lecturer in chemistry and radioactivity in Glasgow during 1904–14; and thereafter was professor of chemistry in Aberdeen. He was president of the Röntgen Society during 1905–06, was elected a fellow of the Royal Society in 1910, and was awarded the Cannizzaro Prize by the Accademia dei Lincei, Rome, in 1913. His special field is radioactivity (q.v.), and he published: *Radioactivity, an Elementary Treatise from the Standpoint of the Disintegration Theory* (1904); *The Interpretation of Radium* (1909); *Matter and Energy*, in the "Home Uni-

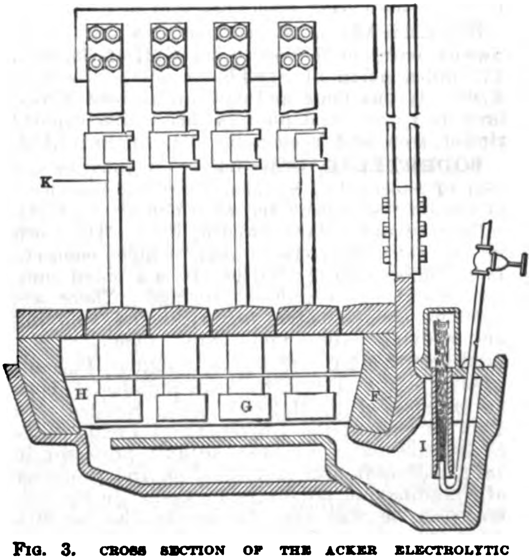

FIG. 3. CROSS SECTION OF THE ACKER ELECTROLYTIC FURNACE FOR ALKALI.

versity Library Series" (1912); *Chemistry of the Radio-elements* (1912–14).

SODEN, zō′den, (HANS KARL) HERMANN, BARON VON (1852–1914). A German Protestant theologian and pastor, born in Cincinnati, Ohio. He was educated at Esslingen, Urach, and Tübingen, and was a vicar in various places from 1875 to 1880. From 1880 to 1882 he was a pastor in Dresden, then in Chemnitz (1882–86), and in 1887 he took charge of the Jerusalemskirche in Berlin. In 1893 he was appointed associate professor of theology in the University of Berlin. Baron von Soden spent 20 years, with the assistance of other scholars, in collecting and comparing manuscripts of the New Testament. He asserted that the Greek text read at present is not essentially different from the earliest versions. His publications include: *Philipperbriefe* (1890; 2d ed., 1909); *Palästina und seine Geschichte* (1899; 3d ed., 1910); *Reisebriefe aus Palästina* (2d ed., 1901); *Urchristliche Literaturgeschichte* (1905; Eng. trans., *History of Early Christian Literature,* 1906); *Die wichtigsten Fragen in Leben Jesu* (2d ed., 1909). He also contributed vol. iii to the *Handkommentar zum Neuen Testament* (1890).

SÖDERBERG, sẽ′dẽr-bĕr′y′, HJALMAR EMIL FREDRIK (1869–). A Swedish author, born in Stockholm. Educated at Upsala, he engaged in journalism, and later entered the customs service, but turned to literature. He showed himself a realistic portrayer of Stockholm life in the story *Förvillelser* (1895), followed by *Historietter* (1898); the romances *Martin Birck's ungdom* (1901) and *Doktor Glas* (1905); the dramas *Gertrud* (1906) and *Aftonstjernan* (1912); *Hjärtats uro* (1909), daily observations; and *Den allvarsamma leken* (1912), a story. His translations of some of Anatole France's work are noteworthy. Söderberg came to be recognized as one of the most important authors of modern Sweden. His humor is negatived by underlying pessimism and skepticism.

SÖDERHAMN, sẽ′dẽr-hămn′. A seaport of Sweden on a small inlet of the Gulf of Bothnia, 135 miles north of Stockholm (Map: Sweden, F 6). It has flour and saw mills, iron works, breweries and wood pulp factories, and exports timber, iron, and wood pulp. Pop., 1910, 11,412.

SÖDERTELJE, sẽ′dẽr-tĕl′ye. A town of the Län of Stockholm, Sweden, 15 miles southwest of the city of Stockholm, of which it is practically a suburb (Map: Sweden, F 7). The town is on the Södertelje Canal, which connects Lake Mälar with the Baltic. It is a noted summer resort, with mineral springs. There are machine shops, match factories, and spinning and weaving mills. Pop., 1910, 11,060.

SÖDERWALL, sẽ′dẽr-wăl, KNUT FREDRIK (1842–). A Scandinavian philologist, born at Drängsered in Halland, south Sweden. In 1858 he entered the University of Lund, where he became docent in 1865, adjunct professor in 1872, assistant professor in 1886, and professor of Scandinavian languages in 1892. In the latter year he was also elected to the Swedish Academy. In 1907 he retired from his professorial duties in order to devote his entire attention to the great *Ordbok öfver Svenska Språket,* the great dictionary of the Swedish Academy, of which he had become an editor in 1884 and editor in chief in 1892. Though the publication of this work was begun in 1892 (Lund), by 1916 it had only reached the letter E. Among other works of importance published by Söderwall are: *Om verbets rektion i fornsvenskan* (1864); *Hufvudepokerna af svenska Språkets Utbildning* (1870); and his important *Ordbok öfver svenska Medeltidsspråket* (1884–1913).

SO′DIUM (Neo-Lat., from It. *soda,* soda, saltwort, glasswort). A metallic element isolated by Sir Humphry Davy in 1807. (See CHEMISTRY; POTASSIUM.) It is one of the most abundant of the chemical elements, the earth's crust containing about two and one-half per cent of it. The chloride of sodium is widely distributed in nature as halite or rock salt, and in solution in sea and other natural waters. Sodium also occurs in the form of nitrate (soda nitre, or Chile saltpetre), which is found abundantly in superficial deposits in the rainless districts of the Pacific coasts of Chile, Peru, and Bolivia; as the sulphate (glauberite) or mirabilite; as the carbonate; and in numerous minerals of more complex composition, such as cryolite, the various feldspars, including albite, labradorite, oligoclase, and the zeolites. Sea plants as well as animal organisms likewise contain sodium salts.

The preparation of the metal itself may be accomplished by decomposing sodium hydroxide by electrolysis. It was first prepared on a large scale by Sainte-Claire Deville, who reduced sodium carbonate with coal and chalk at a white heat, and collected the resulting metallic sodium under coal oil in suitable condensers. A commercial process now extensively employed was invented in 1886 by Castner, and consists in reducing sodium hydroxide by an iron carbide prepared by adding finely divided iron to melted pitch and cooking the mixture in large cylinders. The metal is distilled over into condensers and is purified by passing through linen under petroleum at about 100° C. (212° F.).

Sodium (symbol, Na; atomic weight, 23.00) is a soft white metal possessing a silvery white lustre when freshly cut. Its specific gravity is 0.9712 at 20° C. (68° F.); its melting point is 97° C. (about 207° F.), and it boils at 877.5° C. (1611.5° F.). It is one of the best conductors of heat and electricity, and is one of the most electro-positive metals. Its vapor is colorless when seen in thin layers, but has a purple or violet tinge by transmitted light when seen in quantity. Sodium burns with a bright yellow flame when heated in the air. When thrown into cold water it decomposes it, liberating hydrogen, but not with sufficient heat to ignite the latter, unless the temperature of the water is above 60° C. (140° F.). The metal readily takes up oxygen, and in consequence finds its chief use in the preparation of aluminium, boron, magnesium, and silicon, by reduction from the oxides. Sodium forms alloys with many metals, and the amalgam with mercury is employed in the extraction of gold. It combines with oxygen to form a monoxide (Na_2O) and a peroxide (Na_2O_2), of which the former may be obtained by heating sodium hydroxide with sodium, yielding a gray mass, which melts at a dull red heat; while the latter, which is a white solid that deliquesces in the air, is formed by heating metallic sodium in oxygen.

The salts of sodium are among the most important of the commercial chemicals. Sodium acetate is prepared by treating acetic acid or vinegar with sodium carbonate, filtering the solution and concentrating to crystallization.

Sodium arsenate is prepared by fusing arsenious acid, sodium carbonate, and sodium nitrate, dissolving the resulting mixture in hot water, filtering, and crystallizing. The colorless crystals thus obtained are official in the pharmacopœia and are used in skin diseases and as a substitute for arsenic. Mixed with sugar this salt is frequently employed as a poison for flies. Sodium bromide and sodium iodide, which are prepared by decomposing respectively ferrous bromide and ferrous iodide with sodium carbonate, are white crystalline compounds that find some use in medicine as nervous sedatives. Sodium carbonate, the soda (q.v.) of commerce, is a colorless crystalline odorless compound with a strong alkaline taste, which is found native in many mineral waters and as efflorescences in the neighborhood of soda lakes. Sodium bicarbonate, or "acid" sodium carbonate, is a colorless compound which finds extensive use in the manufacture of baking powders and of artificial mineral waters, and also in medicine as an antacid. (See Soda.) Sodium hypophosphite is prepared by treating calcium hypophosphite with sodium carbonate and recrystallizing the resulting product from alcohol. It forms small colorless crystals that are deliquescent and finds some use in medicine as a restorer in exhausted conditions of the nervous system and as an ingredient in the syrup of hypophosphites. Sodium hyposulphite, or more correctly sodium thiosulphate, is prepared by decomposing soluble calcium thiosulphate with either sodium sulphate or sodium carbonate, resulting in the formation of a colorless crystalline compound that is efflorescent in dry air, and is used in photography as a solvent for the unaltered silver chloride or bromide on the film, and in medicine as an alterative and resolvent. Sodium silicate is prepared commercially by fusing sodium carbonate with sand and a small quantity of charcoal in a reverberatory furnace and then dissolving by prolonged boiling in water. (See Water Glass.) Sodium sulphite is obtained by passing gaseous sulphur dioxide into a solution of sodium carbonate and evaporating the mixture to dryness or crystallization, resulting in a colorless, transparent, efflorescent compound that is used as a bleaching agent under the name of "antichlore," in the manufacture of paper, for the purpose of removing the last traces of chlorine from the bleached pulp; it is also employed in medicine as an antiferment. Sodium hyposulphite, a powerful reducing agent used in dyeing and calico printing, is prepared from acid sodium sulphite. See also Glauber's Salt; Salt; Saltpetre; Soda; etc.

SODIUM, Medical Uses of. Sodium compounds are extensively used in medicine. Among the most important are sodium hydroxide or caustic soda, which is applied externally to destroy excrescences on the skin and as a caustic generally. Sodium acetate is a valuable diuretic; sodium bicarbonate alkalinizes the blood and secretions, and is used as a corrective in functional diseases of the stomach; sodium cacodylate is employed in anæmia, chorea, and malaria; sodium hypophosphite is given in wasting diseases in combination with other hypophosphites; sodium iodide is an alterative and replaces the potassium salt when the latter is too irritating; sodium sulphate is a saline purgative commonly known as Glauber's salt; sodium thiosulphate is an antiseptic. See also Bromides; Salicylates.

SODIUM HYPOCHLORITE, Solution of. See Labarraque's Solution.

SODIUM PHOSPHATE. See Phosphates.

SODIUM SULPHATE. See Glauber's Salt.

SOD'OM (Heb. *Sĕdōm*) and **GOMOR'RAH** (Heb. *'ămōrāh*). Two ancient cities near the Dead Sea, almost invariably spoken of together in the Bible. With Admah, Zeboiim, and Zoar, they formed the five "cities of the plain," which on account of the wickedness of their inhabitants are said to have been destroyed by a rain of brimstone, perhaps also accompanied by an earthquake. Lot and his family were the only ones who escaped. His wife, however, for disobedience was turned into a pillar of salt (Gen. xix. 1–29; Deut. xxix. 23; Zeph. ii. 9; Isa. i. 9). Some scholars say the cities were at the northern end of the Dead Sea, others at the southern end. Names like Jebel Usdum (Sodom) and Zoara or Zughar (Zoar), at the southern end, point to a tradition of the existence of the cities there. The biblical story of the destruction of the cities is considered by many critics similar to tales found among Arabs (and other nations) regarding the sudden disappearance of places. Those who thus deny the literal truthfulness of the narrative call attention to the weird character of the district around the Dead Sea, fatal to plant and animal life, as naturally suggesting the thought of some catastrophe. See Lot.

SODOM, Apple of. A name sometimes given to the fruit of *Solanum sodomæum*. Many unsatisfactory attempts have been made to determine the source of the true apple of Sodom or mad apple of the Dead Sea region mentioned by Strabo, Tacitus, and Josephus, and described as beautiful to the eye, but filling the mouth with bitter ashes if tasted. One explanation is that it is a kind of gall (see Galls) growing on dwarf oaks. These beautiful, rich, glossy, purplish-red galls are about 2 inches long and 1½ inches in diameter, and are filled with an intensely bitter, porous, and easily pulverized substance. Some writers believe the fruit of *Calotropis procera* is the fruit so named. See Mudar.

SO'DOMA, Il, properly Giovanni Antonio Bazzi (1477–1549). An Italian painter of the High Renaissance. He was born at Vercelli (Piedmont) and, after training with obscure local masters, came under the influence of Leonardo da Vinci at Milan. In 1501 he was established at Siena, the city with which he was chiefly identified for the remainder of his life. In 1507 or 1508 he visited Rome and was commissioned by Pope Julius II to paint frescoes in the Camera della Segnatura of the Vatican. Of these only one on the ceiling remains, all the rest having been removed to make way for the frescoes of Raphael, who painted Sodoma's portrait beside his own in "The School of Athens." On his second visit to Rome he lived with Agostino Chigi and painted in Chigi's Villa Farnesina the effective frescoes the "Marriage of Alexander and Roxana," his most beautiful picture of an antique subject, and "Alexander in the Tent of Darius." He was made a knight by Leo X. In 1515 he returned to Siena, where he spent most of the remainder of his life.

Sodoma is best represented by his frescoes at Siena, where, after his Roman period, he painted a large "Flagellation" for San Francesco, the "Ecstasy" and the "Swoon of Saint Catharine" in San Domenico, a "Nativity" in Sant' Agostino, and a large altarpiece in Santo Spirito. In the Convent of Monte Oliveto, near Siena, is a series of twenty-five scenes from the life of Saint Benedict, belonging to the artist's early period. His panel paintings include a "Saint Sebastian" in the Uffizi, a perfect representation of "suffering, refined and spiritual," and "Ascension" at Naples; a "Sacrifice of Abraham" at Pisa; a "Caritas" at Berlin; and the well-known "Leda and the Swan" in the Borghese Gallery, Rome. Sodoma's influence on the Sienese school was marked and resulted in a new manner. He possessed the power to express tenderness, sensuous grace, and an exalted sweetness and suffering, but lacked in composition and in a convincing rendition of individual figures. Consult: Jansen, *Leben und Werke des Malers Giovanantonio Bazzi von Vercelli* (Stuttgart, 1870); Frizzoni, in *Nuova Antologia* (Rome, August, 1871); R. H. H. Cust, *Giovanni Antonio Bazzi, styled "Sodoma," the Man and the Painter, 1477–1549* (New York, 1906); *Masters in Art*, vol. 7 (Boston, 1906).

SODOMY. The unnatural carnal intercourse of persons with each other or with beasts; so called from the form of vice practiced in the ancient city of Sodom. It is punished by death or long imprisonment in all civilized countries.

SOEMMERRING, zĕ′mĕr-ing, SAMUEL THOMAS VON (1755–1830). A German anatomist and physiologist, born at Thorn, educated at Göttingen, and chosen professor of anatomy at Kassel in 1778 and at Mainz in 1784. He defended the theory that the nerves act independently of the brain, and he considered the brain as not essential to life. His division of the cranial nerves into twelve pairs instead of nine is generally adopted. His principal works were: *De Basi Encephali et Originibus Nervorum, etc.* (1778); *Vom Hirn- und Rückenmark* (1788); *Vom Baum des menschlichen Körpers* (1791–96); *Ueber das Organ der Seele* (1796); and *De Morbis Vasorum Absorbentium Corporis Humani* (1795).

SOERABAYA. See SURABAYA.

SOERAKARTA. See SURAKARTA.

SOEST, zōst. A town in the Province of Westphalia, Prussia, 34 miles southeast of Münster (Map: Germany, C 3). Relics of its mediæval splendors still survive in its churches. Of these the finest is the "Meadow Church," restored in 1850–52. The tenth-century Romanesque cathedral has excellent mural paintings. The manufactures include machinery, cigars, tinware, bricks, sugar, and lamps. There are markets for cereals and cattle. In the Middle Ages Soest was an important member of the Hanseatic League, and had a population of over 25,000. Its municipal law, the *jus Susatense*, was the oldest in Germany and served as the model for the other Imperial free towns, Lübeck, Hamburg, etc. Pop., 1900, 16,724; 1910, 18,467.

SOETBEER, zĕt′bâr, ADOLF (1814–92). A German economist, born at Hamburg. In 1840 he became librarian and in 1843 secretary of the Hamburg Chamber of Commerce, where he laid the foundation of the excellent system of commercial statistics for which Hamburg became noted. He published *Denkschrift über Hamburgs Münzverhältnisse* (1846) and subsequently numerous monographs and pamphlets, defending the cause of gold monometallism. Until his death he ranked as the leading defender of the single gold standard, the adoption of which by Germany was brought about largely through his efforts. Among his most important works are: *Denkschrift betreffend die Einführung der Goldwährung in Deutschland* (1856); *Zur Frage der deutschen Münzeinheit* (1861); *Beiträge zur Geschichte des Geld- und Münzwesens in Deutschland* (1862); *Edelmetall-production und Wertverhältnis zwischen Gold und Silber seit der Entdeckung Amerikas bis zur Gegenwart* (1879); *Materialien zur Erläuterung und Beurteilung der wirtschaftlichen Edelmetallverhältnisse und der Währungsfrage* (1885).

SOFALA, sô-fä′lȧ. A name applied formerly to a considerable part of Portuguese East Africa (q.v.), but confined at present to a single district under the administration of the Mozambique Company (Map: Africa, H 7).

SOFIA, sŏ′fê-ȧ, *commonly* sô-fē′ȧ, or **SOPHIA** (Bulg. *Sredetz*). The capital of the Kingdom of Bulgaria, situated in a plain at an altitude of about 1800 feet between the Vitosha Mountains and the main Balkan chain, 206 miles southeast of Belgrade and 300 miles northwest of Constantinople (Map: Balkan Peninsula, D 3). It has been largely rebuilt since 1878 and has a modern appearance with electric lighting and street railways and creditable public buildings. In old Sofia are the ruined Sofia Mosque, the Buyuk-Jami, now used as a national museum and library, and the vast baths with hot springs. The principal modern buildings are the royal palace (1880–82, subsequently enlarged), the university buildings, the cathedral of Saint Alexander, the house of Parliament, the various administration buildings, and the large theatre (1906). Sofia has a university (founded in 1888) with 65 teachers and about 1600 students in 1910, secondary schools, and a military school and college. It is the industrial centre of Bulgaria and has manufactures of silk, cloth, tobacco, etc. Situated at the converging of the principal highways of the Kingdom and connected by rail with Constantinople, Belgrade, and Saloniki, the city is well adapted for its prominent position as a commercial centre, and has an extensive export trade in agricultural products, hides, and attar of roses. The population was 30,928 in 1887, 67,789 in 1900 (including Poduene, and annexed in 1895), and 102,812 in 1912, of which 83,403 were Orthodox, 12,852 Jewish, 2690 Roman Catholic, and 2440 Mohammedan. Sofia is identified with the *Serdica* or *Sardica* of the Romans, which became the capital of *Dacia Ripensis*, and about 344 was the seat of a Church council. The town was plundered by the Huns in the fifth century and at the beginning of the ninth century it was taken by the Bulgarians. In 1382 it passed to Turkey. In 1878 it was occupied by the Russians under Gurko. It was bombarded by allied airships in the Great War which began in 1914. See WAR IN EUROPE.

SOFTA, sŏf′tȧ (Turk. *sŏfta*, from Pers. *sōxtah, sūxtah*, burned [with zeal]. The name applied in Turkey to the students of the theological schools. They are drawn largely from the lower classes and are as a rule opposed to Occidental ideas. Because of this they have often opposed the Turkish government. From them are appointed the Mollahs and the Ulemas (qq.v.). There are now about 16,000 Softas in Constantinople.

SOFTENING OF THE BRAIN. See PARESIS.

SOFT GRASS (*Holcus*). A small genus of grasses. The English name is derived from the soft and abundant pubescence of the two British species, creeping soft grass (*Holcus mollis*) and woolly soft grass, meadow soft grass, or velvet grass (*Holcus lanatus*). They are common in Europe and *Holcus lanatus* is also found from Nova Scotia to Illinois and southward. The latter species is found most abundantly on damp soils, on which it is sometimes sown for forage. The former is generally found on dry, sandy, or other light soils.

SOFT-GROUND ETCHING. A species of etching in which the ground ordinarily used is softened by a mixture with tallow. It is not much used, because the same effects can be obtained by lithography and heliographic processes.

SOFT-SHELLED TURTLE. Any of various fresh-water turtles of the family Trionychidæ, represented in the United States by the two genera *Amyda* and *Aspidonectes*. They are named from the leathery consistency of the shell, seen in the common soft-shell (*Aspidonectes ferox*), about 12 inches long. Another species, the "leather turtle," is *Amyda mutica*. They are carnivorous, web-footed, entirely aquatic, with long serpentine necks. The eggs are laid near shores. Drought and winter are spent in muddy bottoms. Their flesh is said to be of superior quality.

SOGDIA'NA (Lat., from Gk. *Σογδυανή*, *Sogdyanē*, Av. Sυγδa, Pers. Sυγd). An ancient country in Central Asia, comprising part of modern Turkestan, with the Jaxartes on the northeast separating it from Scythia, and the Oxus on the southwest separating it from Bactria. It was conquered by the Persians in the reign of Cyrus and was invaded by Alexander the Great. Afterward it fell into the power of the Seleucidæ (q.v.).

SOGNE FJORD, sŏg'nĕ fyōrd. An inlet in the Province of North Bergenhus, in western Norway (Map: Norway, C 6). It pierces the land for a distance of 110 miles, in some places has a depth of 4000 feet, and is shut in throughout its length by perpendicular walls conveying the impression of wild grandeur.

SOHN, zōn, KARL FERDINAND (1805–67). A German painter of the Düsseldorf school. He was born in Berlin and studied there under Wilhelm von Schadow, whom he followed to Düsseldorf. He treated principally mythical and poetic subjects of a highly romantic character, and painted in the mechanically idealistic manner of the Düsseldorf school. In 1832 he was made professor in the Düsseldorf Academy, where he exercised an important influence. Among his best-known works are: the "Lute Player" (1832, National Gallery, Berlin); "Tasso and the Two Leonoras" (1839); "Rinaldo and Armida" (Düsseldorf Gallery).

His nephew and pupil, WILHELM (1830–99), born in Berlin, painted at first biblical subjects, and then devoted himself to genre scenes, good in characterization and drawing and of great coloristic charm. Among these are "Consultation at the Lawyer's" (1866, Leipzig Museum) and "Warrior of the Seventeenth Century" (1869, Dresden Gallery).

SO'HO SQUARE. A square in London (once a fashionable abode), dating from Charles II's reign and earlier called King's Square.

SOHRAB (sō-räb') **AND RUSTUM,** rŭs'tam. A narrative in blank verse by Matthew Arnold, based on the Persian legend of Rustam (q.v.).

SOIL (Lat. *solum*, ground, soil). A term applied to the superficial unconsolidated portion of the earth's crust (regolith), composed of broken and disintegrated (weathered) rock mixed with varying proportions of decaying organic matter (humus). The processes by which soils are formed from the parent rocks are mechanical and chemical, and sometimes biological. The fertility of a soil is in part determined by the character of the parent rock. Thus granite, richer in the elements of plant food, yields a more fertile soil than the siliceous sandstones.

According to the method of their formation soils are classed as sedentary or transported. When a soil is found resting on its parent rock it is spoken of as sedentary soil. Such formation may show gradual transition from the fully formed soil at the surface to the solid rock beneath. With this class may be grouped the humus or peaty (cumulose) soils due to accumulations of organic matter in bogs, swamps, and marshes. In many cases the residual products have been removed from the place of their formation by the action of water, ice (glaciers), and wind and deposited elsewhere as clayey, sandy, or loamy soils, often representing the mingling of material from several sources. This type is termed transported soil, and, though naturally variable in character, includes some very productive soil. The most important soils of this class are the alluvial soils, such as occur in river and flood-plains (q.v.), and deltas (q.v.), as in the case of the Nile and the Mississippi rivers. In the northern half of the United States much of the soil is of the glacial drift type and represents the débris of rocks of various kinds brought down from the north during the glacial period (q.v.).

Æolian soils are those formed by wind action. They include: (1) sand dunes, shifting, sandy soils heaped up by wind action upon ocean coasts and the shores of inland seas and lakes (see DUNE; DUNE VEGETATION); (2) ash soils, the accumulations of ashes ejected by volcanoes. The deposits are often of considerable extent and are frequently very fertile. Much highly productive soil around Mount Vesuvius is of this kind. Such soils are also found in Nebraska, Colorado, and Montana. There have been notable recent examples of the formation of such soils in connection with the eruptions of Soufrière, St. Vincent, in 1902–03 and Katmai, Alaska, in 1912. Soils from disintegration of volcanic lava are of frequent occurrence, as, e.g., in Italy, in the Hawaiian Islands, and in Idaho and other northwestern States. The loess soils of China and other countries are of æolian origin, though the so-called loess soils of America are believed to be generally alluvial.

Soils containing an excess of soluble salts are found scattered throughout regions of deficient or irregular rainfall and are known as alkali soils (q.v.). Humous, peaty, or moor soils are composed largely of organic matter. The purest types are represented by accumulations of peat (q.v.) formed in ponds and swamps; marine marshes and muck soils represent a less pure variety. When properly drained and aërated and freed from excess of soluble salts, they often prove very productive.

In practice soils are classified as gravelly, sandy, loamy, clayey, calcareous, humus, or peaty, etc., distinctions based on the fineness of the soil particles and the relative proportions of sand, clay, lime, and humus which they contain. Soils are also frequently classed as light and heavy, according to ease or difficulty of tillage. In this sense a sandy soil is termed light (easy to till), although actually having greater weight than a clayey soil, which is termed heavy (difficult to till). The productiveness of a soil depends chiefly upon its chemical composition and its physical and biological properties. Chemical and physical or mechanical analysis separates soil constituents into two general classes: (1) plant food constituents and (2) physical constituents. The food constituents considered necessary to plant growth are nitrogen, sulphur, phosphorus, calcium, magnesium, potassium, iron, and probably manganese, in various forms of chemical combination. The physical constituents, constituting the larger proportion (90 to 95 per cent) of the entire soil mass, act as a mechanical support to plants and furnish a medium for root growth but have little more than an indirect value as fertilizing agents. As a rule they consist very largely of silica.

Chemical Properties. The average chemical composition of soils of humid and arid regions is shown in the following table:

AVERAGE CHEMICAL COMPOSITION OF SOILS

HUMID, SEMIARID, AND ARID REGIONS OF THE UNITED STATES (HILGARD)

CONSTITUENTS	Humid region (average of 696 soils)	Semiarid (transition) region (average of 178 soils)	Arid region (average of 573 soils)
	Per cent	*Per cent*	*Per cent*
Insoluble matter . . .	84.17 } 88.21	75.04 } 83.50	69.16 } 75.87
Soluble silica	4.04	8.46	6.71
Potash	.21	.33	.67
Soda	.14	.32	.35
Lime	.13	.70	1.43
Magnesia	.29	.47	1.27
Iron oxide	3.88	2.08	5.48
Alumina	3.66	4.57	7.21
Manganese oxide . . .	.13	. . . .	.11
Phosphoric acid	.12	.21	.16
Sulphuric acid	.05	.02	.06
Humus	1.22	3.24	1.13
Nitrogen in humus .	*	6.67	12.50
Nitrogen in soil	. . . .	.22	.13

* Less than 5 per cent.

Actual fertilizing constituents, viz., potash, phosphoric acid, nitrogen, lime, etc., are relatively small, arid soils showing larger proportions than humid soils. Other mineral constituents are usually present in sufficient quantity to supply the needs of plants. Humus (q.v.) is important as a soil constituent not only on account of its beneficial effect on the physical properties of soils, but as a source of nitrogen, as well as of available phosphoric acid, potash, lime, etc. The nitrogen of humus is converted into a form (nitrate) available for plants by the process of nitrification (q.v.). Humus may be said to be the final visible product of decomposition of organic matter in the soil, in the course of which a great variety of organic compounds, some beneficial, some harmful (toxic) to plant growth, are produced.

Physical Properties. Physical properties of soils of special importance are color, weight, fineness of division or texture, structure or arrangement of particles, adhesiveness, and relations to gases, heat, moisture, and dissolved solids. Variations in these properties determine to a large extent the productiveness of soils. Good tilth and texture, with accompaniment of good water conditions, aëration, and temperature, are fully as essential to plant growth as an adequate supply of plant food and may in a measure be controlled by man. Physical properties of soils are so largely dependent upon their natural character, and can be modified to such a limited extent by man, that it is of great importance to select soils with special reference to the natural suitability of their physical characteristics to the crop to be grown. This is one of the main purposes and advantages of the comprehensive soil surveys which have been so actively carried on in the United States and many other countries. The physical properties of soils are determined also by the proportions they contain of stones, gravel, sand, clay, lime, and organic matter. A sandy soil is dry, warm, and easy to work, but as a rule naturally poor, with little absorptive power. A clayey soil is apt to be cold, wet, and difficult to till, but to have high absorptive power. Clayey soils generally contain more plant food than sandy soils. Humus makes soils light in weight and dark in color and greatly increases absorptive power. Lime not only has value as a plant food, but improves the structure of soils and corrects acidity. It also promotes the decomposition of organic matter and aids nitrification and other biological activities. Mechanical analysis, which separates the particles of a soil into six or more grades of fineness ranging from stones and gravel through sand and silt to clay, furnishes a valuable means of securing data for judging of the physical properties of soils.

The productiveness of a soil depends very largely upon its texture and structure, i.e., the size of the particles and their arrangement. These determine the circulation of water and gases, solution and retention of plant food, and the growth of plant roots. When the grains are single or separated the soil is said to have a puddled structure, while a compounding of the soil grains gives a flocculated structure. The latter is desirable in all good soils, as it increases the pore space and facilitates the circulation of air and water through the mass. Flocculation may at times be caused by frost action, but more frequently is produced by the action of lime. Fertilizers vary in their action, some, like nitrate of soda, producing puddling, others producing flocculation. The finer the soil particles the greater the injurious effects of puddling, clay soils suffering from this cause more than sandy soils. Puddling increases the water-retaining power, thus retarding percolation, but may accelerate capillary rise of water. Flocculation decreases the retention of water, aids percolation, and may retard evaporation. Water passes more easily from a coarse to a fine layer than from a fine layer to a coarse one—hence when the farmer firms the soil by rolling and then loosens the surface by harrowing, he destroys the capillary spaces and so checks the escape of water into the air. Water is thus held near the surface, and is readily accessible to the roots of plants. The action of the mulch (q.v.) depends upon this principle. In humid regions the clay particles of the soil are usually washed down to a layer several inches below the surface, the surface layer being called the soil proper, and the lower one subsoil. In arid regions this difference does not exist, but the fine clay particles are evenly distributed throughout the soil layers. Soils vary widely in their absorptive power for water and for fertilizing matter. Of the three principal fertilizing constituents—nitrogen, phosphoric acid, and potash—soils apparently have the least retentive power for nitrogen (in the form of nitrate) and the greatest for phosphoric acid. The relation of soils to water probably more than any other one factor determines their productiveness. Water is not only necessary as a constituent of plant tissue, but it performs a most important function as a solvent and carrier of food in both soil and plant. The temperature of soils is modified by a variety of conditions, e.g., a dark-colored soil is usually warmer than a light-colored one; soils so exposed as to receive a large amount of the direct rays of the sun are warmer than those not thus exposed; dry soils are warmer than wet.

Biological Properties. Living organisms —roots of plants, insects, earthworms, etc., but especially the micro-organisms generally known as bacteria—play an important rôle in soil formation and fertility. Bacteria aid in the disintegration of soil-forming rocks and increase the supply of available mineral plant food, fix free nitrogen both directly and in symbiosis with leguminous plants, render organic nitrogen available to plants by nitrification or cause loss of soil nitrogen by denitrification, and in some cases produce substances in the soil which may be either harmful or beneficial according to circumstances. Recent investigation has indicated the practical possibility of curbing the harmful and promoting the beneficial microbiological activities in the soil by various methods of treatment, more especially by partial sterilization of the soil by means of heat or volatile antiseptics.

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SOIL AMENDMENTS. Substances, such as lime, gypsum, salt, muck, etc., which increase the productiveness of soils without directly supplying any constituent which the plant needs. They act mainly by improving the physical condition of soils, collecting and conserving moisture, setting free latent plant food, and correcting certain faulty conditions, such as acidity and alkalinity.

SOILING, SOILING CROPS. Soiling consists in feeding grazing animals in inclosures or in barns with green forage grown especially for them, instead of allowing free pasturage; soiling crops are crops grown for this purpose. Under European conditions stock is frequently fed in barns the year round, but in the United States soiling is usually combined with pasturing, stock being less frequently fed in barns during the summer.

American farmers began to turn their attention to soiling early in the nineteenth century, and agricultural literature shows that about 1840–50 the practice had become general in the eastern and southern States. Crops then used for green forage were grass, clover, corn, oats, cabbage, and roots. The advantages of soiling are many. It requires far less land to sustain a given number of farm animals than under pasturing; feeding green forage in the barn or yard eliminates the expense of pasture fencing and greatly diminishes food waste, the animals being assured sufficient feed at all times. Practically the only serious disadvantage is the extra labor involved.

Since animals kept in the barn seem to require exercise, the two systems of soiling and pasturing are often combined in the United States. In such cases the soiling crops should be grown remote from the pasture, so that the animals may not become restless and disinclined to graze. The fodder should not be fed in open racks, and the quantity given should never be more than will be eaten at the time.

Soil, climate, and the kind of stock naturally determine the crops to be grown. The purpose of soiling crops is to afford abundance of succulent forage. This is best accomplished with rapidly growing plants that produce large amounts of foliage. A general list of soiling crops includes rape, turnips, sorghum, kafir corn, millet; many cereals, such as rye, barley, oats; many legumes, as corn, clover, cowpeas, alfalfa; and combinations of oats and peas, and barley and peas. Consult: Peer, *Soiling, Soiling Crops, and Ensilage* (New York, 1900); C. V. Piper, *Forage Crops and their Culture* (ib., 1914); United States Department of Agriculture, *Farmers' Bulletins Nos. 331, 337, 411, 578, 588* (Washington, 1908–14).

SOISSONS, swä'sôɴ'. An episcopal city and the capital of an arrondissement in the Department of Aisne, France, 65 miles northeast of Paris, on the Aisne River (Map: France, N., J 3). The principal building is the cathedral of Notre Dame, a composite of the Romanesque and Gothic styles of architecture, founded in the twelfth century. There are also some remains of the great castellated Abbey of Saint Jean des Vignes, where Thomas à Becket found refuge when in exile. A short distance from Soissons is an institute for the deaf and dumb, which occupies the site of the famous Abbey of Saint Médard. Other features include the town hall with a library and a museum; the mediæval Abbaye Notre Dame (built on the site of a convent dating from 660), now utilized as barracks; and the seminary occupying the old Abbaye Saint Léger. Soissons is in a region extensively engaged in farming, and has a large trade in grain, haricot beans, live stock, etc. The principal manufactures are leather, foundry products, lumber, flannel, and farm implements. Pop., 1901, 13,240; 1911, 14,334. Soissons is one of the oldest towns in France. In the time of the Romans it bore the names of *Noviodunum*, *Augusta Suessionum*, and *Suessiona*. It is famous for the victory (near by) by Clovis in 486 over the Roman general Syagrius, putting an end to Roman dominion in Gaul. It was the capital of the Frankish Kingdom of Neustria. On Oct. 16, 1870, after a bombardment of four days, Soissons surrendered to the Germans. In 1914, although untouched during the German advance to the Marne, the town suffered severely during the bombardments incidental to the Battle of the Aisne, and again in the Battle of Soissons, Jan. 8–14, 1915. See War in Europe.

SOISSONS, Louis de Bourbon, Count of (1604–41). A French noble, born in Paris. Succeeding to the office of grand master of France and Governor of Dauphiné, he took the part of the Queen Mother, Maria de' Medici, while at the same time making approaches to the Huguenots. He conspired against Richelieu, who had opposed his marriage to Mlle. de Montpensier, and was obliged to flee to Savoy. He was, however, recalled by Louis XIII and took part in the siege of La Rochelle in 1627. In 1636 he again formed a plot against Richelieu, and after its failure fled to Sedan, where he joined an alliance with the Duke de Bouillon, Duke de Guise, and the Spaniards against Richelieu. In July, 1641, they met the royal forces at Marfée, near Sedan, and vanquished them; but at the moment of victory Soissons was killed.

SOJARO, Il. See Gatti.

SOKALSKY, sô-käl'skê, Peter Petrovitch (1832–87). A Russian composer and student of Russian folk songs. After studying at the University of Kharkov, he devoted himself to literature, music, and art in general, contributing articles on these subjects to the Odessa *Herald*, of which he was editor. He was not a prolific composer, however, and is known in this field chiefly for his operas *Maria* (based on Pushkin's *Poltava*), *A May Night*, and *The Siege of Dubno* (based on Gogol's *May Night* and *Taras Bulba*), and the cantata *The Fête of Peter the Great*. In the field of musical research he has left two scholarly works, *The Chinese Scale in Russian Folk Music* (1885) and *The Russian Folk Song; its Melodic Structure and Harmonic Peculiarities* (1888, posthumous).

SOKO, Antigonus of. See Antigonus of Soko.

SOKOLOW, sô-kô'lôf, Nahum (1859–). A Hebrew writer and zionist, born in the Province of Plock, Russian Poland. After 1879 he was editor of *Ha-Zefirah*, an important Hebrew periodical founded by Slonimsky (q.v.), and for this he wrote numerous brilliant essays. He also edited a literary annual, *He-Asif* ("The Collector"), the success of which was phenomenal. Although Sokolow long refused to take sides on the burning issues dividing Judaism, he later became a great leader of political zionism. His prolific writings include critical essays, stories, and occasional articles of all kinds. Among his writings on zionism are *Le-Maranan we-Rabanan* (1900) and *Tochen ha-Ziyonat* (1912). In all respects, Sokolow, who finally settled in London, is one of the greatest figures of modern Jewry.

SOKO'TO. Formerly one of the largest states of Central Sudan, extending with its dependencies eastward from the Lower Niger, above the confluence with the Benue, to the former Kingdom of Bornu and the borders of French Congo, and embracing a large part of the northwest of the present British colony of Nigeria to which it gives the name of a province (see Nigeria) (Map: Africa, E 3). Area, estimated at over 100,000 square miles. Its population was composed principally of Hausas (see Hausa States), but includes also the Fulbe (the ruling class) as well as Tuaregs, Arabs, etc. The total population is believed to have numbered 10,000,000. The Sokoto Empire took its rise in the nineteenth century. It originally formed a part of the great Fulah Empire established by Othman in Central Sudan at the beginning of the same century. It remained in the possession of the family of Othman until the commercial treaty with the Royal Niger Company in 1885, since when the territory has gradually come within the British sphere of influence, with the exception of Adamawa (q.v.), partly within the German sphere. In 1902 the rights of the Niger Company were transferred to the British crown and Sokoto rebelled but submitted in 1903. The city of Sokoto, formerly the capital with about 100,000 people, is now an insignificant place, and the capital has been transferred to Wurnu, a small town about 25 miles northeast. The commercial centre is Kano (q.v.).

SOKOTRA, sô'kô'trȧ *or* sŏk'ô-trȧ. An island in the Indian Ocean. See Socotra.

SO'LANACEÆ (from Lat. *solanum*, nightshade), or The Nightshade Family. A dicotyledonous family of herbs, shrubs, or tropical trees, including about 75 genera and 1750 species, widely distributed, but most abundant in the tropics. It contains some notable cultivated species, such as potato, tomato, egg plant, tobacco, and petunia. The conspicuous genera are *Solanum* (nightshade, bittersweet, horse nettle), *Physalis* (ground cherry), and *Datura* (jimson weed).

SO'LAN GOOSE. See Gannet.

SOLANINE, sŏl'ȧ-nĭn *or* -nēn. See Alkaloids.

SOLANO, sô-lä'nô. See Simoom.

SOLA'NUM (Lat., nightshade). A genus of widely distributed spiny, downy, or smooth herbs or shrubs of the family Solanaceæ, containing several hundred species, particularly abundant in tropical South America and the West Indies. By far the most important of all the species is *Solanum tuberosum*, the potato (q.v.), in which solanine is found in considerable quantity. Other species, *Solanum commersoni* and *Solanum maglia*, have recently come into notice on account of their tubers, some of which appear to be of value. Of the species with edible fruit, the principal is *Solanum melongena*, the eggplant. *Solanum dulcamara*, the bittersweet, and *Solanum nigrum*, the common nightshade, are both common in the United States, having been introduced from Europe. The berries of *Solanum saponaceum* are used as a substitute for soap, and in Australia those of several species are eaten by the natives, some with and others without cooking. In the United States there are a dozen or more indigenous species, some of which, as *Solanum carolinense*, the horse nettle, and *Solanum rostratum*, the buffalo bur, are very spiny troublesome weeds.

HORSE NETTLE (*Solanum carolinense*).

For black nightshade see illustration in article Nightshade. See Colored Plate of Poisonous Plants.

SOLAR APEX. See Apex of the Sun's Way; Star.

SOLAR CONSTANT. The amount of heat which a square centimeter of the earth's surface exposed perpendicularly to the sun's rays would receive per minute if there were no atmospheric absorption. The amount of radiant energy actually reaching the surface of the earth is measured by means of a pyrheliometer (q.v.). If the experiment is repeated at different altitudes, the amount absorbed by the atmosphere can be estimated, and the solar constant can then be deduced. Although the younger Herschel and Pouillet had both determined the constant as early as 1838, still it was not until Langley (q.v.) invented his bolometer (q.v.) that it became possible to obtain measurements of the utmost precision. From simultaneous observations of the radiation received at the summit of Mount Whitney, California, nearly 15,000 feet above sea level, and at its base, Langley was able to determine that the absorption differed in different parts of the spectrum, being greatest in the ultra-violet and least in the infra-red, and that about 40 per cent of the solar radiation striking the clear atmosphere at its upper confines was absorbed before it reached sea level. This was far in excess of all previous estimates of the amount of atmospheric absorption, and Pouillet's value of 1.7 calories for the solar constant was at once almost doubled. In the most recent determination of the solar constant, made by C. G. Abbot (q.v.), nearly 700 measurements, extending over the period 1902–1913, were taken at such widely separated localities as Washington (sea level), Bassour in Algeria (3800 feet), Mount Wilson, Cal. (5670 feet), and Mount Whitney (14,500 feet), and a mean value of 1.93 standard 15° calories per square centimeter per minute was derived. In other words, the amount of heat reaching the outside of our atmosphere from the sun is capable of doing continually the work of a 2 horse-power engine for each square yard of the earth's surface. Abbot found that the constant is subject to a long-period variation corresponding to the sunspot period, and a more irregular fluctuation of about 10 per cent, with a period of about a week or ten days, was detected, attributed to changes in the sun's emissivity.

SOLAR CYCLE. See Period.

SOLARI, sô-lä′rê **(SOLARIO),** Andrea (c.1460–1515). A Lombard Milanese painter of the High Renaissance. He is frequently called Andrea del Gobbo, after his elder brother Cristoforo, the sculptor, who seems to have brought him up and whose artistic influence may be seen in Andrea's delicate modeling of the heads. In 1490 they went to Venice, where Andrea executed many paintings in the manner of Bellini. On his return to Milan he fell completely under the influence of Leonardo da Vinci, and his standing was such that in 1507, when Cardinal George d'Amboise summoned Leonardo to France, Andrea was sent in his stead. He finished his decorations of the Cardinal's chapel at Gaillon in 1509, after which he seems to have gone to Flanders. The latter part of his life was passed probably at Milan. In color, chiaroscuro, and subtle modeling of heads, Solari approached nearer Leonardo than any other of his disciples. His portraits display a characterization and strength suggesting Holbein; the execution is delicate. His principal paintings include: "Holy Family with St. Jerome" (1495); the powerful portraits of a Venetian senator and of Longoni (1503), in the National Gallery (London); a "Madonna," "John the Baptist," and "Saint Catharine" (1499), in the Brera (Milan); a "Crucifixion" (1503), a "Male Portrait," and the "Madonna of the Green Cushion," in the Louvre; a "Rest on the Flight" (1515) and "Ecce Homo," in the Poldi collection, Milan, especially rich in his works; and the altarpiece of the Certosa at Pavia.

SOLARI (SOLARIO), Cristoforo (called Il Gobbo, the hunchback) (c.1450–1523). A Lombard sculptor and architect of the Renaissance. He worked with his brother Andrea at Venice and in 1495 he was appointed ducal sculptor to Ludovico Sforza at Milan. In 1498 he executed his masterpiece, the tomb of the Duke's wife, Beatrice d'Este, in Santa Maria delle Grazie. The monument was destroyed after the fall of the Duke, but the recumbent figures of himself and wife were taken to the Certosa of Pavia. They are naïve and realistic, thoroughly in the style of the early Renaissance. For the Certosa, Cristoforo also executed a number of decorations. During a sojourn in Rome he came under the influence of Michelangelo, which caused serious detriment to his originality as evidenced by his statues of "Christ" and "Adam," Milan Cathedral. His chief architectural work is the cupola of Santa Maria della Passione, Milan (1509).

SOLAR MICROSCOPE (Lat. *solaris*, relating to the sun). An instrument for projecting magnified images of minute objects on a screen, through the agency of the sun's rays or artificial illumination, the latter being more convenient and usual with modern instruments. The microscope consists of a brass tube fastened to the interior side of a closed window shutter over a hole in the latter, and a reflector so placed that rays of sunlight falling on it are reflected into the tube. These rays, or those from an artificial illuminant, are then collected by a powerful double convex lens, and brought to a focus on the object, which is placed on a stage at the opposite end of a tube. An enlarged image of the object thus illuminated is then produced by a second lens or system of lenses upon a white screen. Should the object be opaque, the rays of light reflected from the mirror are concentrated by the double convex lens on another mirror near the opposite end of the tube; they are then reflected upon the back of the object, and diverge on the system of lenses which form the image. Instead of the sun's rays, the oxyhydrogen limelight and the electric arc are employed, the rays being thrown on the double convex condenser by means of a reflector. See Projection Apparatus; Microscope.

SOLAR PARALLAX. See Parallax.

SOLAR SYSTEM. The planets and comets pursuing orbital revolutions round the sun combine with it to form a system to which is given the name of solar system. It is not impossible that many stars are the centres of somewhat analogous systems. This, however, is merely a matter of speculation. No change of much magnitude can take place in the elements of the planets' orbits without having effect on the earth and its inhabitants, on account of the mutual attractions of the planets for each other; in fact, they appear as members of one isolated family, bound together by common ties, which could not be ruptured in the case of one individual without communicating a general shock to the others. See Astronomy; Planets (and each planet under its own name), Planetoids; Comet; Sun; Moon; Satellites; Meteors. Their motions are treated of under Gravitation; Central Forces; Precession; Orbit; Perturbations; and their probable origin under Cosmogony; Nebulæ; so that it only remains here to give the more interesting numerical facts connected with them:

PLANET	Diameter (miles)	Density (earth's 1)	Mass (earth's 1)	Mean distance from sun (millions of miles)	Period of revolution (days)
Mercury	2,770	0.56	0.024	35.7	88
Venus	7,700	0.82	0.82	67.2	225
Earth	7,918	1.00	1	92.9	365
Planetoid Eros	20	?	?	135.1	643
Mars	4,230	0.71	0.105	141.5	687
Planetoid Ceres	480	?	?	257.1	1,681
Jupiter	86,500	0.24	318	483.3	4,333
Saturn	73,000	0.13	93	886.0	10,759
Uranus	31,900	0.22	15	1,781.9	30,688
Neptune	34,800	0.20	17	2,791.6	60,181

SOLDÁN Mariano Felipe Paz. See Paz Soldán, M. F.

SOLDER, sŏd'ẽr *or esp. Brit. pron.* sŏl'dẽr (Lat. *solidare*, to make firm). Any fusible alloy that may be used for joining metals. Solders vary widely in composition according to the metals which it is desired to unite, but may be roughly divided into hard or brazing solders and soft or tinners' solders. Soft solders consist of varying proportions of tin and lead with or without the addition of bismuth. For electrical work soft solder receives a small addition of bismuth thus lowering the melting point of the mixture slightly below the boiling point of water. Soft solder is applied either by melting and pouring upon the joint (wiping), by the blowpipe, or more frequently by heating the metal surface and the solder with a copper bolt attached to an iron handle known erroneously as a "soldering iron." For use the copper bolt must be clean, coated with solder, and somewhat hotter than the melting point of the solder. The fluxes used consist of alkaline or acid reacting compounds capable of dissolving any oxides formed during the operation. Those in common use consist of muriatic or hydrochloric acid, salammoniac, borax, zinc chloride, etc. Common rosin, tallow, beeswax and similar substances protect the cleaned surfaces and are safest to use. Of late years a number of ingenious combinations of solder and flux have come into use, such as tubular solder filled with flux or the many dry granular and paste mixtures.

Cold solder, for articles which cannot be heated, consists of sodium amalgam, usually applied in the form of small pellets which have been previously warmed until the mercury starts to exude. The pellets are firmly pressed into the joint and the parts held rigidly for several hours. Hard solders or spelters are mixtures of copper, zinc, silver, tin, gold, etc., and are roughly classed as hard, white, and jewelers' solders. On account of their high melting point (red heat) they are applied with the blowpipe, torch, or forge fire. Borax is used as a flux in most cases.

Brass solder usually consists of equal parts of copper and zinc; for copper brazing the copper ingredient is increased to three parts. Jewelers' solders consist of silver or gold and copper with zinc. No really satisfactory aluminium solders exist; those in use consist of varying proportions of aluminium and zinc with various other metals; even common soft solder may be used. One compound containing phosphor tin requires no flux.

Autogenous soldering consists in joining two metallic surfaces with a strip of the same metal heated by the oxyhydrogen or oxyacetylene blowpipe. The familiar "lead burning" in chemical works is an example of this class. See Alloy; Brazing.

SOLDIER BEETLE. A name in the United States for any beetle of the tribe Telephoridi of the family Malacodermidæ. The name is derived from the trim appearance and color markings, suggesting an army uniform. The larvæ are predatory and feed upon soft-bodied insects—plant lice and small caterpillars. The Pennsylvania soldier beetle (*Chauliognathus pennsylvanicus*) is a common species in the eastern United States and is considered beneficial.

SOLDIER BUG. A name given to certain predatory stink bugs (q.v.) of the family Pentatomidæ, especially such forms as *Podisus spinosus*, *Stiretrus anchorago*, *Nezara hilaris*, and *Euschistus servus*, which are common enemies of caterpillars.

SOLDIER FLY. Any one of the broad, flat-bodied flies of the family Stratiomyiidæ, called "soldier flies" on account of the brightly colored stripes with which some species are marked. As a rule they are dark-colored and smooth. About 1000 species are known, and 200 of these are found in North America.

SOLDIERS' HOMES. There are two general classes of soldiers' homes in the United States: first, those administered and maintained by the Federal government; second, those administered and partly maintained by State governments in certain States. The former include the United States Soldiers' Home, District of Columbia, and the National Home for Disabled Volunteer Soldiers, which is subdivided into 10 branches, located in different sections of the United States. Both the Northern and Southern States maintain homes. The latter are known as Confederate States Soldiers' Homes, and receive no appropriation, and are not under the jurisdiction of the Federal government. The State Soldiers' Homes of the Northern States, 32 in number, are exclusively under the control of the State authorities and operate under their special regulations, but receive certain financial aid from the Federal Treasury (Act of Congress approved Aug. 27, 1888), and are inspected once yearly under the supervision of the Board of Managers of the National Home for Disabled Volunteers. State Soldiers' Homes are located as follows: California, Veterans' Home, Napa County; Colorado, Monte Vista; Connecticut, Noroton Heights; Idaho, Boise; Illinois, Quincy; Indiana, La Fayette; Iowa, Marshalltown; Kansas, Fort Dodge; Massachusetts, Chelsea; Michigan, Grand Rapids; Minnesota State Home, Minneapolis; Missouri, St. James; Montana, Columbia Falls; Nebraska, Grand Island and Milford; New Hampshire, Tilton; New Jersey, Kearney and Vineland; New York, Bath and Oxford; North Dakota, Lisbon; Ohio, Sandusky and Madison; Oregon, Roseburg; Pennsylvania, Erie; Rhode Island, Bristol; South Dakota, Hot Springs; Vermont, Bennington; Washington, Orting and Port Orchard; Wisconsin, Waupaca; Wyoming, Buffalo. At certain of these State Soldiers' Homes, women who are the wives, widows, mothers, sisters, or daughters of ex-Union soldiers, sailors, and marines, and army female nurses are maintained, amounting in number to about 3000 women. The total amount of Federal aid to State institutions, estimated for the fiscal year 1915, was $1,150,000. The total number of persons maintained varied between 11,000 and 12,000.

United States Soldiers' Home, District of Columbia. This is a Federal institution, the administration of which, in accordance with regulations prescribed by Congress, is supervised by a Board of Commissioners, consisting of the Governor of the Home and the following Bureau chiefs of the War Department: the quartermaster general, the surgeon general, the judge advocate general, the adjutant general, and the chief of engineers. The number of persons cared for at this institution varies, from year to year, between 1000 and 1500. The total disbursements per year, including pensions of inmates, is about $800,000. The sources of the funds are primarily stoppages or fines adjudged against soldiers by sentence of court-martial, forfeitures for desertion, and unclaimed moneys of deceased soldiers. The rules of admission are as follows: "The following persons, members of the Soldiers' Home, according to section 4814 Revised Statues, shall be entitled to the rights and benefits herein conferred and no others. First, every soldier of the army of the United States, who has served, or may serve, honestly and faithfully 20 years in the same. Second, every soldier and every discharged soldier, whether regular or volunteer, who has suffered or may suffer, by reason of disease or wounds incurred in the service and in the line of his duty, rendering him incapable of further military service, if such disability was not occasioned by his own misconduct. Third, the invalid and disabled soldier, whether regular or volunteer, of the War of 1812 and subsequent wars (Revised Statutes, 4821)." Discharged soldiers who served only in volunteer organizations are not received at the Soldiers' Home in the District of Columbia, because provision is made for them in the National Home for Disabled Volunteer Soldiers.

National Home for Disabled Volunteer Soldiers. The government of this home has heretofore been vested by law in a board of managers composed of the President of the United States, the Secretary of War, the Chief Justice of the Supreme Court (all ex-officio), and eleven managers, who were elected by joint resolution of Congress, but an Act approved June 23, 1913, making appropriation for the fiscal year 1914, reduced that number of managers from eleven to five, as vacancies occur. These managers must all be residents of States which furnished organized bodies of soldiers to aid in suppressing the rebellion commenced in 1861, and no two of them shall be resident of the same State, and no person who gave aid or countenance to the rebellion shall ever be eligible. The home is composed of ten separate branches, a general depot, and the general offices which are located as follows:

BRANCH	Post-office address	Location
Central	National Military Home, Ohio	Dayton
Northwestern	National Home, Wisconsin	Milwaukee
Eastern	National Home, Togus, Maine	Togus
Southern	National Soldiers' Home, Virginia	Hampton
Western	National Military Home, Kansas	Leavenworth
Pacific	Soldiers' Home, California	Los Angeles
Marion	National Military Home, Indiana	Marion
Danville	National Home, Illinois	Danville
Mountain	National Soldiers' Home, Tennessee	Johnson City
Battle Mountain	Hot Springs, South Dakota	Hot Springs

Eligibility for admittance: "The following persons only shall be entitled to the benefit of the National Home for Disabled Volunteer Soldiers, and may be admitted thereto upon the order of a member of the board of managers, namely: all honorably discharged officers, soldiers, and sailors who served in the regular or volunteer forces of the United States in any war in which the country has been engaged, including the Spanish-American War, the provisional army (authorized by Act of Congress approved March 2, 1899), in any of the campaigns against hostile Indians, or have served in the Philippines, in China, or in Alaska, who are disabled by disease, wounds or otherwise, and who have no adequate means of support, are not otherwise provided for by law, and by reason of such disability are incapable of earning their living." The average of officers and members present during the year ending June 30, 1913, was 17,457. The yearly number cared for is gradually decreasing. The number cared for according to wars in which they participated, on June 30, 1913, was as follows: Mexican, 58; Civil War, 27,664; Spanish-American War, 2880; Provincial Army, 649; Indian Campaigns, 238; foreign service, 58. Whole number cared for since the organization of the home, to June 30, 1913, was 188,129.

SOLE (Lat. *solea*, sole). A flatfish (q.v.) of the family Soleidæ. The common sole of Europe (*Solea vulgaris*) attains a length of from 10 to 20 inches and is highly esteemed for food. The American sole (*Achirus fasciatus*), or "hog-choker," is only about six inches long and is of less value. See Plate of FLATFISH AND FLOUNDERS.

SOLEILLET, sō'lā'yā', PAUL (1842–86). A French explorer, born at Nîmes. In 1873–74 he attempted to find a route for a commercial road between Algeria and the Niger. He failed in this, but his explorations convinced him of the practicability of a trans-Saharan railroad. He went to Senegambia in 1878 in the interests of this project, but his operations were frustrated by the Governor. In 1881 he went to Kaffa by way of Shoa and laid the way for French approach to the southern borders of Abyssinia. Then he was intrusted with founding the French colony of Obok on the Gulf of Aden. He died while on a new expedition to Shoa. His most important publications are: *Exploration du Sahara central* (1874); *Voyage à Ségou* (1878–79); *Voyages en Ethiopie* (1885); and *Une exploration en Ethiopie* (1886).

SOLEMN LEAGUE AND COVENANT. See COVENANTS, THE.

SOLENHOFEN (*zō'len-hō'fen*) **LITHOGRAPHIC STONE.** A deposit of limestone of Upper Jurassic age, which, on account of its fine-grained and smooth texture, is adapted for lithographic purposes. The most important quarries occur at Solenhofen, near Pappenheim, in Bavaria. The beds of good stone aggregate about 50 feet in thickness and are found in the lower portions of the quarries, many of which are 100 feet deep. Most of the lithographic stone used is obtained from this district. See ARCHÆOPTERYX.

SOLE'NODON (from Gk. *σωλήν*, *sōlēn*, channel, pipe + *ὀδούς*, *odous*, tooth). A rare West Indian insectivore, of which there seem to be two species, inhabiting Cuba and St. Domingo, named respectively *Solenodon cubanus* and *S. paradoxus*. It is like a giant shrew, with a long, slender, conical snout, powerful, naked feet, and long claws fitted for digging, and a long, bare, opossum-like tail. Little is known of the solenodon's life history; it lives only a short time in captivity. It roots in the ground and tears apart rotten logs for grubs and other insects. It is nocturnal and spends the day in a hollow log or a hole. In St. Domingo the animal has been almost exterminated by the mongoose. For the most complete monograph of *Solenodon paradoxus*, consult G. M. Allen, in Museum of Comparative Zoölogy, *Bulletin*, vol. 40 (Cambridge, Mass., 1910). See Plate of CAVIES accompanying article CAVY.

SOLENOID, sō'lē-noid *or* sō-lē'noid (from Gk. *σωληνοειδής*, *sōlēnoeidēs*, pipe-shaped). A cylindrical coil of wire used for producing magnetic effects by electric currents. The coil when traversed by a current possesses all the qualities of a magnet. See MAGNETISM.

SO'LENT. The west portion of the strait which with Spithead separates the Isle of Wight from England (Map: England, E 6). It is 17 miles long by 2 to 5 miles wide, is a favorite yachting ground, and affords safe anchorage. Hurst Castle guards its entrance on the southwest.

SOLER, or **SOLLAR** (AS. *solor*, *soler*, OF. *solier*, both from Lat. *solarium*, from *sol*, sun). An upper chamber. The only private apartment in the old baronial halls was so called. It was placed over the pantry, at one end of the hall, and served as parlor and sleeping apartment for the baron and his family.

SOLEURE, sō'lẽr'. The French name of Solothurn (q.v.).

SOLEY, sō'lĭ, JAMES RUSSELL (1850–1911). An American writer on naval subjects. He was born at Roxbury, Mass., graduated at Harvard in 1870, and was admitted to the bar in Washington, D. C. From 1872 to 1882 he was professor of history and law at the Naval Academy at Annapolis. From 1876 to 1890 he was professor in the United States navy. In 1882 he was transferred to Washington to arrange the Naval Library, and until 1890 was engaged in preparing the naval records of the Civil War. In 1890–93 he was Assistant Secretary of the Navy. He afterward practiced law in New York, and was counsel for Venezuela at the Paris arbitration of the Venezuela-British Guiana boundary in 1899. His publications include: *Historical Sketch of the United States Naval Academy* (1876); *Foreign Systems of Naval Education* (1880); *The Blockade and the Cruisers*, in the "Campaigns of the Civil War Series" (1883); with Commodore Schley, *Rescue of Greely* (1885); *Boys of 1812* (1887); *Admiral Porter* (1903), in the "Great Commanders Series." He also edited *Autobiography of Commodore Morris* (1880), and contributed to *The Battles and Leaders of the Civil War* (1887) and to Justin Winsor's *Narrative and Critical History of America*.

SOLFATARA, sôl'fȧ-tä'rȧ (It. *solfatara*, from *solfo*, sulphur). A dormant volcano near Naples. The word is used as a common name for a volcanic vent emitting only vapors. Volcanoes after activity frequently send off gaseous eruptions, when steam, sulphureted hydrogen, carbon dioxide, and hydrochloric acid come forth, usually without explosive effects. Sulphur and chlorides are sometimes deposited by sublimation. Solfataras are quite numerous in the old volcanic regions of Italy. The Soufrière of Saint Vincent is a notable example of a solfatara at times violently eruptive.

SOLFEGGIO, sôl-fĕd'jō. A vocal exercise the object of which is the training of the ear to acquire certainty in singing any intervals at sight without the aid of an instrument. The tones are sung either on one vowel (a) or on the syllables of solmization (q.v.).

SOLFERINO, sôl'fe-rē'nō. A village in the Province of Mantua, Italy, 20 miles northwest of Mantua (Map: Italy, C 2). It is famous as the scene of a bloody battle on June 24, 1859, in which the allied French and Sardinians, under Napoleon III, defeated the Austrians. The Tower of San Martino, commanding a splendid view and containing a military museum, commemorates this victory, which was decisive in securing Italian independence.

SOLI, Aratus of. See Aratus of Soli.

SOLIC′ITOR. Under the laws of Great Britain, a person duly admitted to practice law under the provisions of the Solicitor's Acts, and who thereby becomes an officer of the Supreme Court and entitled to certain privileges and immunities. Before the Judicature Act (1873) the term was applied only to persons who conducted litigation in the Court of Chancery, but by the above act all solicitors, attorneys, and proctors authorized to practice in any division of the High Court of Justice are known as solicitors of the Supreme Court. The Incorporated Law Society was appointed "Registrar of Solicitors" in 1843, and in 1877 that society was given control of the examination of candidates for admission as solicitors. Each solicitor must obtain annually a certificate of his right to practice from the Registrar of Solicitors. A solicitor can practice in the High Court of Justice, the Court of Appeal, the House of Lords, Privy Council, and all inferior courts. They have a monopoly on certain legal business, as, e.g., the attestation of documents required by the Land Transfer Act. As a solicitor is an officer of the court the latter can exercise summary jurisdiction over him in case of a breach of duty. A solicitor who permits another to practice in his name will be disbarred and can never be readmitted. Where a solicitor is struck off the rolls for other misconduct, he may be subsequently readmitted in the discretion of the court. In the United States the distinction between solicitors and barristers has not been generally recognized. Consult A. Cordery, *Law Relating to Solicitors* (London, 1887–88).

SOLICITOR-GENERAL. One of the important law officers of the English crown, appointed by letters patent. He is always a member of the House of Commons, and is *ex officio* a Minister of the crown and a member of the General Council of the bar. He is not, however, a member of the cabinet. He is next in rank to the Attorney-General and represents him in his absence. His term of office expires with the fall of the ministry of which he is a member. The Solicitor-General of Scotland is next in rank to the Lord Advocate.

In the United States the Solicitor-General is a Federal officer appointed by the President to assist the Attorney-General, and to take the latter's place in case of absence or illness.

SOLID ALCOHOL. See Wood Distillation.

SOLID SOLUTION. See Isomorphism; Solution.

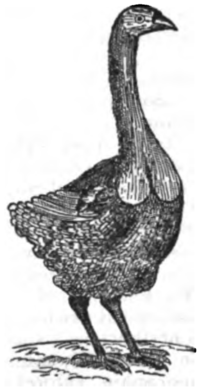
SOLINGEN, *zō′lĭng-en*. A town in the Rhine Province, Prussia, 18 miles north-northeast of Cologne (Map: Germany, B 3). It has long been famous for its steel and iron ware manufactures, especially sword blades, helmets, cuirasses, knives, scissors, and hand bells. Pop., including the town of Dorp, 1900, 45,249; 1910, 50,536.

SOL′IPSISM (from Lat. *solus*, alone, only + *ipse*, self). A term applied, usually by opponents, to any system of philosophy the principles of which do not logically warrant the belief in any other being than the mind of the thinker. It is a subjective idealism (q.v.) which is so subjective as to leave no valid ground for belief in objectivity. As a matter of fact actual solipsists have been rare although perhaps many subjective idealists if they had been consistent would have been solipsists.

SOLÍS, sō-lēs′, Juan Díaz de (c.1470–1516). A Spanish navigator. He is said, although without good authority, to have discovered Yucatan with Vicente Yáñez Pinzón in 1506. After the death of Vespucci in 1512 he was appointed pilot-major of Spain. He discovered the entrance to the Río de la Plata and explored the river as far as the region of the Charrúa tribe, by whom he was killed before September, 1516. His brother-in-law, Francisco de Torres, conducted the survivors of the expedition back to Spain.

SOLÍS Y RIVADENEYRA, sō-lēs′ ē rē′vȧ-dȧ-nā′ē-rȧ, Antonio de (1610–86). A Spanish dramatist, historian, and statesman. He was born, probably, at Alcalá de Henares, studied at Salamanca where he produced (1627) a play, *Amor y Obligación*, and became Secretary of State (1654), private secretary to Philip IV, and chronicler of the Indies. In 1667 he took orders, whereupon he ceased writing for the stage. Of his 10 extant plays two are important in a comparative study of the drama: *El Amor al uso* and *La Gitanilla de Madrid*. His *Historia de la Conquista de Méjico*, which appeared in 1684 and was translated by Townshend (1724), is a Spanish prose classic. Consult D. E. Martell, *Dramas of D. Antonio de Solís y Rivadeneyra* (Philadelphia, 1903).

SOLITAIRE, sŏl′ĭ-târ′ (Fr., solitary). An extinct dodo-like bird (*Pezophaps solitarius*), differing from the dodos in a smaller bill and longer legs. It inhabited Rodriguez, and appears to have been peculiar to that island. François Leguat, in his *Voyages et aventures* (London, 1708), has left an interesting account of the solitaire. He describes it as a large bird, the male weighing about 45 pounds, its head without comb or crest, that of the female with a small widow's peak above the bill; the wings small, incapable of flight, but used for offense and defense, or to wave signals. The plumage was full and beautiful, but the tail was a roundish mass of feathers. It became extinct about 1775, but many skeletons are preserved in European museums. Consult Walter Rothschild, *Extinct Birds* (London, 1907). See Dodo; Extinct Animals.


THE SOLITAIRE (after a drawing by Leguat).

In America the name solitaire is given to the flycatching thrushes of the genus *Myadestes*, species of which occur in Jamaica, Martinique, and other West Indian islands, as well as on the continent. One species, *Myadestes townsendi*, dwells in the western United States from the Rocky Mountains to the Pacific. It is about 8 inches long, and dull brownish ash in color, and is a superb singer, as indeed are all the members of the genus. The name "solitaire" refers to its habit of hiding in solitary depths of the forests.

SOLITAIRE. A game played by only one person. Its origin is not known, but it is supposed to have been invented by a prisoner in the Bastile in the seventeenth century. It is played with 37 balls (usually of glass) on a circular board with 37 hemispherical cups or depressions. The game is played by removing one ball from the board and then placing an adjoining ball in the vacancy, passing over one intervening ball. The ball passed over is then taken up. This is then continued till only one ball remains, when the game is said to be won. Should two or more balls be left and they more than one space apart, and consequently isolated so as not to be liable to capture by each other, the game is lost.

Solitaire with Cards, or **Patience.** The pack or packs (sometimes with the exception of certain cards, which are laid face upward on the table) are shuffled. The player then takes the cards, backs uppermost, and plays them one by one, turning them face upward. His object is to arrange the cards in "families," each family being a complete series from ace to king, but not necessarily of the same suit. They may be formed by building upward, i.e., placing a higher card on the one next below it, or vice versa. The cards may be taken from the pack in the player's hand as already described, or they may be taken from an arrangement of card-piles on the table, or from either. If the player places any top card of these piles (should he elect to arrange the game that way) on any other just above or below it in rank, he is said to be making a marriage, by which he frees the cards underneath and utilizes them in "building." Cards not readily usable in building are laid aside and constitute "stock." Thus the stock may be used over again once or twice (first shuffling). There are several other varieties of card solitaire.

SOLLAS, sŏl′*as*, WILLIAM JOHNSON (1849–). An English geologist. He was born at Birmingham and was educated at the Royal School of Mines and at St. John's College, Cambridge. He was Cambridge University extension lecturer (1873–78); professor of geology and zoölogy at University College, Bristol (1880–83); of geology and mineralogy at Dublin University (1883–97); and in 1897 was appointed professor of geology and paleontology at Oxford. In 1896 the Royal Society gave him charge of an expedition to investigate Funafuti, a coral island in the Pacific. He was elected president of the Geological Society, London. He made numerous contributions to scientific societies and journals on geological, mineralogical, zoölogical, and ethnographic subjects, wrote *Tetractinellida*, the 24th volume of the reports of the *Challenger* expedition; also *The Age of the Earth* (1905); *Ancient Hunters* (1911).

SOLLOGUB, sôl′*o*-gōōp′, VLADIMIR ALEXANDROVITCH, COUNT (1814–82). A Russian author, born at St. Petersburg. He graduated at the University of Dorpat (1834) and held various diplomatic and official positions. He made his literary début in 1837 with the novelettes *Two Students* and *Three Fiancés*, but attracted general attention with his *History of a Pair of Rubbers* (1839), and still more so with his *Tarantas* (1845). Of his numerous works for the stage, the farce *The Troublesomeness of a Tender Heart* (1850) and *The Official* (1856) are best known. His works of fiction appeared in five volumes (St. Petersburg, 1855–56). Though very popular in his day Sollogub is little read nowadays.

SOLL UND HABEN, zôl ụnt hä′b*e*n (Ger., Debit and Credit). A noted romance by Gustav Freytag (1855), based on a study of modern industrial conditions.

SOL′MIZA′TION (from *sol* + *mi*, names of two notes of the gamut). A peculiar method in use for centuries for teaching musical intervals and scales by means of certain syllables. The syllables are *ut* (or *do*), *re*, *mi*, *fa*, *sol*, *la*, and *si*. The first six are the commencement of the lines of an ancient hymn to John the Baptist, peculiar in that the first syllable of each line (with the exception of the last) was sung to a note one degree higher than the first syllable of the preceding line, thus presenting the type of a scale. See GUIDO D'AREZZO.

These syllables are said to have been first used by Guido of Arezzo in the eleventh century. As Guido employed a hexachord, six syllables were sufficient. But when the importance of the leading tone was recognized the heptachord superseded the old hexachord. Then Le Maire, a French musician of the seventeenth century, added to them *si*, for the seventh of the scale. When applied to the key of C, their equivalents, in the ordinary musical nomenclature are:

Do	re	mi	fa	sol	la	si	do
C	D	E	F	G	A	B	C.

These syllables may, however, be applied to other keys, with *do* always as the key-note, so as to express, not the absolute pitch of a note, but its relation to the keynote. See SOLFEGGIO.

SOLMONA, sôl-mō′nȧ, or **SULMONA,** sōōl-mō′nȧ. A city in the Province of Aquila, Italy. Solmona manufactures wine, paper, cloth, and strings for musical instruments. The city is famous as the birthplace of the poet Ovid. Pop. (town), 1911, 13,372.

SOLMS-LAUBACH, zōlms-lou′bäG, HERMANN, COUNT (1842–1904). A German botanist, born near Giessen and educated there and at Berlin, Freiburg, and Geneva. He became professor extraordinary at Strassburg in 1872 and professor of botany and director of the Botanical Garden at Göttingen in 1879, and was called to a similar position at Strassburg in 1888. His publications include: "Ueber den Bau und die Entwickelung der Ernährungsorgane parasiticher Phanerogamen," in the *Jahrbücher für wissenschaftliche Botanik* (1867–68); *Corallina* (1881); *Herkunft, Domestikation und Verbreitung des gewöhnlichen Feigenbaums* (1882); *Die Geschlechterdifferenzierung bei den Feigenbäumen* (1885); *Einleitung in die Paläophytologie* (1887); *Die leitenden gesichtspunkte einer allgemeinen Pflanzengeographie* (1905).

SOLO (It., alone). In music, a piece or passage for a single voice or instrument. In orchestral compositions "solo" indicates that one instrument is to take the leading part.

SOLOGUB, sôl′*o*-gōōp′, FEODOR (1863–). The pen name of a Russian writer, his real name being Feodor Kuzmitch Teternikov. He studied at the St. Petersburg Teachers Institute and later became a schoolmaster. His literary career dates from 1894, when his first story, "Shadows," appeared in the periodical *Severny Vestnik*. Afterward he wrote poetry, plays, novels, fables, essays, and short stories. His first literary success came in 1907, when his novel *The Little Demon* proved immensely popular. His complete works numbered 20 volumes in 1914. Sologub, like Anton Chekhov (q.v.), is a true literary descendant of Gogol, but he excels Chekhov in the power of creative imagination. As a stylist he is unsurpassed among writers of his day. His peculiar sphere in fiction is the life of the small provincial Russian towns. In English appeared *The Sweet-Scented Name and Other Stories* (1915).

SOL'OMON (Heb. *Shĕlomōh,* peaceable or prosperous). A son of David and Bathsheba (2 Sam. xii. 24), successor of David on the throne of Israel (c.993–953 B.C.). The biblical account of Solomon is found in 1 Kings i–xi, and its parallel 2 Chron. i–ix. When David was old his son Adonijah set himself up as a pretender to the throne, but Bathsheba interceded for Solomon. David granted her request and Solomon became King. One by one the new King had his enemies, Adonijah, Joab, and Shimei, put to death, so that he rested securely on his throne. A daughter of Pharaoh was among his wives. Solomon divided Israel into twelve parts for administrative purposes, and we are told that his territory extended from the river (Euphrates) unto the land of the Philistines, and unto the border of Egypt, and that he made bondsmen of the Canaanites who remained in the land. He made an alliance with Hiram, King of Tyre, who, in return for food, furnished him with timber; the ships of the allies went out trading together. The Yahwe temple was built in great splendor with Hiram's aid and dedicated with much magnificence. The temple took from the fourth to the eleventh year of Solomon's reign for its completion; the palace in the Lebanon from the seventh to the twentieth year. He also built sanctuaries to Chemosh, the Moabitish god. Many foreign women were in his household, who are said to have influenced him to worship alien gods. Almost all other details about Solomon are amplifications either of his wisdom or his splendor. We are told that God appeared to him in a dream and asked him to choose a gift, whereupon Solomon chose neither riches nor power, but wisdom, and as a reward was given both what he chose and what he resigned. A proof of his wisdom immediately follows (1 Kings iii. 16–25), and it is never lost sight of afterwards (cf. 1 Kings iv. 29 et seq., where he is said to be "wiser than all men"; v. 7–12; x. 1–3, where Solomon answers the "hard questions" propounded by the Queen of Sheba, and x. 24). The entire narrative is a recital of the magnificence of the King, especially the description of his building operations (1 Kings iv. 22–28, ix. 26–29, x. 1–13; 2 Chron. ix. 9). On the visit of the Queen of Sheba, see SABÆANS; SHEBA.

The narrative in Kings concerning Solomon is based upon earlier documents, such as the "Book of the Acts of Solomon" (1 Kings xi. 41). The main facts are unquestionably authentic, though the account has to some extent been colored by a view of Solomon belonging to a period many centuries later. This view is still more consistently carried out in the narrative in Chronicles, which has no independent historical value. In the Book of Kings there are still traces of a conception of Solomon which did not hold him up in a favorable light. The extension of power is made responsible for the introduction of foreign religious customs, and the blame for the rebellion immediately following upon the death of Solomon is in part, at least, put upon the King. In Chronicles, however, all these unfavorable features are suppressed and the King is held up as a marvel of piety and wisdom, as well as a great ruler under whom the Kingdom rose to its highest point of glory.

Solomon's distinguishing quality was as an administrator. He kept the Kingdom intact during his reign, though not in such a condition that his successor could continue his policy. An important step was his strengthening the fortifications of the country, and no less significant was his foreign policy, which involved alliances with surrounding nations such as the Phœnicians. Through this international intercourse an impetus was given to commerce in Solomon's days. (See ELATH; EZION GEBER; OPHIR.) Contact with other nations also had its result in a marked intellectual advance, and it is probably safe to assume that already in Solomon's days there was a genuine literary activity in Israel. The new epoch thus marked by Solomon's reign is sufficient to account for the view taken by the later tradition, which makes Solomon himself an author of high rank and prodigious fertility. The books ascribed to him, Proverbs, Canticles, Ecclesiastes, Wisdom of Solomon, Psalms of Solomon, and Odes of Solomon (qq.v.), belong to various periods which, however, are all many centuries later than his time. That the simpler sanctuary of former days was replaced in his reign by a more ambitious edifice was a natural consequence of a general political growth, but the description of the new edifice is colored by the desire to extol the grandeur of Solomon's achievements, while the account of the ceremonies, including the prayer, is probably a post-exilic production. Consult the chapters on Solomon in the Hebrew histories of Guthe, Stade, Kent, Wellhausen, Piepenbring, Kittel, and Cornill; also W. S. Caldecott, *Solomon's Temple: Its History and Structure* (Philadelphia, 1907).

SOLOMON, ODES OF. A collection of 42 odes ascribed to Solomon. Five of these are quoted in the Gnostic work, *Pistis Sophia.* The *Odes* are referred to in the *Pseudo Athanasian Synopsis* (sixth century), and in the *Stichometry* of Nicephorus (ninth century); Lactantius quotes one of them, and a sixteenth-century Syriac manuscript discovered and published by J. Rendel Harris in 1909 contains 40 of the hymns. They were first supposed by Harnack and some other scholars to be a Jewish work with extensive Christian interpolations, but the majority of investigators are now agreed that they are of Christian origin. They were probably written in Greek in northern Syria in the first half of the second century A.D., and seem to be to some extent affected by Gnosticism of the type found in the apocryphal Acts of the Apostles (see APOCRYPHA). Some scholars have attempted to prove that they were composed by Montanus, Valentinus, or Bardesanes, but the arguments are not convincing. Though the Syriac translation does not fully reveal the characteristics of the original form, there can be no question that the author was an exceptionally gifted poet as well as a mystic of deep religious experience and tenderness of feeling. The peculiarities of theological opinion and sentiment offer many difficulties to the interpreter, but the *Odes* are universally regarded as one of the most remarkable recent discoveries in the field of early Christian literature.

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Solomon Montanist (ib., 1911); S. A. Fries, *Die Oden Salomos* (ib., 1911); W. Stölten, *Gnostische Parallelen zu den Oden Salomos* (ib., 1912); W. Frankenberg, *Das Verständnis der Oden Salomos* (Giessen, 1912); W. R. Newbold, in *Journal of Biblical Literature* (Boston, 1912).

SOLOMON, Psalms of. A collection of 18 psalms ascribed to Solomon. They are found in eight Greek manuscripts, and are mentioned in the catalogue at the beginning of the *Codex Alexandrinus* and other early lists. A Syriac version, made from the Greek, was discovered by J. Rendel Harris and published in 1909, and some fragments of other manuscripts have come to light since then. The close from xvii, 38 b to the end of xviii is still missing. These Psalms were originally written in Hebrew, and unmistakable historic allusions show that they were composed after 63 and before 48 B.C. They reflect the attitude of the Pharisees to the Hasmonæan dynasty and the hope of a Messiah who shall be truly a descendant of David and a righteous King. The Greek text has been edited by E. H. Ryle and A. James (*Psalms of the Pharisees*, Cambridge, 1891) and O. von Gebhardt (*Die Psalmen Salomos*, Leipzig, 1895), and the Syriac text by J. Rendel Harris (*The Odes and Psalms of Solomon*, 2d ed., Cambridge, 1911). Consult J. Viteau, *Les Psaumes de Salomon* (Paris, 1911), and G. B. Gray, in R. H. Charles, *The Apocrypha* and *Pseudepigrapha of the Old Testament* (Oxford, 1913).

SOLOMON, Wisdom of. One of the deuterocanonical books of the Old Testament, sometimes called also the Book of Wisdom. Solomon is introduced as the speaker (cf. chaps. vii–ix), whence the name first mentioned. The book consists of three parts: (1) chapters i–v commend wisdom to rulers and incidentally attack Greek philosophy, particularly the Epicurean school, and show how absorption in worldly affairs leads to spiritual ruin; (2) chapters vi–ix teach how wisdom, which is above all other benefits, may be gained, and Solomon relates how he came to choose wisdom as his life's companion; the section closes with Solomon's prayer for wisdom; (3) chapters x–xix illustrate the influence of wisdom on Israel's history, the miracles in the history are ascribed to wisdom, and, by way of contrast, the results of folly in the history of heathen nations are held up to scorn. The book seems to have been written originally in Greek about the middle of the first century B.C. An influence of Greek philosophy is admitted by most scholars. The unity of the book is not quite certain. Consult: K. Siegfried, in E. Kautzsch, *Die Apokryphen und Pseudepigraphen des Alten Testaments* (Tübingen, 1900); A. Hernisch, *Die griechische Philosophie im Buche der Weisheit* (Münster, 1908); F. C. Porter, "The Pre-Existence of the Soul in the Book of Wisdom," in *Semitic Studies* (Chicago, 1908); Samuel Holmes in R. H. Charles, *Apocrypha and Pseudepigrapha of the Old Testament* (Oxford, 1913). See Apocrypha.

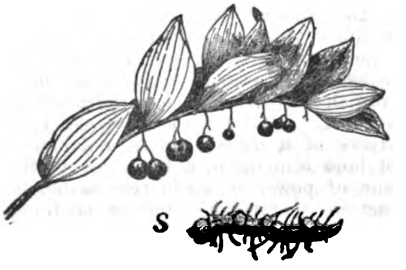
SOLOMON BEN GABIROL, bĕn gä'bē-rōl'. A Jewish philosopher and poet, best known as Avicebron (q.v.).

SOLOMON ISLANDS. A group of islands in the Pacific Ocean, extending in a direction from northwest to southeast between lat. 5° and 11° S., and long. 154° 40′ and 162° 30′ E. (Map: Australasia, J 3). It is about 120 miles distant from the Bismarck Archipelago on the west. Area about 17,000 square miles. The principal islands are Bougainville, Choiseul, New Georgia, Ysabel, Malaita, Guadalcanar, and San Cristoval. They are mostly oblong in shape, mountainous, and lined with coastal coral reefs. Traces of volcanic origin are found in the shape of craters, hot springs, etc. There are some active volcanoes, and earthquakes are frequent. The flora is luxuriant; many islands have forests of ebony and sandalwood; the fauna is Papuan in character. The climate is hot, moist, and unhealthful. Copra, pearl shell, and sandalwood are exported.

The population, estimated at 200,000, are Melanesians, with the possibility that in the unexplored mountains of the larger islands there may exist a race of still more primitive autochthons. Their physical type is not uniform, the people of the islands on Bougainville Strait being taller, darker, more robust, and more brachycephalic, those of San Cristoval and the islands adjacent shorter, lighter, less vigorous, and more dolichocephalic. The languages show great variation, amounting sometimes to mutual unintelligibility. Traces of Polynesian influences occur in speech, institutions, etc. Head-hunting, slavery, cannibalism, and taboo (here tambu) are among the native institutions, now waning.

Germany owned Bougainville, Buka, and some smaller islands, up to the Great War which began in 1914, when they were captured by an Australian expeditionary force. (See War in Europe.) The island of Choiseul, the island of Ysabel, and the various smaller islands to the east of Bougainville, with an area of 14,800 square miles and a population in 1914 of about 150,000, were transferred to Great Britain in 1899. The discovery of the Solomon Islands is attributed to the Spanish navigator Mendaña (1567). By an agreement in 1885 the group was divided between Great Britain and Germany and by that of 1899 in settlement of the partition of Samoa Great Britain acquired a large part of the German share in exchange for the island of Savaii. Consult: H. B. Guppy, *The Solomon Islands and Their Natives* (London, 1887); id., *The Solomon Islands, Their Geology, etc.* (ib., 1887); Elisée Reclus, in *Nouvelle géographie universelle*, vol. xiv (Paris, 1889); C. M. Woodford, *A Naturalist Among the Head Hunters* (London, 1890); Alvaro Mendaña de Neyra, *Discovery of the Solomon Islands*, translated and edited by Lord Amherst of Hackney and Basil Thomson for the Hakluyt Society (2 vols., ib., 1901).

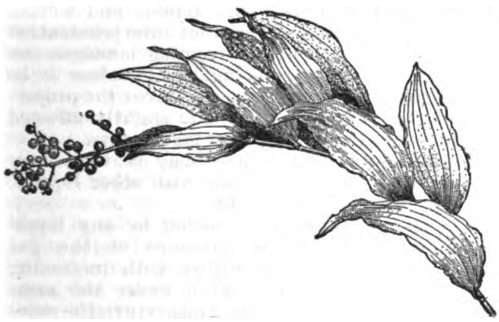
SOLOMON'S SEAL (*Polygonatum*). A genus of plants of the family Liliaceæ, differing from lily of the valley chiefly in the cylindrical tubular perianth, and in having the flowers joined to their flower-stalks. Of several European spe-



solomon's seal (*Polygonatum*).

A fruiting spray of Solomon's seal, with a terminal piece of a root-stem; *s*, showing the scars or "seals."

cies, the common Solomon's seal (*Polygonatum multiflorum*) has a stem about 2 feet high, the upper part of which bears two rows of large, ovate-elliptical, alternate leaves. The flower-stalks are generally branched; the small flowers white and drooping. The young shoots of *Polygonatum officinale* are eaten by the Turks like asparagus. The root is white, fleshy, inodorous, with a sweetish, mucilaginous, acrid taste. It has been made into bread in times of scarcity. Among the American species *Polygonatum commutatum*, the great Solomon's seal, and *Polygonatum biflorum*, smaller Solomon's seal, occur from the Atlantic coast to the Great Plains. The name is derived from the seal-like markings left upon the knotted rootstocks by the falling of the annual stems. Medicinal virtues were once attributed to the dried rootstocks. *Smilacina racemosa*, an allied plant, is called false Solomon's seal and false spikenard.



FALSE SOLOMON'S SEAL (*Smilacina racemosa*).

SOLOMON'S SONG. See CANTICLES.

SOLOMOS, sô′lô-môs, DIONYSIOS. See ROMAIO LITERATURE.

SO′LON (Lat., from Gk. Σόλων) (c.639–559 B.C.). An Athenian lawgiver and patriot, son of Execestides, descended from the noble line of the Codrids. In his earlier years Solon engaged in trade and probably visited the eastern Ægean, where he learned much from progressive Ionia. He mastered Ionic literature, and wrote verse in the Ionic dialect—he was the first Athenian to win renown by his poetry. Solon's life fell in the time of great social and economic change in Greece. As a result of the growing importance of commerce, capital was becoming concentrated in a few hands, while the small farmers and agricultural laborers were weighed down with debt. The small proprietors were deprived of their lands; many free Athenians who could not pay what they owed were sold into slavery. The law favored the rich, and a revolution seemed imminent, when, in the year 594–593 (or 592–591), Solon was elected archon, probably by the more moderate of both parties, and received full power to reform the oppressive conditions. He began with two radical measures: he forbade the borrowing of money on the person of the debtor, and also annulled all mortgages and debts in which the person of the debtor had been pledged. Probably he reduced debts in general and lowered the rate of interest. This great reform was called the *Seisachtheia* (σεισαχθεία), or Shifting of Burdens, and was celebrated by a festival. He then restored by an amnesty all who had lost civil rights before his archonship, with the exception of those who had been punished for murder or attempted tyranny. His next remedial measure was to forbid the export of all products with the exception of oil; he thereby secured a sufficient supply of grain for Athens at a moderate price. He also limited the amount of land which might be held by a single person. Of great importance was the substitution of a standard of coinage closely resembling the Eubœan for the prevailing Æginetan standard. Seventy of the new drachmæ equaled one hundred of the old. This secured to the poor great relief, and emancipated Athens from her rivals, Ægina and Megara, and gave her the advantage of trade with the colonies in Sicily and Italy. Solon abolished the laws of Draco (q.v.), except those which referred to murder. In place of the old four classes, which had been based on the amount of capital possessed, he divided the citizens into four classes on the basis of income. The political offices were open only to the members of the first three classes; the treasury and the archons were reserved for the first. The fourth class had simply the right to take part in the assembly (Ἐκκλησία) and the public law courts. But the gaining of this privilege was a most important step in the direction of democracy, for before the popular courts every magistrate might be accused when he laid down his office, and in this way the people had control over the administration. For the selection of officials Solon introduced a peculiar combination of choice and lot. The Senate (Βουλή) was composed of 400 members, 100 from each tribe. (See BOULE.) This body and the popular assembly undoubtedly received many of the rights formerly possessed by the Areopagus (q.v.), which now retained jurisdiction only in murder cases, together with general censorial power over the laws. Tradition says that after his year of office Solon bound his fellow citizens by an oath to keep the laws and withdrew from Athens for a period of 10 years. Although many details are obscure and disputed, it is undoubted that Solon emancipated the individual and took the first decisive step towards complete democracy, despite the fact that after his year of office internal disorder broke out, and Solon lived to see a tyranny established at Athens by one of his own kinsmen. See PISISTRATUS.

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SOLOTHURN, zō′lō-tụrn (Fr. *Soleure*). A canton of Switzerland (Map: Switzerland, B 1). It is traversed lengthwise by the main ridge of the Jura, reaching a maximum height of 4754 feet. The northwestern part is covered by the minor Jura ridges and parallel mountain valleys, while along the southeastern boundary extends the valley of the Aar. The climate is somewhat severe. Almost the entire area is utilized for grain and stock raising, and the output of cereals is above the domestic demand. Fruit, dairy products, wood, marble, gypsum, and building stone are exported. The chief manufactured article is matches. The constitution of the canton dates from 1875, and, as amended in 1895, provides for a legislative assembly elected for four years at the rate of one member for every 800 inhabitants. The five members of the Executive Council are also elected by the people for the same period. The canton returns six members to the National Council. Capital, Solothurn. Pop., 1910, 116,728, of whom Roman Catholics form over three-fourths. German is the predominating language. The history of the canton centres chiefly around its capital, Solothurn, which dates from pre-Roman times, and which in 1218 became a free Imperial city. The burghers were associated with Bern in the struggles against the petty princes of the region. Solothurn was formally admitted into the Swiss Confederation in 1481, by which time it had extended its rule over the region now constituting the canton. The aristocratic régime which had long existed in the canton ended in 1830.

SOLOTHURN. The capital of the Canton of Solothurn, Switzerland, on the Aar, about 20 miles north-northeast of Bern (Map: Switzerland, B 1). It is a walled city with broad streets and numerous churches. The cathedral of Saint-Ours (the cathedral church of the bishopric of Basel) is a cruciform structure of the eighteenth century, built on the site of an old church dating from 1050. Other interesting architectural structures are the ancient clock tower and the cloth hall with its collection of weapons. The town library contains about 40,000 volumes. There is a natural-history museum with valuable zoölogical and paleontological collections. The environs of the town are exceedingly picturesque and abound in villas and resorts. The chief industries are watchmaking and stone quarrying. Pop., 1900, 10,100; 1910, 10,465.

SOLOVIOV, sŏ'lô-vyof', SERGEI MIKHAILOVITCH (1820–79). An eminent Russian historian, born and educated at Moscow. From 1842 to 1844 he was abroad as tutor in Count Stroganov's family, attending the lectures of Ranke, Böckh, and Michelet. His treatise on *The Relations between Novgorod and the Grand Princes* (1845) and his dissertation, *History of the Relations among the Russian Princes of the House of Rurik* (1847), established his reputation and brought him a professorship in history at Moscow University. Subsequently he was dean of the Historico-Philological Faculty and rector of the university. His *History of Russia* in 29 volumes (7th ed., 1879), the first thorough treatment of the subject from the earliest period to 1774, is a rich storehouse of historical material drawn upon by all subsequent writers to this day. He wrote also a number of historical textbooks, including *Historical Letters* (1858), *History of the Fall of Poland* (1863), and *Political and Diplomatic History of Alexander I* (1877). With Kostomarov (q.v.) and others, he adopted the organic view of history.

SOLSTICE, sŏl'stĭs (Lat. *solstitium*, from *sol*, sun + *sistere*, to stand). That point in the ecliptic (q.v.) at which the sun attains its greatest north or south declination, and where it is consequently at the turning point of its apparent course. There are two such points in the ecliptic, one of which is the summer, and the other the winter, solstice to those who inhabit northern latitudes. The term is also employed to signify the dates at which the sun attains these two points, viz., June 21 and December 21.

SOLUBLE GLASS. See WATER GLASS.

SOLU'TION (Lat. *solvere*, to dissolve). In chemistry, a term applicable to any mixture that can be formed by the interdiffusion of two or more substances, gaseous, liquid, or solid. A mixture so formed is invariably homogeneous, i.e., its ingredients do not exist alongside of one another in separate masses, and therefore cannot be distinguished separately even by means of a powerful microscope. For the distinction between a homogeneous mixture and a chemical compound, see the article CHEMISTRY.

Gaseous Mixtures. The formation of these is not limited to any particular set of substances, as is the case with liquids and solids; all gases are capable of mutual interpenetration by diffusion and hence of forming homogeneous mixtures. In a gaseous mixture (unless it be under extraordinarily great pressure) the properties of each ingredient are but slightly affected by the presence of the other ingredients.

Liquid Solutions. These may be formed by liquids with gases, by liquids with other liquids, and by liquids with solids.

The mass of any gas absorbed by any liquid is proportional to the pressure of the gas (Henry's law) and diminishes with increasing temperature. Of course, even under the same conditions of pressure and temperature the solubility of different gases in some liquid is not the same; thus carbonic acid gas is much more soluble in water than oxygen. The solubility in the case of each system consisting of a gas and a liquid is termed by Bunsen the "coefficient of absorption." To understand clearly the meaning of this term imagine some gas in contact with a given liquid and maintained at some temperature t, under a pressure equal to the normal pressure of the atmosphere; imagine that when no more of the gas is being absorbed, all the gas contained in one cubic centimeter of the solution is driven out of it, confined separately, and cooled off to 0° C. (32° F.); the volume that the gas will then occupy is its coefficient of absorption with respect to the given liquid at the temperature t. Gases that are very soluble fail to obey Henry's law, possibly because they enter, to a greater or less extent, into chemical combination with the solvent liquid; for the reliability of the law itself has been clearly demonstrated by theoretical considerations of indubitable reliability. (See HENRY.) However, it must be borne in mind that theoretically Henry's law can only be expected to hold true as long as the amount of gas absorbed by the solvent is very small.

Dilute solutions of gases in liquids obey the laws of osmotic pressure as well as do dilute solutions in general. See further below.

Passing to solution of liquids in liquids, we find, first, that some liquids (e.g., water and alcohol) are miscible in all proportions, that the mutual solubility of others (e.g., water and ether) is limited, and that still others are practically insoluble in each other. There are strong reasons for assuming that the third of these classes is really identical with the second; only the amounts dissolved are so small that they cannot be detected by the analytical means at our disposal. One of the most important properties of solutions of liquids in liquids is their vapor pressure, which plays an important part in processes of fractional distillation. (See DISTILLATION.) When two liquids, A and B, are mixed, the vapor pressure of either undergoes a diminution: *A* in the solution is less volatile than in the free state, and so is *B*. The vapor pressure of each in the solution is termed its "partial vapor pressure," and the total vapor pressure of the solution is equal to the sum of the diminished, partial vapor pressure of its ingredients. If *A* and *B* are mutually soluble to a limited extent, two solutions may be formed (viz., *A* in *B* and *B* in *A*), of which the partial as well as the total vapor pressures are respectively equal. Take, for instance, water and ether; if shaken up in sufficient relative quantities and then allowed to stand undisturbed, they will form two distinct liquid layers, the upper a saturated solution of water in ether, the lower a saturated solution of ether in water; the partial vapor pressure of the water in the upper equals the partial vapor pressure of the water in the lower solution; the partial vapor pressure of the ether in the upper equals the partial vapor pressure of the ether in the lower solution; and hence, the total vapor pressure of the upper solution equals the total vapor pressure of the lower. Analogous relations are found in all cases examined.

The solubility of solids in liquids is invariably limited. As a rule it increases with the temperature, but cases are known (e.g., that of anhydrous sodium sulphate, with respect to water) in which an elevation of temperature causes a decrease in solubility. A fact important to remember is that if a solid is capable of existing in two or more different modifications (e.g., in different allotropic forms, or say in an anhydrous form and one or more forms containing water of crystallization, etc.), each modification has its own solubility, and a solution exactly saturated with the more soluble modification is more or less "supersaturated" with the less soluble one. Bearing in mind that the supersaturation of a solution is destroyed, with rapid separation of the excess of dissolved substance, when a trace of the latter is introduced into the solution, the following experiment may serve to illustrate the point under consideration: Let ordinary Glauber's salt, i.e., sodium sulphate containing 10 molecules of water of crystallization ($Na_2SO_4.10H_2O$), be heated to boiling with about one-half its weight of water, in a flask whose mouth is loosely closed with a plug of cotton (to keep out particles of Glauber's salt that may be floating in the air). If the solution thus obtained be cooled to $-10°$ C., a sodium sulphate containing seven molecules of water of crystallization ($Na_2SO_4.7H_2O$) will separate out, and when the separation is complete the mother liquor will be exactly saturated with respect to this salt. Now, $Na_2SO_4.7H_2O$ has a greater solubility than $Na_2SO_4.10H_2O$. Hence, the saturated mother liquor of $Na_2SO_4.7H_2O$ must evidently be supersaturated with respect to $Na_2SO_4.10H_2O$. As a matter of fact, if a trace of the latter be now introduced into our mother liquor, a new crystallization will set in, a mass of $Na_2SO_4.10H_2O$ separating out and leaving the solution exactly saturated, this time with respect to this latter form of the salt. Such, as well as a host of other phenomena, complicate exceedingly the problem of discovering a precise relationship between the solubility of substances in various solvents and their nature.

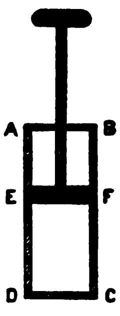
Solid Solutions. The existence of solutions in the solid state has only been recognized within recent years. It was mentioned in the article on diffusion (q.v.) that cases of diffusion have been actually observed in solids. But there is also an increasing number of indirect proofs that many homogeneous solid mixtures are true solutions, i.e., might be formed by the interdiffusion of their ingredients, although actually such a process would of course be very slow. Isomorphous crystalline mixtures, while homogeneous, may not be solutions at all; for it is possible that in them free diffusion cannot take place, the molecules of either of the ingredients being controlled by the forces that determine the crystalline form of the whole; but this is not certain. Among solid solutions containing fluids may be mentioned the well-known case of metallic palladium and hydrogen gas. The two were formerly supposed to combine chemically, forming the compound Pd_2H. But the composition of this substance has now been shown to vary with the temperature. Hence it cannot be considered as a chemical compound. See CHEMISTRY; ISOMORPHISM.

Osmotic Pressure. It may be seen from the above that a theory of solutions, in the full sense of the term, does not yet exist. Some of the most important questions with regard to solutions remain unanswered, and the known facts are mostly uncorrelated; in brief, the subject is largely not yet rationalized.

In one of its phases, however, the subject of solutions has, within recent years, received a development which must be counted among the most brilliant scientific achievements of our time. The achievement in question is based on the most characteristic property of solutions, viz., the capacity of the "solute" (i.e., the dissolved substance) to diffuse within the solution until the concentration of the latter is the same at all its points. Let an aqueous solution of sugar, for instance, be placed at the bottom of a vessel, and let some pure water be introduced over it, cautiously, so as not to disturb the solution; the result will be that the sugar will gradually diffuse upward, and after a certain length of time the liquid will have a perfectly uniform composition throughout. Now, to cause this motion of the sugar upward, against gravity, there must obviously be some force. An analogous case that readily suggests itself to the mind is that of gases. A gas, too, will flow upward, and, like a substance in solution, will distribute itself evenly within an available volume. Of course, when a gas is evenly distributed within a vessel, it still exercises pressure on the walls, while in the case of a substance in solution, once diffusion is over, there would seem to be no evidence of the existence of a pressure. Yet there, too, a pressure must exist; for let a new volume of pure water be placed over our diluted solution of sugar, and diffusion upward against gravity, as well as in all other directions from points of higher to points of lower concentration, will recommence.

All this suggests that, in general, the properties of matter in a highly dilute state (i.e., when a small mass occupies a large volume) may be the same whether the dilute state is that of a gas or that of a substance in solution. For in either of those states matter possesses the most important characteristic of gases, viz., the capacity for expanding indefinitely. The problem therefore arises, to ascertain whether the laws of the interrelation of pressure, volume, and temperature of substances in solution are not similar to, or identical with, the corresponding laws of gases—a problem that can be solved only by experimental inquiry. The volume and temperature are evidently those of the solution and can be easily measured. So the solution of the problem depends on a method for measuring the pressure of the solute. To measure this directly, it is necessary to employ an apparatus by means of which it would be possible to exert pressure upon the solute without at the same time exerting pressure upon the solvent. Such an apparatus would show the resistance offered by the solute alone and would thus furnish a measure of its pressure. Let, for instance, an aqueous solution of sugar be placed in a cylindrical vessel with a tight-fitting piston just touching the solution. If the piston is made of a solid impermeable material, then external pressure upon it will be resisted by the solution as a whole, most of the resistance being of course offered by the water (which is highly incompressible). If, on the other hand, the piston is made of some permeable filtering material, then external pressure upon it will scarcely be resisted at all, the solution as a whole passing through it. Evidently, to answer our purpose, the piston must be made of a semipermeable material, through which the water, but not the sugar dissolved in it, could pass freely. By means of such a piston alone could we compress the sugar without compressing the water and thus ascertain the resisting pressure of sugar within the volume of the solution, as we might ascertain the pressure of a gas within an ordinary vessel.

The best artificial semipermeable material thus far discovered, especially well adapted for separating water from dissolved sugar, is a membrane of ferrocyanide of copper, formed by the action of potassium ferrocyanide upon copper sulphate. Pfeffer, who was the first to employ this substance for measuring the pressure of substances in solution, proceeded as follows: He filled a porous clay cylinder with a solution of copper sulphate and immersed it in a solution of potassium ferrocyanide; the two solutions, penetrating into the clay from the opposite sides, yielded a precipitate of copper ferrocyanide where they met within the walls of the cylinder, the walls serving to impart to the precipitated membrane considerable mechanical resistance. In recent years H. N. Morse has greatly improved the preparation of such osmotic cells and has carried out with them a large number of measurements of unexcelled precision. To return to Pfeffer's experiment: the osmotic cell was filled with a solution of sugar, its upper end was tightly closed with a lid bearing an ordinary mercury manometer, and the apparatus was placed in pure water so that the level of the latter was precisely the same as that of the solution within. To understand the phenomenon that followed, imagine a cylindrical vessel *ABCD* in which, say, air has been compressed within the volume *EFCD*, while the space *ABFE* is empty; if we relieve the piston *EF*, it will be driven up by the expansive power of the air until it is stopped by *AB* or by some other resistance; if, instead, we hold up the cylinder in the air by the handle, the expansive power of the compressed air will cause the entire volume *ABCD* to move over, the result being, again, a larger space occupied by the air. Precisely analogous phenomena would be observed if *EFCD* were filled with a solution of sugar and *ABFE* were pure water, while *EF* were a semipermeable membrane: Either the piston would move upward or the entire liquid volume (pure water plus solution) would move in the direction of the dissolved sugar; in either case the cause would be the expansive power of the sugar and the result an increase of the volume occupied by it, i.e., an addition of pure water to the solution. As a matter of fact, in Pfeffer's apparatus, the semipermeable walls being fixed, the expansive power of the dissolved sugar caused pure water to enter the clay cylinder. The increasing amount of liquid naturally caused an increasing compression of the air within the cylinder, and finally a point was reached when the expansive power of the sugar was no longer capable of overcoming the resistance of the air, the latter having grown precisely equal to it. Then equilibrium ensued, the mercury manometer showing the pressure of the air within the cylinder, and hence the equal of that pressure—the "osmotic pressure" of the sugar in solution. Similar experiments showed: (1) that the osmotic pressure of sugar and other substances in dilute solutions is proportional to the concentration, i.e., inversely proportional to the volume of the solution; (2) that the osmotic pressure of sugar and other substances in dilute solution is proportional to the absolute temperature (i.e., the centigrade temperature plus 273 degrees); (3) that the osmotic pressure of substances in dilute solution is equal to the pressure that the solute would exert if removed from the solution, vaporized, and inclosed within an empty volume equal to that of the solution, at a temperature equal to that of the solution. In brief, the laws of gases, viz., the law of Boyle and Mariotte, the law of Charles and Gay-Lussac, and Avogadro's rule, hold good in the case of dilute solutions as they do in the case of gases. It has been shown, besides, that the osmotic pressure of all very dilute solutions is the same no matter what the solvent.



The importance of these results will be evident to those who realize that the science of chemistry is based on the laws of the gaseous state, Avogadro's rule, which embodies those laws, being the only sure guide in finding those comparable units of compounds—their molecular weights. (See CHEMISTRY; MOLECULES—MOLECULAR WEIGHTS; AVOGADRO'S RULE; ATOMIC WEIGHTS; GASES, GENERAL PROPERTIES OF; ETC.) Yet a majority of compounds are nonvolatile, and therefore our theoretical knowledge of them remained uncertain, and in many cases vague, until the above results proved that what we can learn of a substance by studying it in the gaseous state we can learn with equal certainty by studying it in dilute solution. Very few indeed are the substances that are neither volatile nor soluble in any liquid.

Direct methods for measuring osmotic pressure, like the one described above, have been of importance only in demonstrating the fundamental laws; the experimental difficulties involved render their use for determinations of molecular weights practically impossible. But, on the other hand, it has been shown that the depression of the freezing point or the elevation of the boiling point caused by dissolving a substance in a given liquid is proportional to the osmotic pressure in the solution; and so, molecular weights are now generally determined by observing the freezing points or the boiling points of solutions. (See Molecules—Molecular Weights; Freezing Point; Boiling Point.) At first, experimental research seemed to show that compounds of three important classes, viz., acids, bases, and salts, do not obey the laws of osmotic pressure; their osmotic pressure was found to be much higher than it should be theoretically. But Arrhenius' theory of electrolytic dissociation (see Dissociation) soon came to add itself to the theory of osmotic pressure, and, instead of disproving it, only furnished further proof of its correctness, just as the phenomena of chemical dissociation, when correctly understood, had once furnished additional proof of the reliability of Avogadro's rule (q.v.) for gases.

History. The history of our subject commences perhaps with Graham's researches on the diffusion of substances in solution, dating back to 1851. Ten years later Graham investigated the well-known method of dialysis, based on the fact that many animal and vegetable membranes are permeable to water and the so-called "crystalloids," but impermeable to "colloids" (q.v.). In 1867 Traube discovered that copper ferrocyanide is permeable to water, but impermeable to sugar, and more or less impermeable to many other substances. Ten years later Pfeffer published the researches mentioned above (*Osmotische Untersuchungen*, Leipzig, 1877). Finally, in 1886, on the basis principally of the experimental researches of Pfeffer, De Vries, and Raoult, Van't Hoff worked out the theory of dilute solutions, which has extended the domain of rational chemistry as few general ideas had done before. The principal names connected with the further development of the theory are those of Nernst, Ostwald, and Arrhenius. In America Arthur A. Noyes has made a number of original contributions of recognized value. For an account of the physiological importance of osmotic phenomena, see Osmosis.

SOLUTION OF CHLORINATED SODA. See Labarraque's Solution.

SOLU′TREAN EPOCH. See Paleolithic Period.

SOL′VAY. A village in Onondaga Co., N. Y., adjoining Syracuse on the west, and on the Delaware, Lackawanna, and Western and the New York Central and Hudson River railroads, and the State Barge Canal. Chemicals, pottery, and iron are manufactured. The village has a Carnegie library and a fine high-school building. Pop., 1900, 3672; 1910, 5139.

SOLVAY, sŏl′vȧ, Ernest (1838-). A Belgian manufacturing chemist, known as the Carnegie of Belgium. His great achievement was the development of the ammonia process for the manufacture of soda (q.v.) and its establishment on a commercial basis. His first plant was erected in Couillet, Belgium, in 1863, the process being continually improved until 1872, when patents covering it in its present form were granted him. He then established plants in all parts of the world and by 1880 was manufacturing half, and by 1913 practically all, of the world's supply of soda. He became interested in social democracy, founding the Solvay Institute in Brussels for its advancement, and was active in varied philanthropic work. On his seventy-fifth birthday he made gifts of $100,000 each to the universities of Paris and Nancy, and divided $1,000,000 among Belgian educational and charitable institutions and the employees of his company. He was made Grand Officer of the Order of Leopold by King Albert of Belgium, received the Lavoisier medal of the Institute of France and a grand medal from the University of Paris, and was elected president of the Belgian Academy of Letters. During the Great War he was active in relieving distress among the Belgians, although much of his fortune was taken from him during the German occupation of his country.

SOL′WAY FIRTH. An arm of the Irish Sea, separating Cumberland, England, from Scotland, and forming in its upper part the estuaries of the Esk and Eden (Map: Scotland, E 5). Its length is 33 miles and its width increases gradually, although irregularly, to upward of 20 miles. Its spring tides, which rush in as a bore from three to six feet high, advance at the rate of eight to ten miles an hour.

SOL′YMAN (or **SULEIMAN**) **II** (c.1495-1566). Sultan of the Turkish Empire, surnamed The Magnificent. In September, 1520, he succeeded his father, Selim I (q.v.). He overthrew the rebellious Governor of Syria, repressed the Egyptian Mamelukes, and concluded a treaty with Persia. In 1521 he took Belgrade, the key to Hungary. He next drove the Knights of St. John from Rhodes (1522). Afterward he devoted himself to improvements in administration and to preparations for an onslaught upon Hungary (q.v.). On Aug. 29, 1526, he overwhelmed the army of King Louis II at Mohács. In 1529 he was summoned to Hungary to aid his protégé, John Zápolya, Waywode of Transylvania, then contesting the crown with Ferdinand, brother of the Emperor Charles V. He laid siege to Vienna, but after a number of unsuccessful assaults retreated. In 1532 he laid Styria waste and again advanced to the neighborhood of Vienna, but was baffled by the resistance of the Hungarian fortress of Güns, and the advance of the Imperial army under Charles V forced him back. Soon after this the Sultan waged a successful war against Persia. In 1535 Solyman concluded with Francis I the famous treaty which opened the commerce of the Levant to the French flag alone. By 1541 the Turks were in permanent possession of the heart of Hungary. In 1542 the combined French and Turkish fleets ravaged the Italian coasts and pillaged Nice. The Turks were now supreme in the Mediterranean; in 1551 Tripoli fell into their hands. A second and third war with Persia, now in a state of semisubjugation, a brilliant naval victory (1561) over the Knights of Malta and their allies, the Spaniards, an unsuccessful siege of Malta (1565), and a fresh expedition to Hungary (1566), were the chief events of the remainder of his reign. Solyman encouraged literature, and did much for the improvement of the laws as well as for the military organization of the state. See Turkey.

SOMA (Skt., from *su*, to press). An Oriental plant identified, but not certainly, with the *Sarcostemma acidum*. It was at first deified in India on account of the intoxicating nature of its juice, and was then identified with the moon. The plant is plucked up by moonlight in the mountains and is crushed between two stones. It is then filtered through cloth and is allowed to ferment; and being thickened with meal and sweetened, it is drunk by the priests after being offered to the gods. At the present day only the priests may drink of it. The Vedic hymns (see Veda) are chiefly concerned with the Soma cult. The deification of the plant had already begun before the separation of the Indo-Iranians. In the Persian cult, *haoma*, the Iranian equivalent of the Indian *soma*, is a god, but also the tree of life. It is probable that the name has been applied to different plants even in India. Consult: Sir William Muir, *Original Sanskrit Texts*, vol. ii (London, 1871); W. Caland and V. Henry, *L'Agniṣṭoma, description complète de la forme normale du sacrifice de soma dans le culte védique* (2 vols., Paris, 1906–07); E. W. Hopkins, *Religions of India* (Boston, 1895); A. A. Macdonell, *Vedic Mythology* (Strassburg, 1897); L. D. Barnett, *Antiquities of India* (London, 1913).

SOMADEVA, sō'mȧ-dā'vȧ (eleventh century A.D.). A Sanskrit author. Of his life nothing is known, except that he was probably a native of Kashmir. He composed but one work, the *Kathāsaritsāgara*, or "Ocean of Streams of Stories," which he began about 1070. This is the longest and most important collection of stories which has been preserved in Sanskrit. It contains 22,000 *çlokas*, and is divided into 124 chapters, called *tarangas*, or "waves." These fairy tales are told in the main for their intrinsic interest, not to point a moral. Although in the main Brahmanistic in spirit, Buddhistic influence is frequently apparent. The *Kathāsaritsāgara* was edited and translated into German by Brockhaus (3 vols., Leipzig, 1839–66), edited by Durgaprasad and Parab (Bombay, 1889), and translated into English by Tawney (2 vols., Calcutta, 1880–87). Selected stories have been translated into German by J. Hertel in *Bunte Geschichten vom Himalaya* (Munich, 1903), and into Italian by E. Bartoli, *Devasmitâ, novella indiana* (Bari, 1908). Consult J. Speyer, *Studies about the Kathāsaritsāgara* (Amsterdam, 1908).

SOMALI, sô-mä'lė̇. A Hamitic or Ethiopian people in the extreme east of Africa, partly in Italian, partly in British territory. They are tall (1.725 m.), dark skinned, and dolichocephalic. The infusion of negro and later of Semitic blood causes much variation in color. Their activities are the raising of grains, coffee, and spices, camel breeding, and coastwise industries. The clothing of the men is a toga-like robe of cotton. They are neither mechanical nor artistic; always at strife, they pride themselves on their weapons, of African pattern—lances, edged weapons, and rawhide shields. Their social organization is patriarchal, clans and chieftains being numerous. Their religion is fanatical Mohammedanism.

SOMALI COAST. See SOMALILAND.

SOMALILAND, sô-mä'lė̇-lănd. A country forming the eastern peninsula of Africa, lying between Eritrea (Italian) and British East Africa, and consisting of territories under the jurisdiction of France, Great Britain, Italy, and Abyssinia (Map: Africa, J 4). Abyssinian Somaliland extends inland from the borders of the other three territories; its extent is not clearly defined, and its population not definitely known.

French Somali Coast. A French colony on the Strait of Bab el Mandeb and the Gulf of Aden. It extends from Eritrea on the north to British Somaliland on the southeast, and with its dependencies is bounded on the west and south by Abyssinian territory. The total area is variously estimated at from 5800 to 46,000 square miles. The population was estimated in 1911 at 213,000. The coast is generally hilly, and the interior for the most part a plateau with elevation of about 4000 feet. The country is almost without industries. Its trade is of some importance, but to a considerable extent is transit. Imports and exports (general trade) were valued at 7,114,000 and 3,468,000 francs respectively in 1900; in 1913, 33,917,000 and 47,704,000. Among the imports are cotton goods, foodstuffs, tobacco, and ironware. The important exports include coffee, hides and skins, ivory, and gold. Imports in 1913 valued at 7,832,000 francs came from France, and exports amounting to 3,561,000 francs were sent to that country. The ports are in communication with Aden by local boats, and French and British vessels call regularly. In the overseas trade in 1912 there were entered 247 vessels, of 737,748 tons, and cleared 246, of 734,988 tons. The chief port is Jibuti, from which a railway extends into Abyssinia; the line is being extended, with Addis Abeba as the objective; 81 miles are in French territory.

The country has been administered since 1899 by a governor and by a general council of six members, three chosen from government officials and three from leading residents. In 1912 the local budget balanced at 1,585,000 francs; expenditure of France (1914 budget), 667,500 francs. The natives belong to the Danakil and Galla races. The principal towns are Jibuti, the capital (pop., 16,535 in 1912), Obok, Tajurah, Ambado, Gobad, and Sagallo.

Obok has been in the possession of the French since 1862. In 1884 they began active operations in this region. They acquired Sagallo and Tâjurah in 1884; and Ambado in 1885. In 1888 a port was created at Jibuti. In 1887 and 1891 the boundaries of the country were definitely fixed with England and with Italy, and in 1896 with Abyssinia on the west. Consult André Bacquart, *Une colonie de commerce française* (Paris, 1907).

SOMALILAND PROTECTORATE. A British protectorate on the Gulf of Aden, extending eastward from the French Somali coast and bounded inland by Abyssinian and Italian territory. The area is about 68,000 square miles. The country is a sandy steppe having few undulations, though surmounted here and there by granite and basaltic mountains from 4500 to 6800 feet in height. The climate at the coast is rather unhealthful for Europeans. The natives are almost entirely nomadic, except in the coastal towns, and graze their flocks and herds over considerable areas in the wet season; in the dry season they remain near the wells. All transport is by pack animals, chiefly camels and donkeys. The wealth of the people consists in live stock. Exports are largely hides and skins, cattle and sheep, gums, ostrich feathers, salt, ivory, and gold. The principal imports are rice, dates, cotton piece goods and shirtings, sugar, and ironware. The chief ports are Zeila, Bulhar, and Berbera. Imports and exports were valued at £290,567 and £221,256 respectively in 1906–07; in 1913–14, £238,218 and £216,596. Revenue in 1913–14 was £29,646, and expenditures £68,646. The estimated number of inhabitants, who are practically all Mohammedan, was 359,819 at the end of 1913. The 1911 census returned 344,323. Berbera, the chief town and capital, has upwards of 30,000 inhabitants in the trading season; Bulhar about 7300; Zeila about 7000. The protectorate, established in 1884, is administered by a commissioner, with British officials at the coast towns. Consult

H. G. C. Swayne, *Seventeen Trips through Somaliland* (2d ed., London, 1900), and R. E. Drake-Brockman, *British Somaliland* (ib., 1912).

Italian Somaliland. A colony and protected territories of Italy, extending along the coast from British Somaliland on the north to the Juba River, British and Abyssinian territory lying to the west. The country comprises northern Somaliland (consisting of protectorates) and southern Somaliland (the colony). The area of the former is stated at 189,000 square kilometers; of the latter, at 168,000 square kilometers; total, 357,000 (137,838 square miles). Northern Somaliland comprises the Sultanate of the Mijertius (capital, Bereda), the Sultanate of Obbia (capital, Obbia), and the territory of the Nogal (capital, Illig). The colony, formerly called Benadir, is divided into four districts: Mogadiscio, Giumbo, Lugh, and Mahadei Uen. The surface of the country, resembling in general that of British Somaliland, is flat along the coast and elevated in the interior. The country is largely arid, having scarcely any forested areas and few streams; the Schebehli, the largest stream, fails to reach the sea. The climate is fairly favorable. The interior of the country is not fully explored, owing in part to the stubborn hostility of the natives. The natives are chiefly nomadic graziers. The leading imports include cotton goods, rice, sugar, petroleum, and lumber. The chief export is hides and skins; other exports of some note are butter, gums, cotton, and live stock. Imports and exports (special trade) were valued at 4,239,000 and 1,691,000 lire in 1909–10; in 1912–13, 6,088,000 and 2,063,000. The transit trade is small. There is no railway. The principal ports are Mogadiscio and Obbia. The population is estimated at about 365,000. The country is administered by a governor. The 1913–14 budget showed estimated revenue of 6,031,000 lire (including 3,629,000 lire state grant) and expenditure 5,771,000 lire. The southern part of the protectorate was acquired by Italy in 1889, when the Sultan of Obbia placed the territory from 2° 30′ to 5° 33′ north under Italian protection. In the same year the protectorate was extended farther north, and in 1892 the cession of territory by the Sultan of Zanzibar increased the country to its present proportions.

SOMASCHIANS, sô-măs′kĭ-*a*nz. A Roman Catholic congregation of priests founded by St. Jerome Emiliani (1491–1537). The motherhouse was at Somasco, Italy. The order was confirmed by Paul III in 1540; after it had been for a short time united with the Theatines, Pius V enrolled it among the religious orders in 1568, assigning it the rule of St. Augustine. From 1616 to 1647 the French *Doctrinaires* (see DOCTRINE, FATHERS OF CHRISTIAN) were united with them. Now it has only 16 houses, all but one in Italy. Consult Heimbucher, *Die Orden und Congregationen der katholischen Kirche* (Paderborn, 1897).

SO′MATOL′OGY (from Gk. σῶμα, *sōma*, body, + -λογία, *-logia*, account, from λέγειν, *legein*, to say). That division of anthropology which treats of the anatomy and physiology of mankind, especially by a comparative survey of different races from this point of view. See ANTHROPOMETRY; INDEX.

SOMBART, zŏm′bärt, WERNER (1863–). A German political economist, born at Ermsleben am Harz. He studied law and political economy at the universities of Pisa and Berlin, was syndic of the Bremen Chamber of Commerce in 1888–90, and served as professor of political economy at Breslau from 1890 to 1906, when he became professor at the Handelshochschule of Berlin. His publications include: *Die römische Campagna* (1888); *Sozialismus und soziale Bewegung im 19. Jahrhundert* (1896), which passed through more than 40 German editions and was translated into more than 20 foreign languages, with an English translation by A. P. Atterbury as *Socialism and the Social Movement in the Nineteenth Century* (1898); *Der moderne Kapitalismus* (2 vols., 1902); *Die deutsche Volkwirtschaft im 19. Jahrhundert* (1903); *Gewerbewesen* (2 parts, 1904); *Die gewerbliche Arbeiterfrage* (1904); *Das Proletariat* (1906); *Warum gibt es in den Vereinigten Staaten keinen Sozialismus?* (1906); *Kunstgewerbe und Kultur* (1908); *Das Lebenswerk von Karl Marx* (1909); *Die Juden und das Wirtschaftsleben* (1911; Eng. trans. by M. Epstein as *The Jews and Modern Capitalism*, 1913); *Die Zukunft der Juden* (1912); *Der Bourgeois* (1913); *Krieg und Kapitalismus* (1913); *Luxus und Kapitalismus* (1913). In 1915 appeared *The Quintessence of Capitalism*, a translation by Epstein.

SOMBRERETE, sôm′brâ-rā′tâ. A town in the State of Zacatecas, Mexico, 85 miles northwest of Zacatecas, in a mountainous district celebrated for its rich silver mines, from which Sombrerete derives all its importance (Map: Mexico, G 6). Pop., 1900, 10,082.

SOMERS, sŭm′ẽrz, or **SUMMERS**, SIR GEORGE (1554–1610). An English mariner, born at or near Lyme Regis, Dorsetshire. He was an active promoter of the London company formed to colonize Virginia, and in 1609 he sailed for America in command of a small fleet. His squadron was scattered by a hurricane and Somers's vessel was wrecked on the Bermuda Islands, which Somers took possession of in the name of England. He died there while on a second visit. One of the many contemporary versions of his shipwreck is said to have given Shakespeare the setting for *The Tempest*.

SOMERS, JOHN, LORD (1651–1716). An English lawyer and statesman, born in Worcester and educated in private schools and at Trinity College, Oxford. He was called to the bar in 1676, distinguished himself in the trial of the seven bishops, became leader in the negotiations of the discontented nobles with William III, and was an important member of the first Parliament after the revolution of 1688–89. The Bill of Rights was drafted by a committee of which he was chairman, and its chief defense in Parliament was intrusted to him. He was Solicitor-General in 1689, Attorney-General in 1692, and Lord Keeper in 1693, and became Speaker of the House of Lords a few months later. In 1697 he was appointed Lord Chancellor of England, and raised to the peerage. He was removed from the chancellorship in 1700, impeachment proceedings being begun against him, which, however, were soon dropped. Consult Henry Maddock, *An Account of the Life and Writings of Lord Chancellor Somers* (London, 1812).

SOMERSET, sŭm′ẽr-sĕt. A city and the county seat of Pulaski Co., Ky., 79 miles south of Lexington, on the Cincinnati, New Orleans, and Texas Pacific Railroad (Map: Kentucky, F 5). It has large railroad shops, a knitting mill, and manufactories of spokes, staves, and lumber. The city has a Carnegie library. Pop., 1900, 3384; 1910, 4491.

SOMERSET, sŭm′ẽr-sĕt. A town in Bristol Co., Mass., 5 miles north of Fall River, on the New York, New Haven, and Hartford Railroad and on the Taunton River (Map: Massachusetts, E 5). It contains the Hood Library. Stoves are the leading manufactured articles. Pop., 1900, 2241; 1910, 2798; 1915 (State census), 3377.

SOMERSET, Earl of. See Carr, Robert.

SOMERSET, Edward. See Worcester, Marquis of.

SOMERSET, Edward Seymour, Duke of (c.1506–52). See Seymour.

SOMERSET, Fitzroy James Henry, Lord; first Baron Raglan. See Raglan.

SOMERSET, Lady Henry (Isabel) (1850–). A British social reformer. The eldest daughter of the third Earl Somers, she married Lord Henry Somerset in 1873. Soon afterward she became interested in temperance reform, in behalf of which she addressed large audiences, both in England and in America. She founded in 1895 the industrial farm colony for inebriate women at Duxhurst, Surrey, the first institution of its kind in England. She also established and conducted for 15 years a home for training workhouse children, and a home for children from the National Society for the Prevention of Cruelty to Children. She was elected president of the National British Women's Temperance Association and of the World's Women's Temperance Union. She established and edited the *Woman's Signal*, a journal devoted to women's work, and published several books and pamphlets on social reform.

SOMERSETSHIRE, -shĭr. A maritime county in the southwest of England (Map: England, C 5). Area, 1615 square miles. Pop., 1901, 385,111; 1911, 407,304. The surface is diversified with lofty hills and barren moors, rich vales and marshy levels, thousands of acres of the latter being below high-water mark, depending for security on sea banks and sluices. The hills are divided into several ranges running east and west, the Mendips being conspicuous. In the west is the wild district of Exmoor (q.v.). The chief river is the Bristol Avon. The wheat and barley grown around Bridgewater are famous; grazing and dairy farming form leading branches of husbandry; and the cheese of Cheddar is noted. The hilly districts are rich in minerals, especially iron, with some lead and freestone, but are little worked. The manufactures are woolen cloth, coarse linens, lace, silk, and gloves. Capital, Taunton. British camps are numerous on the hills, and extensive remains of stone circles are visible at Stanton Drew, near Bristol. Consult *Victoria History of the County of Somerset*, edited by W. Page, vols. i–ii (London, 1906–11).

SOMERS (sŭm′ẽrz) **ISLANDS**. A group of islands in the Atlantic Ocean. See Bermuda Islands.

SOMERSWORTH, sŭm′ẽrz-wûrth. A city in Strafford Co., N. H., five miles north of Dover, on Salmon Falls River, and on the Boston and Maine Railroad (Map: New Hampshire, J 7). There are a public library and a municipally owned theatre. Somersworth is noted chiefly for the manufacture of textiles and large bleachery and dye works. Other manufactures are shoes, boxes, wooden ware, etc. Settled in 1729, Somersworth was incorporated as a town in 1754. Pop., 1900, 7023; 1910, 6704.

SOMERVILLE, sŭm′ẽr-vĭl. A city in Middlesex Co., Mass., two miles northwest of Boston, on the Mystic River, here spanned by two bridges, and on the Boston and Maine Railroad (Map: Massachusetts, E 3). It is a residential and manufacturing city, with many places of historic interest. Broadway, over which Paul Revere passed on his famous ride; Central Hill, occupied by a redoubt during the siege of Boston; the old Powder House (storehouse for the American army); Prospect Hill, said to be the scene of the first unfurling of the American flag, and the headquarters of Generals Greene and Charles Lee, are especially noteworthy. The city has a large public library, Somerville Hospital, Roman Catholic Home for the Aged, Somerville Home for the Aged, a State armory, and fine high school. Slaughtering and meat packing, cloth bleaching and dyeing, distillation of liquors, and the manufacture of metal tubing, desks, pictures and frames, are leading industries.

The government is vested in a mayor, chosen annually, and a unicameral council. The assessed valuation of real and personal property in 1914 was $74,946,894, and the net debt (Jan. 1, 1915) $1,616,000. The city spent for maintenance and operation $1,699,000, the main items being: For schools, $455,750; for streets, $124,600; for protection of person and property, $246,750; for health and sanitation, $161,200; for water works, $176,759. The water works are owned by the city. Pop., 1900, 61,643; 1910, 77,236; 1915 (State census), 86,854. Settled about 1631, Somerville was a part of Charlestown until separately incorporated in 1842. In 1871 it was chartered as a city. Within the limits of the present city a large body of Hessian prisoners were quartered in 1777–78. Consult: Samuels (editor), *Somerville, Past and Present* (Boston, 1897), and Hurd, *History of Middlesex County* (Philadelphia, 1890).

SOMERVILLE. A borough and the county seat of Somerset Co., N. J., 36 miles west by south of New York City, on the Raritan River, and on the Central Railroad of New Jersey (Map: New Jersey, C 2). It is an attractive residential place and has a public library. The principal manufactures are woolen cloth, clothing, stoves, iron pipe, etc. Pop., 1900, 4843; 1910, 5060; 1915 (State census), 6038.

SOMERVILLE, Alexander (1811–85). A Canadian journalist. He was born at Springfield, Scotland, and early entered the army. While with his regiment at Birmingham in 1832 he was charged with an act of insubordination and was sentenced to 200 lashes on the bare back. One hundred lashes were inflicted. This brutal episode was the occasion of a parliamentary discussion, with the result of lessening the harshness of British army discipline. Somerville served five years longer, resigning from the army in 1837. For 20 years (1838–58) he was a contributor to leading British journals, and then he went to Hamilton, Upper Canada, where he edited the *Canadian Illustrated News*, contributed to the *Spectator*, and wrote sketches for the Montreal *Gazette*. He published: *Autobiography of a Workman* (1849); *History of the Fiscal System* (1850); *The Whistler at the Plough* (1852), being his collected contributions to the chief British newspapers; *The Conservative Science of Nations* (1860), containing an account of his military service, with his punishment at Birmingham; *Canada a Battle Ground* (1862); *A Narrative of the Fenian Invasion of Canada in 1866* (1867).

SOMERVILLE, Edith Anna Œnone (?–). An Irish novelist, who habitually signed herself E. Œ. Somerville, and wrote in collaboration with "Martin Ross" (Violet Martin, q.v.) a series of highly entertaining stories and novels, the most popular of which, both in America and England, was *The Experiences of an Irish R. M.* (1899). Miss Somerville, educated at home at Drishane House, Skibbereen, County Cork, studied art in Paris and at the Royal Westminster School of Art in London. She had exhibitions of her pictures in Dublin and in London; and she was active as an illustrator, especially of children's picture books and of sporting picture books—she was herself a devoted sportswoman and became master of the West Carbery Foxhounds. For the books she and Miss Martin wrote together, see the article on the latter.

SOMERVILLE, Mary (1780–1872). A writer on mathematics and physical science, born at Jedburgh, Scotland. In 1804 she married Captain Greig of the Russian navy, and removed to London. Widowed after three years, she thereafter devoted herself to study. In 1812 she married her cousin, Dr. William Somerville. After presenting a successful paper on the *Magnetic Properties of the Solar Spectrum* to the Royal Society in 1826 Mrs. Somerville was invited by Lord Brougham in the following year to try to popularize for the English public Laplace's great work, the *Mécanique Céleste.* This was published as the *Celestial Mechanism of the Heavens* in 1831. *The Connection of the Physical Sciences* was published in 1834, *Physical Geography* in 1848, and *Molecular and Microscopic Science* in 1866. The Mary Somerville scholarship in mathematics for women was founded at Oxford University in her honor. An autobiography, edited and supplemented by a daughter, Martha Somerville, was published in 1873.

SOMERVILLE, William (1675–1742). An English poet of an ancient family, born at Colwich, in Staffordshire. Somerville is remembered mainly for his blank-verse poem *The Chase* (1735), which vividly depicts his favorite sport. He also wrote some good verse fables (1725, 1727), a burlesque of rural games entitled *Hobbinol* (1740), and *Field Sports* (1742). His poems with a *Life* are in the collections of Johnson and Chalmers. A collective edition of his poetical works appeared in 1801. Consult also *The Chase,* with memoir by G. Gilfillan (Edinburgh, 1859).

SOMMA, sôm'mȧ, Luigi (1834–84). An Italian pediatrist. Born and educated at Naples, he became professor of pediatrics there in 1874. Somma was the founder of pediatrics in Italy. Among his writings are: *Tratto d'igiene per gli ospizii degli esposti* (1871); *Clinica pediatrica dell' Ospizio dell' Annunziata di Napoli* (1875).

SOMME, sôm. A small river of north France, entering the English Channel through an estuary which is navigable for ocean steamers to Saint-Valery (Map: France, N., G 2). From that point a lateral canal follows the river past Amiens to Saint-Quentin, whence first-class water-ways communicate with the Oise and the Scheldt.

SOMME. A maritime department of north France (Map: France, N., H 3). Area, 2443 square miles. Pop., 1901, 537,848; 1911, 520,161. The chief river is the Somme, which traverses the department from southeast to northwest. Somme is mostly level, but in some parts is marshy. The department produces corn and garden fruits. The raising of cattle is carried on to a great extent. The chief manufactures are velvets, chemicals, woolens, cottons, linens, silk, leather, and tapestries. Capital, Amiens. The department was formed mainly out of the old Province of Picardy.

SOMNAM'BULISM (from Lat. *somnus,* sleep + *ambulare,* to walk). A state intermediate between those of sleeping and waking, characterized by the performance of various acts apparently indicative of conscious control, by absence of the usual reaction to stimuli, and usually by inability to recall on awakening the thoughts or movements which have taken place during the abnormal condition. The term is often applied in popular speech to sleep-walking, which is nothing more than the expression in action of a vivid dream; it is analogous to talking during sleep, and is similarly explained.

Two distinct types of somnambulism may be distinguished: the first, artificial somnambulism, is the third stage of hypnosis. (See Hypnotism.) In this, the final stage, the subject is almost completely anæsthetized, obeys orders by perception, and when awakened has no memory of what has elapsed during the somnambulistic period. The second type, natural or spontaneous somnambulism, is a phenomenon of hysteria (q.v.). It is characterized not only by amnesia, but also by apparently normal perceptions. In spite of innumerable variations, two main forms are evident. The first frequently shows many of the symptoms of hypnosis, such as lethargy, catalepsy, partial anæsthesia, etc. The subject is engrossed in a group of ideas which refer to some former highly emotional experience, and which in normal life are inhibited through constant repression. In the somnambulistic state these ideas find expression in various movements; the former scene is, as it were, relived. The somnambulism of Macbeth (Act V, i) will serve as an illustration. The second form includes cases in which, to all outward appearance, the subject is normal; loss of memory continues, however, and there is frequently a decided change from the emotivity of the normal life. There are various degrees, ranging from the trance of the spiritistic medium to the complete somnambulism of double or multiple personality. See Double Consciousness.

Consult: D. H. Tuke, *Sleep-Walking and Hypnotism* (London, 1884); Jules Liégois, *De la suggestion et du somnambulisme dans leur rapport avec la jurisprudence et la médecine légale* (Paris, 1888); P. M. F. Janet, *The Mental State of Hystericals* (New York, 1901), English translation by C. R. Corson; W. M. Wundt, *Lectures on Human and Animal Psychology* (3d ed., ib., 1907), English translation from second German edition by Creighton and Titchener; I. H. Coriat, *The Hysteria of Macbeth* (ib., 1912); also references under Double Consciousness and Hysteria.

SOMNATH, sŏm'năth, or Patan. A town in Gujurat, Province of Bombay, India, on the Kathiawar Peninsula, 38 miles northwest of the island of Diu, on the Arabian Sea. Its port is Verawal, 3 miles to the northwest. Of great antiquity as an important commercial centre and pilgrimage resort, the town was captured by Mahmud of Ghazni in 1025 and its celebrated temple of Siva despoiled of its vast riches. Pop., 1911, 8672.

SOM'NUS (Lat., sleep). The Latin god of sleep, son of Night and twin brother of Death, corresponding to the Greek Hypnos. His home was in the far west, from which he brought sleep to gods and men alike. In art he is variously represented, e.g., with eagle's wings, a butterfly, a poppy stalk, with a horn from which he poured out slumber.

SONATA, sô-nä'tȧ (It., from Lat. *sonare*, to sound). In music, an instrumental composition in cyclical form, originally any instrumental work as opposed to a cantata or vocal work. At first the sonata was almost identical with the suite (q.v.), but it soon abandoned the pure dance forms which the suite embodied. The violin sonata attained a somewhat perfected form before that of any of the keyed instruments. Its slow introductory first movement generally shows traces of ecclesiastical influence; the second movement, an allegro, which corresponds to the first movement of a modern sonata, was derived from vocal madrigals or part music; the third movement, which is characteristically slow, was evolved from solo vocal music, while the last movement showed elements of dance music, and was therefore a pure suite movement. Of the popular dance forms, the minuet survived the longest but was ultimately supplanted by the scherzo, while the gigue and chaconne, of which Bach left so many examples, were succeeded by the finale or rondo. The first noteworthy advance is in a set of seven sonatas for the clavier, *Frische Klavierfrüchte* (1703), by Johann Kuhnau, in which he shows a partial recognition of the relation and balance of keys. Johann Mattheson chose the gigue for the concluding movement of his sonatas, and both he and Alessandro Scarlatti did much to define and unify the sonata form. In the works of Domenico Scarlatti are found the first traces of a distinct secondary subject in the first allegro. The domain of the sonata was long monopolized by writers for the violin, and through the advances made by Locatelli, Geminani, and Tartini the sonata finally reached the four-movement type. Johann Sebastian Bach wrote many sonatas for various instruments and for combinations of instruments, but he did not aid in the direct development of the form. His son, Philipp Emanuel Bach, established the number of movements as three. Stamitz definitely established the form of the first movement by the introduction of a clearly defined second theme forming a contrast with the principal subject. He also established the principle of thematic development as against mere repetition of themes in different keys. Haydn adopts and develops further the ideas of Stamitz, and adds the minuet and rondo as essential movements of the sonata. Mozart adds grace and employs more elaborate themes and harmonies. Beethoven brought the sonata to perfection. In his greatest sonatas he attains to such a command of technical resource and emotional expression that the form seems incapable of further development. Schubert takes the form as left by his great predecessor and fills it with the contents of his individual genius. Brahms, while preserving the fundamental architectonic structure, shows that details are capable of an infinite variety of new arrangement. When occasion demands it, he does not shrink from introducing a third theme. More than any other master he proves the inherent vitality and plasticity of the form.

Sonata Form is a term applied to the form of the first movement of a sonata, symphony, or chamber-music composition. The first movement of a sonata or kindred cyclical form consists of three sections: (1) the exposition, (2) the development, (3) the repetition. The first section begins with the principal subject in the tonic key. An episode consisting of some development of the principal subject leads into the secondary subject. This appears in the key of the dominant, if the movement is in major. If the movement is in minor the secondary subject is announced in the key of the relative major. Then follows some development of the secondary subject. After this the entire exposition section is repeated literally. The second or development section is devoted to a full thematic working out of either one or both the themes announced in the previous section. In the development section episodes built upon new themes may also be introduced. The third or repetition (also recapitulation) section is a repetition of the exposition section, though, in the case of orchestral works, composers generally vary the instrumentation. In this section the secondary subject appears in the key of the tonic. A more or less extended coda, constructed either upon the material already introduced or upon new material, closes the movement. Frequently the movement is preceded by a shorter or longer introduction in slow tempo. (See INTRODUCTION.) Essentially this form has not been changed since Beethoven's time. Consult: J. S. Shedlock, *Pianoforte Sonata* (London, 1895); O. Klauwell, *Geschichte der Sonate* (Leipzig, 1899); B. Selva, *La sonate* (Paris, 1914).

SONATINA, sŏ'nȧ-tē'nȧ (It., little sonata, diminutive of *sonata*, sonata). In music, a short sonata, with two or three movements, and themes much lighter than those of the regular sonata. Sonatinas are designed especially for young players as a preparation for sonata study.

SONDERBUND, zôn'dẽr-bụnt. A league formed in the fall of 1843 by the Swiss cantons Lucerne, Fribourg, Zug, Uri, Schwyz, and Unterwalden for the protection of the interests of the Catholic church. The Canton of Valais joined the league in 1845. In 1847 the Liberal majority in the National Assembly decreed the dissolution of the Sonderbund, and this was accomplished by force of arms in the same year. See SWITZERLAND.

SONDERBURG, zôn'dẽr-bụrk. A town on the island of Alsen (q.v.).

SONDERSHAUSEN, zôn'dẽrs-hou'zen. The capital of the Principality of Schwarzburg-Sondershausen (q.v.), Germany, 33 miles northwest of Weimar, on the Wipper (Map: Germany, D 3). The Prince's castle, in a beautiful park, contains a natural-history collection and a museum of antiquities. Sondershausen was founded in 525 and passed to Schwarzburg in 1248, and since 1909 has been united in the person of its ruler with the principality of Schwarzburg-Rudolstadt. Pop., 1910, 7759.

SONE, sŏ'nȧ, ARASUKE, VISCOUNT (1849–1910). A Japanese statesman, born at Choshu. In 1872–77 he studied military science in France, but later entered the civil service. From 1881 to 1890 he was counselor of the Legislative Bureau and held other positions. He then became Secretary of the Lower House, and in 1893–97 represented Japan at Paris. He served as Minister of Justice in the third Ito cabinet in 1898, and from then until 1900 was Minister of Agriculture and Commerce in the Yamagata cabinet. In 1902 he was elected to Parliament, of which he became President. In 1909 he succeeded Prince Ito as Administrator of Korea.

SONG (AS. *song*, Ger. *Gesang*, from AS. *singan*, Ger. *singen*, to sing). A short lyric or narrative poem set to music in a way to reproduce the mood of the poem, the music also lending impassioned utterance to the words. The term "song" should properly be applied only to compositions for one or two voices with instrumental accompaniment. The art song (Kunstlied) was developed in Germany from the folk song. See Aria; Ballad; Folk Music; Lied; Meistersinger; Minnesinger; Music, History of, *XXVII;* National Hymns; Romance.

SONG BIRDS. The song birds of the world belong almost entirely to the order Oscines, which is that of the highest organization, and distinguished as a group by the possession of vocal organs of a specialized and peculiar sort. Yet all Oscines are not capable of singing, and some birds which utter melodious notes are to be found in other groups. The principal singers are to be found among the thrushes, wrens, warblers, pipits, larks, starlings, and in the great family of finches. These are largely birds of temperate climates, and the popular idea that the birds of the tropics are not singers has a basis in fact, though it is by no means true that no tropical birds utter melodious strains.

SONG CELESTIAL. See Bhagavad-Gita.

SONGEESH, sŏn-gēsh′, or **SONGISH.** A tribe of Salishan stock (q.v.) occupying a territory on the southeastern end of Vancouver Island, B. C. Their proper name is *Lkungen*, the other being a corruption of one of the subtribal names. Their general culture is that of the coast Salishan tribes. See Salishan Stock.

SONGHAY, sŏŋ-gī′, **SONRHAY,** or **SURHAY.** A Sudanese Nigritian people numbering 2,000,000, living in the bend of the Niger, below Timbuctoo, with separate speech. They are mixed at the north with Moors and at the south with Fulahs, and are Moslem.

SONGISH. See Songeesh.

SONG-KOI, sŏng′koi′. A river of Indo-China. See Red River.

SONG OF DEGREES. See Gradual Psalm.

SONG OF IGOR'S BAND. See Igor's Band, Song of.

SONG OF SOLOMON. See Canticles.

SONG SPARROW. See Sparrow.

SONG THRUSH. Any of several thrushes locally conspicuous for their song. In the United States the wood thrush (q.v.) is most often the one meant. In Great Britain it is the thrush (*Turdus musicus* or, more correctly, *philomelus*) called "mavis" provincially, and often kept caged for the sake of its melody. It is a permanent resident of all temperate Europe, and in its ground hunting and hardy habits resembles its congener, the American robin; its nesting habits are similar, though it uses less mud and its blue eggs are spotted with brown. The adult male is dark brown above, tinted with golden brown; throat buff; underparts yellowish white, closely spotted with brown. It is a pleasing songster, and especially a favorite in Scotland and Scandinavia. See Thrush.

SONNAMBULA, sŏn′nȧm-bōō′lȧ, La. An opera by Bellini (q.v.), first produced in Milan, March 6, 1831; in the United States, May 14, 1842 (New York).

SONNEBERG, zŏn′e-bĕrk. A town and summer resort in the Duchy of Saxe-Meiningen, Germany, on the Röthen, 13 miles northeast of Coburg (Map: Prussia, D 3). Its principal industry is the manufacture of toys. Masks, grindstones, slates, and pencils are also manufactured. Pop., 1900, 13,317; 1910, 15,878.

SONNECK, Oscar George Theodore (1873–). An American musical scholar and writer, born in Jersey City, N. J. When he was 10 years old he entered the Gymnasium at Kiel, completing the course in Frankfort. From 1893 to 1897 he attended the University of Munich, studying philosophy under Stumpf and the history of music under Sandberger. In 1898 he entered the conservatory at Sondershausen, where he studied chiefly conducting. After that he again spent some time at Frankfort, perfecting himself on the piano under Kwast and studying instrumentation under Knorr. After devoting a short time to research work in Italy he returned to the United States in 1899. In 1902 he was appointed librarian of the musical section of the Library of Congress at Washington, which under his administration became one of the great musical libraries of the world. Under his editorship the *Musical Quarterly*, published by G. Schirmer, New York, was established in 1914. His extensive and scholarly researches concerning early American music and musical life laid the first foundations of an authoritative history of American music. Among his numerous publications the most important are: *Francis Hopkinson and James Lyon: Two Studies in Early American Music* (1905); *Early Concert Life in America* (1907); *Early Opera in America* (1913); *A Survey of Music in America* (1913). Of the greatest value are also the descriptive catalogues published, under his direction, by the Library of Congress, especially those on *Dramatic Music* (1908), *Orchestral Music* (1912), *Early Books on Music* (1913), *Opera Librettos Printed before 1800* (1914).

SONNENFELS, zŏn′en-fĕls, Joseph von (1732–1817). An Austrian author, of Jewish parentage, born in Nikolsburg, Moravia. After giving up his theological studies he served in the Austrian army in 1749–54, was then for a time a lawyer's clerk, and became particularly active in endeavors towards the improvement of the Vienna stage, in connection with which he wrote the *Briefe über die wienerische Schaubühne* (1768; new ed., 1884). His *Abschaffung der Tortur* (1775) effectively secured the abolition of the torture throughout Austrian domains. In 1763 he was appointed professor of political science in the University of Vienna, and subsequently received various posts, including that of president of the Academy of Fine Arts (1811). His collected writings appeared at Vienna in 13 volumes (1783–87). Consult the biography by Müller (Vienna, 1882).

SONNENSCHEIN, sŏn′nen-shīn, Edward Adolf (1851–). An English classical scholar, brother of William S. Sonnenschein. He was born in London and was educated at University College, London, and University College, Oxford. He was assistant professor of humanity (Latin) at the University of Glasgow (1877–81), professor of Greek and Latin in Mason College, Birmingham (1883–1900), and professor of Latin and Greek at the University of Birmingham from 1900. His publications include numerous papers in the periodicals, Latin and Greek grammars, and annotated editions of plays of Plautus—the *Captivi* (published in 1879), the *Rudens* (1891, 1901), and the *Mostellaria* (2d ed., 1907).

SONNENSCHEIN, sŏn′nen-shīn, WILLIAM SWAN (1855–). An English publisher and compiler, brother of Edward A. Sonnenschein. He was born in London and was educated there at University College. In 1878 he established in London a publishing business which in 1895 became a limited company with himself as chairman. He collected an important library in bibliography and literary history and published *The Best Books* (1887; 5th ed., 1901), a classified list of about 50,000 available works, and *A Reader's Guide to Contemporary Literature* (1894; 2d ed., 1901), supplementary to the foregoing. Later these two were combined and brought down to date (2 vols., 3d ed., 1910–12), covering about 100,000 works. He also spent much time in preparing a *Dictionary of Phrases*.

SONNENTHAL, zŏn′en-täl, ADOLF VON (1834–1909). An eminent Austrian actor, born in Budapest. He first worked as a journeyman tailor, but after some experience on the provincial stage was engaged at the Court Theatre in Vienna, where he was soon recognized as an actor of the first rank, excelling equally in tragic rôles and in comedy. In 1881 he was knighted by the Emperor. In 1885, on a visit to New York, he was most cordially received by the public. He visited the United States again in 1899 and 1902. Consult Eisenberg, *Adolf Sonnenthal* (Dresden, 1896).

SONNET (Fr. *sonnet*, song). As perfected by the Italians, a stanza of 14 hendecasyllabic verses. The stanza is divided into two unequal parts. The first part, called the octave, is composed of two quatrains (or four-line strophes). The second part, called the sestet, is composed of two tercets (or three-line strophes). The octave runs on two and the sestet on two or three rhymes. According to a common type, the rhymes are arranged thus: *abba, abba, cde, cde*. This rhyme scheme may vary considerably, especially in the sestet. The four divisions—particularly the octave and the sestet—are usually kept distinct in sense as well as in form. In this rigid metrical form the idea, mood, or sentiment of the poet is developed by stages. The sonnet was primitively a lyric sung with musical accompaniment. Indeed, in old Provençal and French the words *son* or *sonet* designated a lyric in the vernacular. It is now generally held that the sonnet originated in Sicily. Some philologians, however, find its germ in the Provençal *cobla esparsa*. Even Arabic origins have been suggested.

The sonnet, widely cultivated in Italy and Provence during the thirteenth century, assumed its highest art in Petrarch (1304–74). The form was also practiced by Lorenzo de' Medici, Michelangelo, and Tasso, and has always enjoyed great popularity in Italy. From Italy, the vogue of the sonnet spread over western and northern Europe. In Spain it was naturalized by Juan Boscan (c.1493–c.1542). Portugal had the great Camões (q.v.). The form seems to have been introduced into France by Mellin de Saint-Gelais, and was at once adopted by his master Marot. It received an immense impulse from the Pléiade. Du Bellay produced nearly 200 sonnets, and Ronsard more than 900. In France the fashion, after declining in the eighteenth century, came in again with the Romantics. Among recent French adepts in the sonnet are Sully-Prudhomme and Hérédia.

The sonnet was introduced into England by the Earl of Surrey and Sir Thomas Wyatt. Their collection, numbering 36 altogether, first appeared in Tottel's *Miscellany* under the title *Songes and Sonnetes* (1557). Between 1591 and 1597 were published, according to the conservative estimate of Sidney Lee, more than 2000 English sonnets. The Elizabethans did not follow strictly the Petrarchan type. Spenser and Shakespeare, though logically developing the idea, reduced the sonnet to three quatrains clinched by a final couplet. Shakespeare further simplified the sonnet by employing a distinct set of alternating rhymes in each quatrain. His rhyme scheme is *abab, cdcd, efef, gg*. After 1600 the sonnet impulse, though weakened, was still a force. Then came Milton, with his small but grand group. For a century after Milton few English sonnets were written, but with the Romantic revival the sonnet returned (about 1750), though even Wordsworth, as late as 1827, thought it necessary to defend the form against the critics. Among the great English poets of the nineteenth century who practiced this form are Wordsworth, Coleridge, Keats, Mrs. Browning, and the Rossettis. In America lyric poets from Poe to Thomas Bailey Aldrich wrote notable sonnets. Unsurpassed in this form was Longfellow, whose sonnet series on the *Divine Comedy* is of high excellence both in form and substance. In Germany, though sonnets appeared as early as the seventeenth century, with Weckherlin (1585–1653) and Opitz (1597–1639), they were not much cultivated till taken up by the Romantics and a few poets just preceding: Bürger, A. W. Schlegel, Arnim, Voss, Goethe, Rückert, Eichendorff, Heyse, Geibel, and Redwitz.

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SONNINO, sŏn-nē′nō. A town in the Province of Rome, Italy, 64 miles southeast of the city of Rome. Its chief feature is the convent of Fossanova, an exceptionally fine specimen of early Gothic architecture. Pop., 1911, 4915.

SONNINO, Sidney, Baron (1847–). An Italian statesman. He was born at Pisa, and he graduated LL.D. from the university there in 1865. In 1867–72 he was connected with the diplomatic service, and after 1880 was a deputy in the Italian Legislature. He served as Minister of Finance in 1893–94 and as Minister of the Treasury in 1894–96, and was Premier and Minister of the Interior in 1906 and in 1909–10. When Italy made preparations to enter the European War Baron Sonnino, though leader of the Opposition, accepted the portfolio of Foreign Affairs in the Salandra (q.v.) cabinet in December, 1914. He served as editor of the *Rassegna Settimanale* in 1878–82, and was author of *I contadini in Sicilia* (1876) and other works on social and political topics.

SONORA, sȯ-nō′rȧ. A state of northwest Mexico (Map: Mexico, D 3). Area, 76,619 square miles. Along the coast extends a low arid region rising gradually towards the interior. In the east rises the Sierra Madre with its numerous offshoots inclosing deep valleys. The rivers are few, the Yaqui being the most important. The climate differs considerably in the different parts of the state, but the rainfall is generally scanty and agriculture can be carried on only with irrigation. The mineral deposits of Sonora are among the richest in Mexico, the most important being of copper, gold, and silver. Mining is carried on extensively and a large proportion of the mineral products is exported to the United States. Sonora is crossed from north to south by a railway line which touches at Guaymas, the chief port. Pop., 1910, 265,383. Capital, Hermosillo (q.v.).

SONORA, Marqués de la. See Gálvez, Joseph.

SONO′RAN REGION. An American faunal region whose bounds are widely extended by some writers, but which may be restricted to the high and dry plateau region of the northern interior of Mexico and to the contiguous arid region of the southwest United States, reaching eastward into Texas and northward into Colorado, Utah, and Nevada between the mountain ranges. It is characterized by a large variety of small animals adapted to desert life, and has been studied and described by C. H. Merriam.

SONRHAY. See Songhay.

SONS OF AMERICA. See Secret Societies, Patriotic-Political.

SONS OF LIBERTY. The first secret society to appear in the United States, after the introduction of the Masonic Order. It had a loose organization and was found in all of the 13 Colonies, having come into existence as a political organization about 1764, at which time the Stamp Act aroused the opposition of its members. (See Secret Societies, Patriotic-Political.) The connection between the various societies of Sons of Liberty was mainly through correspondence. The name was used in reference to their activities by Col. Isaac Barré (q.v.), in Parliament at London, 1765, and the American organizations adopted the title at once. John Lamb (q.v.) and Isaac Sears (q.v.) were among the more active members of the Sons in New York. Paul Revere was a leader in New England. The society was active in supporting the nonimportation agreement, and also took part in the calling of the Continental Congress in 1774. After the Revolution the society died out, many members helping to form or joining the then new Tammany Societies (q.v.). Consult: Leake, *Life of Gen. John Lamb* (Albany, 1850); Dawson, *Sons of Liberty in New York* (Poughkeepsie, 1859); also *The New Englander* (Boston, April, 1876).

SONS OF THE AMERICAN REVOLUTION, National Society of the. A hereditary patriotic society organized in New York City on April 30, 1889, by representatives of the Society of the Sons of the Revolution, and of the Sons of Revolutionary Sires. The latter had been organized in San Francisco, Cal., on Oct. 22, 1875, and after April 30, 1889, became the California State Society of the Sons of the American Revolution. Membership is restricted to lineal descendants of an ancestor who rendered actual service in the cause of American independence, as an officer, soldier, seaman, marine, militiaman, or minuteman in the forces of the Continental Congress or of the several Colonies. The membership was about 13,000 in 1915. The National Society was incorporated by Act of Congress in 1906.

SONS OF THE CLERGY MUSICAL FESTIVAL. An annual musical festival held in St. Paul's Cathedral, London. It was first organized in 1698, the proceeds being devoted to the needs of the Sons of the Clergy Corporation. The Royal Society of Musicians for a long time supplied the orchestra.

SONS OF THE REVOLUTION. A patriotic hereditary society originally organized in New York City on Feb. 22, 1876, and reorganized on Dec. 4, 1883. It admits to membership any male lineal descendant from an ancestor who actively assisted in establishing American independence during the War of the Revolution between April 19, 1775, and April 19, 1783. This society has been specially active in marking historic localities with tablets, especially in New York City. Noteworthy among these monuments are the tablets commemorating the battle of Long Island and that marking the site of the battle of Harlem Heights. The statue of Nathan Hale in City Hall Park, New York, was also erected by this organization. The membership in 1915 was about 7000.

SONS OF VETERANS. A patriotic society organized in Philadelphia, Pa., on Sept. 29, 1879. It admits to membership lineal male descendants of honorably discharged soldiers, sailors, and marines who served in the Civil War. The insignia consists of a bronze bar on which are the words "Filii Veteranorum"; and pendent from this bar is a red, white, and blue ribbon attached to a medallion containing a monogram of the letters "S. V." in relief on a wreath over crossed cannons, surmounted by a spread eagle. Of similar character is an organization known as Daughters of Veterans, which admits to membership daughters of honorably discharged soldiers, sailors, and marines, and daughters of Sons of Veterans, who are fifteen years of age and upward. The membership in 1915 was about 55,000.

SONS OF WAR VETERANS, Society of. A patriotic society founded in 1893, having for its objects to preserve and perpetuate the principles for which the Federal soldiers fought in the Civil War; to assist surviving veterans and their widows; and the mutual benefit and advancement of its members. It admits to membership any male lineal descendant of an honorably discharged Union soldier, sailor, or marine who served during the Civil War for not less than six months, part of this at the front.

SONSÓN, sôn-sōɴ'. A town of the Department of Antioquia, Colombia, 110 miles northwest of Bogotá, on the Sonsón River, at an altitude of 8300 feet. In the vicinity are extensive mines of gold, silver, and salt. The industries include weaving of cotton and woolen mantles, and the manufacture of straw hats. Pop., 1912, 29,346.

SONSONATE, sôn'sō-nä'tȧ. A town of Salvador, 32 miles west of San Salvador (Map: Central America, C 4). It is the capital of a department of the same name, and is regularly built. Pop. (est.), 13,000. It was founded in 1524 by Pedro de Alvarado.

SONTAG, zôn'täɢ, Henriette (1806–54). A German operatic soprano, born at Coblenz. She was engaged upon the stage from early childhood. In 1824 she sang at Leipzig in *Der Freischütz* and *Euryanthe*, in the latter creating the title rôle. Her success was immediate, and in 1824 she went to the Königstädter Theater, Berlin. Two years afterward she sang the part of Rosina in *Il Barbiere di Seviglia*, in which her coloratura power gave her a distinct triumph over Catalani. In 1827 she was engaged at the Paris Italian opera, and a year afterward married Count Rossi. She sang in all the musical centres of Europe, and in 1852 visited the United States. In 1854 she was engaged for the Italian opera in Mexico, but was stricken there with cholera and died. Consult W. Berger, *Berühmte Frauen* (Berlin, 1904).

SONTHALS. See Santals.

SONYA, sōn'yȧ. See Kovalesky, S. V.

SOOCHOW, sōō'chou'. A town of China. See Suchow.

SOOTHSAYER. See Mantis.

SOO TUNG-P'O. See Su Tung-P'o.

SOOY SMITH, William (1830–1916). An American engineer. He graduated at Ohio State University (1849) and at West Point (1853). After serving in the artillery he resigned from the army in 1854 and became a civil engineer. In 1857 he made surveys for the first international bridge across the Niagara River. Subsequently he was connected with the Trenton Locomotive Works, but resigned in 1861 to reenter the army. He became brigadier general of volunteers, serving in the Vicksburg campaign under Grant, and later in the Department of Tennessee under Sherman, but in 1864 was compelled to resign in consequence of illness. He returned to his profession, settling in Chicago, and in 1865 became actively engaged as engineer for various bridges and tunnels, including the bridge across the Missouri River at Glasgow, Mo., and the projected Hudson River Tunnel at New York. General Sooy Smith made many notable improvements in pneumatic processes for sinking foundations and in methods of construction of high buildings.

SOPHIA, sō'fē-ȧ. The capital of Bulgaria. See Sofia.

SOPHIA ALEX'EYEV'NA (1657–1704). A regent of Russia, born at Moscow. She was the daughter of Czar Alexius I by his first wife. When her brother, Czar Theodore III, died in 1682, she incited a rebellion of the *stryeltsy* or musketeers, who murdered the supporters of the young Peter the Great. Sophia then declared herself Regent over her two half-brothers Ivan and Peter, and for seven years was the actual ruler of Russia. In 1689 Peter compelled her to retire into a convent at Moscow, and after 1698 had her imprisoned under military surveillance. Consult R. N. Bain, *The First Romanovs* (London, 1905).

SOPHI'A DOR'OTHE'A (1666–1726). Consort of George I, King of England and Elector of Hanover. She was the heiress of Duke George William of Brunswick-Luneburg-Celle, and married her cousin, the Crown Prince of Hanover, in 1682. She bore two children, who became King George II of England and Queen Sophia Dorothea of Prussia, mother of Frederick the Great. Her life at the Hanoverian court was made miserable by the intrigues of her father-in-law's mistress, the Countess von Platen, who accused her of a liaison with Count Philip Christopher von Königsmarck. The Count, a wealthy young Swedish nobleman, had been a page at court, and was then colonel of the guards at Hanover. One night as he left the Crown Princess's apartments he was set upon by four soldiers stationed to arrest him, and accidentally killed. The body was concealed and his disappearance remained a mystery. Soon afterward the Crown Princess was arrested, tried before a court appointed for the purpose, and her marriage annulled. She was then sent to the castle of Ahlden, where she was confined until her death, thirty-two years later. Her guilt or innocence has long been a matter of controversy. Consult W. H. Wilkins, *The Love of an Uncrowned Queen* (London, 1900). See Königsmarck.

SOPHIOLOGY (from Gk. *σοφία*, *sophia*, wisdom, from *σοφός*, *sophos*, wise + *-λογία*, *-logia*, account). The science of philosophies. All peoples in every stage of development produce philosophies, or general systems of thought designed to explain the phenomena coming within their observation. To some extent these systems are the product of individual minds, yet each philosophy is in no small measure a collective product.

SOPH'ISTS (Lat. *sophista*, from Gk. *σοφιστής*, *sophistēs*, wise man). A class of thinkers and teachers who appeared in the fifth century B.C. in Greece, and especially at Athens. We have little information concerning them except such as has come from their opponents. We can perhaps form a fair estimate of the character and significance of their work if we remember that much of what is said of them in extant Greek writings is extravagant satire. The change of political institutions following the Persian and Carthaginian wars, the growth of democracy with an increasing opportunity for the orator, the distrust in the inviolable character of social rules, now seen to differ in various countries, all conspired to create a demand for instruction which should qualify men for life under new conditions. The Sophists arose to meet this demand. They popularized the results of the investigations of previous philosophers. Of the earlier Sophists some were Eleatic, some Heraclitean, some Pythagorean in their views, but they laid more emphasis on equipping their pupils for the tasks of public life than for philosophic or scientific work. Philological studies, rhetoric, and argumentation by which the worse could be made to appear the better reason, were their leading interests. In the history of philosophy their significance, apart from the fact that their activity called forth the philosophical activity of Socrates, and through him that of Plato and Aristotle, is mainly epistemological and ethical. The readiness with which all their arguments were received by their listeners made them distrustful of human knowledge. They came to believe that any proposition could be proved as satisfactorily as any other. When every statement is demonstrable none can command absolute credence, and skepticism (q.v.) is the foregone conclusion. This skepticism found a theoretical confirmation in views then becoming current as to the origin of knowledge. Against the older rationalism (q.v.), which distinguished between sense and thought, Protagoras, the leading Sophist, maintained that sensations were the sole content of consciousness. But if this is true and if sense impressions of one and the same object vary, there is no court of appeal. One sensation is as good as another; everything is just what it appears at the moment. There is no ascertainable identity underlying differences of appearance. The unity of phenomena in their laws is lost sight of, and each individual man becomes the measure of the universe. Opposite conclusions have been drawn from this sensationalism. Gorgias argued that nothing is, for everything is full of contradictions. Euthydemus, conversely, denied that there can be contradiction. If subject and predicate mean different things, then what seems to be contradiction is mere difference. Lycophon went so far as to advise the omission of the copula in propositions, presumably because all judgments are supposed to be mere unrelated sequences of words. In ethics the upshot of the sophistic teaching was an ultraindividualism with consequent license in practical life. Everything institutional and social came to be regarded as conventional, with nothing natural left except unscrupulous self-seeking. Protagoras recognized the originality of justice and of regard for social approval (*αἰδώς*). But other Sophists were not so conservative. Callicles, in Plato, is made to say that all laws are created by the strong and enforced on the weak, while Thrasymachus contends that no man but a fool is willingly just. It is obvious that where the whole of morality is brushed aside as a trick whereby the strong make the weak do their will, religion cannot stand untouched. Protagoras prudently claimed that he knew nothing about the gods, while his successors ran the whole gamut from skepticism to avowed atheism.

It is interesting to note the unanimity with which Socrates, Plato, and Aristotle condemned the Sophists for accepting pay for their teaching. The truth was that by many of the Sophists learning was prostituted; and yet no universal condemnation may properly be passed on the Sophists as a class, as was done by modern historians till the appearance of Hegel's *History of Philosophy*. On the other hand, Grote in his *History of Greece*, vol. viii, has gone to the other extreme and has failed to appreciate the subversive tendency of much of the sophistic activity. Among the Sophists are to be mentioned Protagoras, Gorgias, Prodicus, Hippias, Polus, Thrasymachus, Euthydemus, Dionysodorus, Callicles, and Antiphon. Consult: Martin Schanz, *Die Sophisten* (Göttingen, 1867); Henry Sidgwick, in *Journal of Philology*, vols. iv and v (Cambridge, 1872–74); George Grote, *History of Greece* (new ed., 10 vols., New York, 1899); F. C. S. Schiller, *Plato or Protagoras?* (London, 1908); A. W. Benn, *Early Greek Philosophy* (New York, 1909), and the histories of philosophy by Ueberweg-Heinze, Windelband, Erdmann, Zeller, Gomperz, Benn, and Burnet.

SOPHOCLES, sŏf'ō-klēz (Lat., from Gk. Σοφοκλῆς, *Sophoklēs*) (c.496–406 B.C.). An Athenian dramatist, born of a prosperous family, at Colonus, a beautiful suburb of Athens. His long and happy life coincided with the period of the Imperial greatness of Athens. His dramas are the most perfect examples of Attic art. His statue in the Lateran is the ideal type of Greek manhood. At the celebration of the victory of Salamis (480 B.C.) he was selected to lead the chorus of youths. His grace and youthful beauty in the rôle of the Princess Nausicaa playing ball with her attendant maidens were long remembered. He served also as the model of the painter Polygnotus for his ideal picture of the bard Thamyris. He composed the music of his beautiful choric odes, and in addition to his plays wrote many poems, including a Pæan to Æsculapius, which was still sung in the third century A.D. He served his country as ambassador, treasurer of the tribute, and general. He was noted for his piety, held a minor priesthood in his old age, and was worshiped with heroic honors after death. He was the friend of Herodotus (q.v.) who wrote an ode in his honor, and the associate and colleague of Pericles (q.v.).

In 468, at the age of 28, he produced his earliest play, the *Triptolemus*, which won the first prize against the veteran Æschylus (q.v.). For the remaining years of Æschylus' life the two mighty rivals contended, with varying success, each learning much from the art of the other. The first recorded contest with Euripides occurred in 438, when the younger poet's *Alcestis* won the second place. In the contests of the next 32 years Sophocles was generally successful, receiving first prize about 20 times and never falling below second place.

In 440 he was elected one of the board of generals for the Samian War, according to the legend, because of the popularity or political wisdom of the *Antigone*. The great poet as general was the theme of many anecdotes, some of which have been preserved by the writer of memoirs, Ion of Chios, who met him in Chian society. His old age is said to have been clouded by the attempt of his son, Iophon, to deprive him of the management of his estate on the ground of mental incapacity. The legend adds that Sophocles refuted the charge by reading to the jurors the magnificent chorus in praise of Colonus from the *Œdipus at Colonus*, his latest play, produced after his death by his grandson and namesake. If the tale is true it is strange that Aristophanes makes no allusion to it in the *Frogs* (405 B.C.). There the relations between father and son are so friendly that Dionysus is unwilling to bring back Sophocles to the upper world until he has had an opportunity to test Iophon's poetic powers when unaided by his father. On the death of Euripides in the spring of 406 Sophocles assumed mourning and ordered his chorus to appear without wreaths. A few months later he followed his younger rival.

The chief changes in the external form of tragedy attributed to Sophocles are the raising of the number of members of the chorus from 12 to 15 and the introduction of a third actor, which made possible the complication of the action and the more effective portrayal of character by contrast and juxtaposition. He also abandoned the Æschylean fashion of composing plays in groups of three about a central myth or motive and made each play an independent psychological and dramatic unity. The chorus participates very slightly if at all in the plot, and the length of the choric odes relatively to the dialogue diminishes, though they never become mere musical interludes, as is too often the case in Euripides. The Sophoclean chorus is the ideal spectator and interpreter of the ethical and religious significance of the action. The great choric odes of the *Antigone* and the *Œdipus* unite the grace of the Greek lyric to the moral earnestness of the Hebrew psalm.

Sophocles composed about 120 plays, of which seven are preserved, together with fragments of 80 or 90 others. (1) *Ajax.* Ajax, brooding upon the dishonor done him by the awarding of the arms of Achilles to Odysseus, is bereft of his reason by Athena, whom he has offended by presumptuous speech. In his frenzy he wreaks his wrath upon the cattle of the Greeks, thinking that he is exacting vengeance from the Greek chieftains. At this point the action begins. Awakening to the intolerable humiliation of his position, he slays himself after a touching farewell to his infant son and a noble apostrophe to earth and sea and sky. The debate on the question of granting him honorable burial, which fills the last third of the play, is an anticlimax to modern feeling, but effectively displays the conciliatory temper of the sagacious Odysseus and the vindictive spirit of Menelaus. (2) The *Antigone*, perhaps the first problem play in literature, presents the moral antinomy that arises from a conflict between political authority and the law of the individual conscience. Antigone, in obedience to Greek religious feeling and the dictates of her woman's heart, bestows the rites of burial upon her rebel brother Polynices in defiance of the edict of King Creon, and so brings about her own death, and, by tragic complication, that of her lover, Hæmon, the King's son, and that of Eurydice, Creon's wife. (3) The *Electra* corresponds to the middle play of Æschylus' trilogy, the *Oresteia*, and to the *Electra* of Euripides. It treats the slaying of Clytemnestra and her paramour, Ægisthus, by her children, Orestes and Electra, to avenge the murder of their father, Agamemnon. The psychological interest centres in the character of Electra, a sort of ancient Colomba, nerving her brother to the prosecution of the blood feud. (4) The *Œdipus Tyrannus* is the most ingeniously constructed of Greek plays and a typical example of the so-called Sophoclean or dramatic irony. The plot turns on the gradual inevitable revelation to Œdipus (q.v.), through his own insistent inquiry, of the dreadful truth, already known to the audience, that he has unwittingly fulfilled the oracle which doomed him to slay his father and live in incestuous marriage with his mother. (5) The *Trachiniæ*, named from the Trachinian maidens of the chorus, treats the poisoning of Hercules by the Nessus robe sent to him as a love charm by his jealous wife, Deianira, and his translation to heaven from the funeral pyre on Mount Œta. (6) The *Philoctetes* was produced in 409. Philoctetes, bitten by a serpent and afflicted with a disgusting wound, had been abandoned by the Greeks on the desert shore of Lemnos. After many years an oracle declares that he, the possessor of the bow of Hercules, is indispensable to the besiegers of Troy. Odysseus and Neoptolemus, the son of Achilles, are sent to fetch him, if need be against his will. Very beautiful are the descriptions of nature and the account of Philoctetes' lonely life. But the chief interest of the play lies in the psychological study of the final revolt of the frank nature of Neoptolemus against the treachery which Odysseus requires him to practice upon the unsuspecting Philoctetes. (7) The *Œdipus at Colonus* (first produced in 401) depicts the reconciliation of Œdipus with destiny and his sublime and mysterious death at Colonus after years of wandering as a blind exile, sustained by the loving tendance of his daughter, Antigone.

As a poet Sophocles cannot vie in imaginative sublimity with Æschylus. As a thinker he may be less fertile in suggestion than the ingenious Euripides. But regarded as a Greek artist, shaping Greek legends in the conventional molds of Attic tragedy, he holds the just and perfect mean between the titanic symbolism of the older poet and the sentimental, rhetorical realism of the younger. He is reported to have said that Æschylus did right without knowing it, and that Euripides painted men as they are, while he himself represented them as they ought to be. A slight plot suffices him for the creation of a masterpiece because his subtle dramatic art and his exhaustive psychological analysis elicit from a simple situation a complete revelation of character and destiny. Fate, the prime motive of ancient tragedy, is no longer felt as a capricious external power, but as the inevitable outcome of character and the unavoidable condition of life. Tragic pathos is refined to a sense of the universal human fellowship in frailty and suffering. And beauty, the all-pervading, gracious serenity of an unfailing and unobtrusive art, takes from pathos and tragedy their sting. Sophocles is the most truly Hellenic of the Greek tragedians, and for those who have drunk deeply of the Hellenic spirit the most human too.

The best edition is that of R. C. Jebb, in seven volumes, with elaborate introductions and commentary and English translation facing the Greek (Cambridge, 1881–96). There is a good annotated edition by L. Campbell (Oxford, 1871–81), and an excellent monograph by the same author. Plumptre's verse translation (1870) is much esteemed. That of Whitelaw (1883) is perhaps better.

Bibliography. R. C. Jebb, *The Growth and Influence of Classical Greek Poetry* (Boston, 1894); Gilbert Murray, *A History of Ancient Greek Literature* (New York, 1897); A. and M. Croiset, *An Abridged History of Greek Literature* (ib., 1904); W. C. Wright, *A Short History of Greek Literature* (ib., 1907); James Adam, *The Religious Teachers of Greece* (2d ed., Edinburgh, 1909); Christ-Schmid, *Geschichte der griechischen Litteratur*, vol. ii, part ii (5th ed., Munich, 1913); and the article "Sophokles" in Friedrich Lübker, *Reallexikon des klassischen Altertums*, vol. ii (8th ed., Leipzig, 1914). See Plate of Greek Art.

SOPHOCLES, Evangelinus Apostolides (1807–83). A Greek American classical scholar, born at Tsangaranda, near Mount Pelion, in Thessaly. He received his earlier education at the convent on Mount Sinai. In 1829 he emigrated to the United States and continued his studies at Amherst College. He was tutor at Harvard College, with a short intermission, from 1842 to 1849. In 1849 he was appointed assistant professor of Greek, and in 1860 professor of Ancient, Byzantine, and Modern Greek. His publications include, in addition to several textbooks: *Catalogue of Greek Verbs* (1844); *History of the Greek Alphabet* (1848); *Glossary of*

Later and Byzantine Greek (1860), revised and published under the title *Greek Lexicon of the Roman and Byzantine Periods* (1870; new ed., 1914).

SO'PHONIS'BA (Lat., from Gk. *Σοφόνισβα*). The daughter of the Carthaginian Hasdrubal, son of Gisco. Her father promised her in marriage to the Numidian prince Masinissa (q.v.), but subsequently gave her to Masinissa's rival, Syphax (q.v.). When Masinissa in the Second Punic War overthrew Syphax, Sophonisba fell into his hands and he soon made her his wife, to the displeasure of Scipio, who insisted that he should surrender her. To save her from captivity, her husband sent her poison, with which she ended her life. Her history forms the theme of many tragedies, among them, in English, those by Thomson (1729), Nathaniel Lee (*Sophonisba, or Hannibal's Overthrow*, 1676), Marston (*Sophonisba, or The Wonder of Women*, 1602); in French, under the title *Sophonisbe*, by Mairet (1630) and by Corneille (1663); in Italian, as *Sofonisba*, by G. del Carretto (1502), Trissino (1529), and Alfieri (1783).

SO'PHRON (Lat., from Gk. *Σώφρων*) **OF SYRACUSE** (460–420 B.C.). A Greek writer of mimes. Though from time immemorial the Greeks of Sicily had practiced the mimes at their public festivals (see Mime), Sophron was the first to reduce them to the form of a literary composition. They consisted in the representation of scenes from actual life in Sicily, chiefly in the lower classes, brought out by a dramatic dialogue, interspersed with numerous colloquial forms of speech. These pieces of Sophron, which were in the Doric-Greek dialect and in a kind of cadenced prose, were great favorites with Plato, who made use of them for the dramatic form of his dialogues (Quint., i, 10, 17; Diog. Laert., iii, 13). It is said that Theocritus borrowed his second and fifteenth idyls from Sophron. Very unsatisfactory fragments have been preserved. Consult Botzon's collection (Marienburg, 1867) and his *De Sophrone et Xenarcho Mimographis* (Lyck, 1856); also Christ-Schmid, *Geschichte der griechischen Litteratur*, vol. i, part i (6th ed., Munich, 1912).

SOPORIFICS, sō'pō-rĭf'ĭks *or* sŏp'ō-. See Narcotics.

SOPRANO, sō-prä'nō (It., treble, high, supreme). The highest species of female voice, whose range normally extends from c^1 to a^2.

With the exception of those at either extremity, all the tones are common to both the head and chest registers. A voice sometimes distinguished as intermediate between alto and soprano is the *mezzo-soprano*. See Mezzo. For soprano clef, see Musical Notation, *The Clefs*.

SO'RA. A city in the Province of Caserta, Italy, on the Garigliano, 62 miles east-southeast of Rome (Map: Italy, D 4). The river is here spanned by two bridges. There are remains of walls and castle ruins above the town. It manufactures woolen cloth and paper and trades in wine, oil, fruits, and cattle. Sora, originally a Volscian town, was colonized by the Romans in 303 B.C. Pop. (commune), 1901, 16,001; 1911, 16,245 (town, 6050).

SORA. A small rail (q.v.); especially, in the Middle States, the Carolina rail (*Porzana carolina*), very abundant in the marshes of the Atlantic coast at early autumn, giving fine sport and good eating. It is eight or nine inches long, olive brown above varied with black and white, and beneath (in the fall) plain brownish. In breeding plumage the face and throat are black, other underparts slate-gray. The sora breeds from the Middle States northward to Hudson Bay, and winters from the Carolinas southward to South America. The nest is of grass on the ground in swamps; the eight to 15 eggs are buffy, brown-spotted. See Plate of Rails, etc.

SORA'NUS. A Greek physician, who flourished c.110–130. He was born at Ephesus, but practiced at Alexandria and at Rome. Two of his medical treatises are extant in part, *On Fractures* and *On Diseases of Women*. The former may be found in T. L. Ideler, *Physici et Medici Minores*, vol. i (1841); the latter was edited by V. Rose (1882), with a translation into Latin, made by a physician named Moschio, in the sixth century. His chief work, *On Acute and Chronic Diseases*, exists now only in a Latin translation by Cælius Aurelianus. He wrote also *Lives of Physicians*, one of which, the *Life of Hippocrates*, still extant, is our chief authority for the life of Hippocrates. Consult Christ-Schmid, *Geschichte der griechischen Litteratur*, vol. ii, part ii (5th ed., Munich, 1913), and Fr. Lübker, *Reallexikon des klassischen Altertums*, vol. ii (8th ed., Leipzig, 1914).

SORATA, sō-rä'tȧ, or Illampu. The highest mountain of Bolivia and one of the highest of South America (Map: Bolivia, D 7). It is situated in the Bolivian Department of La Paz, about 16 miles east of Lake Titicaca, and reaches an altitude of 21,500 feet. It was first ascended by Sir William Martin Conway in 1898.

SORAU, zō'rou. A town in the Province of Brandenburg, Prussia, on the Sorebach, 60 miles south-southeast of Frankfort-on-the-Oder (Map: Germany, F 3). It has an old castle (now a prison) and a new castle (the seat of the magistracy). There are important bleach fields, print works, color works, iron foundries, and manufactories of cloth, machinery, glass, porcelain, tubing, wooden shoes, and glazed bricks. Deposits of lignite are near. Sorau, the oldest town of Lusatia, received municipal privileges in 1260. It was ceded by Saxony to Prussia in 1815. Pop., 1900, 15,945; 1910, 18,019.

SORAUER, zō'rou-ẽr, Paul (1839–). A German botanist, born at Breslau and educated at the University of Berlin. In 1871 he became director of the experiment station at the Proskau Pomological Institute, and in 1892 he was made professor. In 1893 he went to Berlin as secretary of the International Phytopathological Commission. He became distinguished for his investigations in the diseases of plants, and founded the *Zeitschrift für Pflanzenkrankheiten* (Stuttgart), besides publishing: *Das Handbuch der Pflanzenkrankheiten* (1886; 3d ed., with Lindau and Reh, 1905–13; Eng. trans., *Manual of Plant Diseases*, 3 vols., 1915 et seq.); *Die Obstbaumkrankheiten* (1879); *Die Schäden der einheimischen Kulturpflanzen durch Schmarotzer, etc.* (1888); *Populäre Pflanzenphysiologie* (1891; Eng. trans., *Popular Treatise on the Physiology of Plants*, 1895); *Pflanzenschutz* (with Frank, 1896; 5th ed., with Rörig, 1910).

SORB. See Service Berry.

SORBITE, sôr'bīt. See Mannite; Metallography, *Heat Treatment*.

SORBONNE, sôr'bŏn', La. An institution of learning in Paris, founded by Robert de Sorbon. He was born Oct. 9, 1201, in Sorbon, near Rethel, not far from Rheims. Even to the present day the place name of this man has been attached to the focus of intellectual activity in France.

Robert de Sorbon studied in Paris, looking forward to the priesthood. He became priest, doctor of theology, and canon, first in the cathedral of Cambrai, then in that of Paris. By his eloquence and piety he won renown and was made chaplain, and perhaps confessor to King Louis IX (Saint Louis). Impressed by the importance of theological science and by the necessities of poor young men who might need support while engaged in its study, De Sorbon established a society of secular ecclesiastics. The King and some ecclesiastical dignities favored this enterprise; and in 1257 a site was secured by royal bounty for the home of the society. It was near the Palais des Thermes, in the heart of the present Latin Quarter. There were other similar associations or colleges, but this was destined to perpetuity and distinction. The founder called the establishment *La Communauté des pauvres maîtres étudiant en théologie;* but the public shortened this phrase, and before the close of the century the college was called, from its founder's name, La Sorbonne, which it has borne to the present day. Its Latin title was Domus Sorbonnæ. The house was a hall of residence and of study, not a place for systematic instruction and lectures. For the work of Robert papal approbation was secured in 1268. Several years later, to this theological seminary the founder added a college for the humanities and philosophy, and he died soon afterward, at Paris, 73 years old (1274).

His life is full of interest and is told in Jadart's memoir, published at Rheims, in 1880. The principal incidents are well presented in the *Biographie générale*, and by Baroux in *La grande cyclopédie* (vol. xxx). The early muniments of this foundation may be found in Denifle's compendium of *Documents relatifs à l'Université de Paris* (Paris, 1883) and in the *Cartularium Universitatis Parisiensis,* vol. i (ib., 1889).

From its origin the Sorbonne has been the centre of intellectual activity, and until the French Revolution it was recognized as especially the seat of theological learning. The faculty pronounced their opinions on important questions and their decisions were authoritative. The reader need only consult the *History of France* by Henri Martin to discover illustrations of this. The faculty intervened in the trial of Jeanne d'Arc; it condemned the views of Luther and showed hostility towards reformers; censured many noteworthy books and writers; opposed the Cartesian philosophy; and addressed the Czar in regard to a reunion of the Greek and Latin churches. Among books condemned were the treatise of Helvetius, *De l'Esprit*, the fourth volume of Buffon's *Natural History*, and Rousseau's *Emile*. Among the glories of the Sorbonne was its encouragement of printing in France, by giving quarters for their presses to Ulric Gering and other early printers.

The buildings of the Sorbonne were reconstructed early in the seventeenth century by Richelieu, who merits the distinction of a second founder. The church which he built as the college chapel is one of the celebrated monuments of ecclesiastical architecture in Paris. His tomb is there, not far from that of Robert de Sorbon. The Sorbonne was given to Paris in the middle of the nineteenth century, and a magnificent building was erected for the departments of science and letters. This edifice, called La Nouvelle Sorbonne, was completed in 1889, and it is perhaps the finest university building in the world. Its lecture rooms and laboratories are well equipped, and the mural decorations (especially the great picture by Puvis de Chavannes) are of rare beauty. In the transition from the old to the new Sorbonne M. Gréard published a noteworthy pamphlet, entitled *Nos adieux à la vieille Sorbonne.*

Changes in the interior administration due to the progress of science and to the increase of funds are too complex for presentation here. The most radical are the disappearance, after the French Revolution, of the Faculty of Theology, once the sole authority, so that a Sorbonnist was of course a theologian; the consequent supremacy of literature and science, evinced by the organization of the Ecole des Hautes Etudes, and by the founding of libraries and seminaries; also by the establishment, in the immediate neighborhood, of schools of medicine and law. The faculties of science and letters of the University of Paris are installed in the New Sorbonne and *Minerva* for 1913–14 reports that their libraries contained 600,000 volumes.

At a recent date, connected more or less closely with the New Sorbonne, there were 5000 students, 100 professorships, and many accessory positions for associates and assistants. Consult: A. L. A. Franklin, *La Sorbonne: ses origines, sa bibliothèque, etc.* (2d ed., Paris, 1875); Hastings Rashdall, *Universities of Europe in the Middle Ages* (Oxford, 1895); Pierre Leguay, *La Sorbonne* (Paris, 1910); Agathon (pseud.), *L'Esprit de la nouvelle Sorbonne* (3d ed., ib., 1911).

SORBS, or **SORBIANS,** sôr′bĭ-*a*nz. See WENDS.

SORBY, sôr′bĭ, HENRY CLIFTON (1826–1908). An English geologist. Born at Woodbourne near Sheffield, he was educated privately, and afterward devoted himself to independent investigations in biology, geology, and archæology. He was the originator of microscopic petrology, but at first his work in this field received scant recognition. He was elected F. R. S. in 1857, and in the following year his great paper "On the Microscopic Structure of Crystals" appeared in the *Quarterly Journal* of the Geological Society. Sorby was president of the Royal Microscopical Society and of the geological section of the British Association in 1880.

SORCERY. See WITCHCRAFT.

SORDEL′LO. An Italian troubadour of the thirteenth century who wrote in Provençal. He was a native of Goito, Mantua. The earliest mention of him has reference to a tavern brawl, which took place about 1220 at Florence, and the last document in which his name appears is dated 1269. While living at the court of Richard of San Bonifazio he carried off his master's wife, Cunizza, at the instigation of her brother, Ezzolino de Romano. Soon afterward he fled to Provence, where, with the exception of visits to Spain and Portugal, he seems to have spent the greater part of his life. Here he took part in important public events, his name appearing as that of a witness in various treaties and other documents. In his old age he returned to Italy as a knight in the train of Charles of Anjou, on his Naples expedition (1265), and received from him several castles in the Abruzzi as a reward for his services. In 1266 he was a prisoner in Naples. He died in Provence. As a poet he rises little above mediocrity. His political, moral, and personal sirventes show vigor and spirit, but his love songs are purely conventional, and his didactic poem *Documentum Honoris* has no unusual merit. His reputation depends upon Dante's treatment of him in *Purgatorio,* vi and vii, where he is represented as a type of high-minded patriotism. This conception is founded upon a sirvente (1237) on the death of Blacatz, in which Sordello imagines his patron's heart divided among the various princes who need its virtues, being wholly forgetful of their country in their selfish squabblings. Dante has put into the mouth of his shade in Purgatory a similar invective as well as a magnificent apostrophe to Italy. Robert Browning's poem *Sordello* has but the slightest historical foundation. Consult: Cesare de Lollis, *Vita e poesie di Sordello di Goito* (Halle, 1896); V. Crescini, *Sordello* (Verona, 1897); J. H. Chaytor, *Troubadours of Dante* (Oxford, 1902).

SORDINO, sôr-dē′nō. See Mute.

SORE. See Ulcer.

SOREL, sō-rĕl′. A city and the capital of Richelieu County, Quebec, Canada, on the Richelieu River at its mouth in Lake St. Peter, and on the Quebec, Montreal, and Southern, and the Canadian Pacific railways, 45 miles northeast of Montreal (Map: Quebec, G 5). It has large shipbuilding and manufacturing interests. Pop., 1901, 7057; 1911, 8420.

SOREL. A river of Canada. See Richelieu.

SOREL, Agnes. See Agnes Sorel.

SOREL, Albert (1842–1906). A French historian, born at Honfleur. He became professor of diplomatic history in the School of Political Sciences at Paris in 1872. He was a disciple of Taine (q.v.), whom he succeeded (1896) as a member of the French Academy. Some of his works are *La grande falaise* (1871); *Histoire diplomatique de la guerre franco-allemande* (1875); *La question d'Orient au XVIII siècle* (1878); *Montesquieu* (1887); *Madame de Staël* (1890), in the "Grands Ecrivains Series"; *Bonaparte et Hoche en 1797* (1896); *Etudes de littérature et d'histoire* (1901). His masterpiece is *L'Europe et la révolution française* (1885–1904). Shortly before his death he was awarded the Osiris prize of 100,000 francs, offered for the first time by the French Institute.

SOREL, Charles (c.1599–1674). A French burlesque romancer, of whose life little is known. In 1622 appeared anonymously his picaresque novel, *Histoire comique de Francion,* first in seven, later (1641) in eleven books. This work, reprinted more than 40 times in the seventeenth century, made merry with the pastoral and chivalric romances then so popular. In *Le berger extravagant* (1621), an imitation of *Don Quixote,* Sorel likewise mocked the "ideal" romance. His *Polyandre* (incomplete, 1648) portrays the well-to-do Parisian bourgeoisie with some accuracy. Consult Körting, *Geschichte des französischen Romans in XVII. Jahrhundert* (Leipzig, 1885), and Roy, *La vie et les œuvres de Charles Sorel* (Paris, 1853).

SOREL, Georges (1847–). A French writer on syndicalism (q.v.), born at Cherbourg. He attended the Ecole Polytechnique in 1865–67, became an engineer in the service of the Department of Bridges and Highways, and in 1892, having been decorated with the Cross of the Legion of Honor and become chief engineer, he resigned from the service of the state. Thereafter he contributed to the *Devenir Social* (1895–97), which he had founded with Lafargue, Deville, and Bonnet, to *Le Mouvement Socialiste* (1899 and 1906–08), to *Il Divenire Sociale* after 1905, and to other periodicals. Through his numerous writings in these journals Sorel became recognized as the chief philosopher of the Syndicalist movement. His publications include: *Le procès de Socrate* (1889); *L'Avenir socialiste des syndicats* (1900); *Introduction à l'économie moderne* (1903; 3d ed., 1911); *Saggi di critica del Marxismo* (1903; Ital. trans., 1903); *Les illusions du progrès* (2d ed., 1911); *Réflexion sur la violence* (1909; Eng. trans. by T. E. Hulme as *Reflections on Violence,* 1912; new ed., 1915), this latter work being his most important. Consult Giuseppe Prezzolini, *La teoria sindacalista* (Naples, 1909), and Agostino Lanzillo, *Giorgio Sorel, con una lettura autobiografica* (Rome, 1910).

SORE MOUTH, Infantile. See Thrush.

SORE NIPPLES. See Mammary Gland, Diseases of.

SOR′GHUM (Neo-Lat. *sorghum,* Indian millet, sorghum, probably of Oriental origin), *Sorghum vulgare* or *Andropogon sorghum,* var. *saccharatus.* A tall, earless, maizelike grass with a terminal head of small seeds. It is supposed to be a native of Africa, but has long been cultivated in southern Europe and China as a forage plant (see below), and for the sirup made from its sweet juice, which does not yield a profitable quantity of sugar. See Sugar, *Manufacture.*

The *nonsaccharine sorghums* constitute a group of varieties deficient in sugar. The plants, which are very leafy, grow from 4 to 8 feet high and are cultivated for food and forage. All varieties are closely allied and belong to the above-named species. The most common varieties are Kafir corn, Milo maize, durra, Egyptian rice corn, Jerusalem corn, and broom corn (q.v.). They are extensively grown in Africa, India, and China for the seed, which forms a staple human food. In Europe they are sometimes planted, but they do not ripen seed in regions remote from the Mediterranean. In the United States they are grown for forage in the semiarid Western States, where, owing to drought-resisting qualities, they have become important crops. Soil, climatic requirements, and cultural methods are practically the same for all varieties. Kafir corn, the most important variety for the American farmer, was introduced by the United States Department of Agriculture about 1885 and widely distributed. It has become a valuable and important crop in California, Kansas, and Oklahoma. It succeeds on many soils, but best returns are obtained on rich soils suitable for corn. Profitable yields, however, are often obtained on land too poor for corn. The preparation of the soil consists in deep plowing and fine surface pulverization to insure best conditions for the young plants, which are at first feeble and slow to grow. The seed is sown broadcast, in hills or drills after the soil becomes warm. When grown in hills or drills it is treated like corn, when sown broadcast like hay crops. When the grain is ripe the plants are cut by hand or with a corn harvester, put up in shocks, and left to cure. When curing is complete the heads are threshed for the seed and the stalks and leaves used as fodder. Frequently the entire plants are used for feeding. From 25 to 50 bushels of seed per acre and from 5 to 10 tons of fodder are obtained under ordinarily favorable conditions. Milo maize requires a longer season of growth than Kafir corn, and is therefore more liable to injury by frost in many localities. Durra, also sometimes called Egyptian corn, grows vigorously, sending out profuse stolons. The heads are heavy, short, and thick, and hang downward from a short curve in the upper part of the stalk. The name is often written dhoura or doura. Egyptian rice corn differs from other varieties in stooling little and having a smaller amount of foliage. The seeds are white, large, and sweet. Jerusalem corn produces heavy yields of grain. Its seeds are nearly free from husk and shatter easily. None of these varieties are materially affected by either plant diseases or insects. See SMUT.

The *saccharine sorghums* are favorably regarded for sirup production, for silage and soiling purposes, and for forage. Growing animals thrive upon them, and dairy cattle produce an increased flow of milk. The bagasse or refuse from the press in sirup making is also fed advantageously. According to experiments 40 per cent of the protein, 71 per cent of the nitrogen-free extract, and 42 per cent of the crude fibre of sorghum forage is digestible. About 15,000,000 gallons of sorghum sirup are produced in the United States annually.

The average composition of sorghum products follows:

AVERAGE COMPOSITION OF SORGHUM PRODUCTS

PRODUCT	Water	Protein	Fat	Nitrogen free extract	Crude fibre	Ash
	Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
Whole plant fresh	72.7	1.4	1.7	15.2	7.4	1.6
Whole plant cured	43.6	3.9	3.3	25.8	20.2	3.2
Sorghum silage	75.5	1.5	1.2	11.9	8.0	1.9
Sorghum seed	12.8	9.2	3.4	70.8	2.6	2.1
Sorghum bagasse	11.3	3.4	1.4	50.5	30.5	2.9

Although sorghum furnishes excellent pasturage for all stock, it is especially valuable for sheep and pigs, but until the animals become accustomed to it they should have only small amounts. It is best adapted for fall and early winter feeding, since it does not keep as well as many other coarse fodders. Sorghum silage has a greater tendency to develop acidity than corn. When in good condition it is an excellent feeding stuff. The seed is a concentrated feed, and quite similar in composition to shelled corn, though regarded as somewhat inferior in feeding value. When sorghum is grown for making sirup the seed heads are often fed whole; otherwise they are frequently left on the stalk and fed as forage. It is believed that grinding increases the digestibility of the seed. Since Kafir corn is the most important nonsaccharine sorghum, and since other varieties resemble it, it is taken as a type of the group. See table.

'COMPOSITION OF KAFIR CORN PRODUCTS

PRODUCT	Water	Protein	Fat	Nitrogen free extract	Crude fibre	Ash
	Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
Whole plant, green	76.4	2.4	0.7	12.0	6.6	1.9
Cured fodder, whole plant, dry	9.0	8.9	2.8	43.1	26.8	9.4
Stover-cured fodder (without heads), dry	16.3	5.1	1.7	41.2	27.4	8.3
Heads (mature)	12.4	9.6	2.9	65.2	6.4	3.5
Seed	11.8	11.1	3.0	70.1	2.3	1.7

In composition, the Kafir corn products closely resemble similar products of maize. Studies at the Kansas Experiment Station have shown that as the plant ripens there is a decrease in albuminoids, but an increase in percentage of other constituents and in total weight of the seed. It is believed, therefore, that the best time to harvest Kafir corn is when the crop is ripe or nearly so. The stover, with practically the same feeding value as corn stover, should be run through a cutting machine to obtain best results. It has been found an excellent coarse fodder for cattle. The seeds have also given very satisfactory results, though it has not been found in tests at the experiment stations to be quite equal to corn, as is sometimes asserted. To obtain the best results the grain should be ground, as otherwise the small hard seeds are not thoroughly masticated and pass through the animal undigested. According to the Kansas Experiment Station, a bushel of Kafir corn will produce 10 pounds of pork, a bushel of corn 12 pounds, an acre of the former, however, producing more pork than an acre of the latter. Animals tire of Kafir corn alone more quickly than of corn alone. Digestion experiments with chickens have shown that about 88 per cent of the total organic matter, 53 per cent of the protein, and 96 per cent of the nitrogen-free extract of whole Kafir corn is digestible. Similar values have been obtained for the ground grain. In experiments with Kafir corn stover fed to sheep about 42 per cent of the protein, 67 per cent of the nitrogen-free extract, and 54 per cent of the crude fibre was digested.

Flour, which is said to be especially good for pancakes and has also been used for bread, is ground from Kafir corn, which is, however, not extensively used as food in the United States. The seeds of the closely related durra are much eaten by the Abyssinian and other African races, and those of other nonsaccharine sorghums in India and China. Kafir corn flour or meal has the following percentage composition: Water, 16.8; protein, 6.6; fat, 3.8; nitrogen-free extract, 69.5; crude fibre, 1.1; and ash, 2.2.

Consult United States Department of Agriculture, *Farmer's Bulletin Nos. 246, 288, 322, 458, 477, and 552* (Washington, 1906–14), and E. G. Montgomery, *Corn Crops: A Discussion of Maize, Kafirs, and Sorghums* (New York, 1913). See Plate of BRAZIL NUT.

SORIA, sō′rê-ȧ. The capital of the Province of Soria, Spain, 110 miles northeast of Madrid, on the right bank of the Duero (Map: Spain, D 2). The town, still partially surrounded by thick walls, and dotted with many ancient palaces, presents a mediæval appearance. The collegiate church of San Pedro, its principal structure, has a Latin portal of the twelfth-century style. A solid mediæval bridge crosses the Duero. The town has manufactures of chocolate, leather goods, and linens. Pop., 1900, 7296; 1910, 7535.

SORITES′ (Lat., from Gk. *σωρίτης*, *sōritēs*, logical sophism formed of an accumulation of arguments). A logical term with a twofold meaning. It is the name of a series of syllogisms so arranged that the suppressed conclusion of each preceding syllogism is a premise of the succeeding; e.g., A is B, B is C, C is D, D is E, and therefore A is E. The term "sorites" is also used to designate a fallacy wherein it is argued that as the addition of each single object to a collection of objects does not change the character of the collection up to a certain point, therefore such addition can be made indefinitely without altering the character of the collection. See Logic.

SORLEY, sôr′lĭ, William Ritchie (1855–). A British moralist, born at Selkirk, Scotland. He was educated at Edinburgh University and at Trinity College, Cambridge, and held a fellowship in both places. From 1888 till 1894 he was professor of logic and philosophy at University College, Cardiff; from 1894 until 1900 served as professor of moral philosophy in Aberdeen; and in the latter year became Knightbridge professor of moral philosophy in the University of Cambridge. His works include: *Hulsean Essay on Jewish Christians and Judaism* (1881); *Shaw Fellowship Lectures on the Ethics of Naturalism* (1885); *Mining Royalties, a Report of an Inquiry Made for the Toynbee Trustees* (1889); *Recent Tendencies in Ethics* (1904); *The Interpretation of Evolution* (1910); *The Moral Life* (1911).

SORMA, zôr′mȧ, Agnes (Countess Minotto) (1865–). A German actress, born in Breslau. She appeared first in Breslau in children's rôles at the age of fourteen. From 1880 to 1882 she played in Görlitz, Posen, and Weimar, and in 1882 was engaged by the Deutsches Theater at Berlin. In 1897–98 Sorma visited the United States, where she appeared with success in Hauptmann's *Versunkene Glocke* and as Nora in Ibsen's *Doll's House.*

SOROCABA, sō′rô-kä′bȧ. A town of the State of São Paulo, Brazil, 53 miles west of the city of that name, with which it has railway communication (Map: Brazil, H 8). Coffee and sugar are produced, but the main interest centres in a live-stock fair, when the sale of horses and mules sometimes reaches 70,000. Pop., about 12,000.

SOROKI, sŏ-rŏ′kē̇. The capital of a district in the Government of Bessarabia, Russia, situated on the Dniester, 116 miles north of Kishinev (Map: Russia, C 5). It contains the ruins of an old castle and remnant of the Genoese settlement of Olchionia, which stood there in the twelfth and thirteenth centuries. The town has a library, a hospital, several schools and philanthropic institutions. Pop., 1911, 19,500, chiefly Jews and Moldavians.

SOROLLA Y BASTIDA, sô-rōl′yȧ ē̇ bȧ-stē̇′dȧ, Joaquin (1863–). An eminent Spanish figure, landscape, and portrait painter. He was born at Valencia and obtained his artistic training principally at the academy there. He also copied old masters at Madrid and in Italy, but was most influenced by his study of the works of Bastien-Lepage and the German Menzel in Paris. Sorolla first gained recognition with the well-known "Another Marguerite" (1892, St. Louis Museum) and the "Fishing Boats' Return" (Luxembourg Museum, Paris). In 1900 he was awarded the Grand Prix at the Paris Salon, after which he produced an incredible number of paintings, holding exhibitions in Paris (1906), London (1908), and at the Hispanic Society, New York (1909), probably the most popular exhibition ever held in New York. Sorolla is one of the foremost and most influential of modern Impressionistic painters. His subjects are chiefly out-of-door scenes with brilliant sunlight—landscapes, marines, fisherfolk, mothers with babies, children at play. His technique is sure and spontaneous, the presentation sincere and robust. With a comparatively simple color scheme he achieves remarkable prismatic effects. Good examples of his work include: "Sewing the Sail" (gold medals, Munich and Vienna, and now in Venice); "A Sad Inheritance" (church of the Ascension, New York); "Swimmers" (1905), "The Bath" (1905), "After the Bath" (1908), and "Beaching the Boat" (all in the Metropolitan Museum, New York, the two last named being lent by the Hispanic Society). His portraits, which include members of the Spanish royal family, the nobility, and other noted people, display forceful characterization and technical brilliancy. Good examples are those of the King and Queen of Spain and Prince Troubetzkoy at the Hispanic Society, which also possesses a number of fine landscapes and figure subjects. The Metropolitan Museum has a portrait of "Señora de Sorolla in Black." Consult *Catalogue of Paintings,* published by the Hispanic Society of America (Chicago, 1911), containing a biographical sketch and bibliography by Leonard Williams.

SOROR′ITIES. See Fraternities, *Women's Fraternities;* Women's Clubs.

SO′ROS. See Marathon.

SORO′SIS (Neo-Lat., from Gk. *σωρός*, *sōros*, a heap). The first woman's club in America, organized with 12 members in March, 1868, by Mrs. Jane Cunningham Croly, in New York City, and incorporated in January, 1869. Its object is to further the educational and social activities of women, and to bring together for mutual helpfulness representative women in art, literature, science, and kindred pursuits.

SOR′REL (from OF. *sur*, sour), *Rumex.* A genus of plants of the family Polygonaceæ. Common sorrel (*Rumex acetosa*) is a perennial herb with erect stems one to two feet high and arrow-shaped leaves, found in pastures throughout Europe. Its leaves are used as a salad and as a potherb, for which purposes it is cultivated. French sorrel, or Roman sorrel (*Rumex scutatus*), a native of France and Italy, with broad, blunt leaves, is more frequently cultivated than common sorrel, being of finer flavor. Sheep's sorrel (*Rumex acetosella*) is a smaller plant with widely spreading roots, on account of which it often becomes troublesome in dry soils. Cultivation and the addition of lime and other fertilizers to the soil quickly eradicate it. Compare Dock; Hibiscus; Oxalis.

SORREL TREE (*Oxydendrum arboreum*). A tree of the family Ericaceæ, remarkable for its size, which contrasts with its small shrubby relatives. It is found from Pennsylvania to Indiana and south to Florida, but it grows chiefly from Virginia to Georgia, attains a height of 50 feet, a trunk diameter of 12 to 15 inches, and bears peachlike acid leaves, which are sometimes used for dyeing wool black. The principal use of the tree is as an ornamental. Its wood is of little or no use.

SORREN'TO. An episcopal city in the Province of Naples, Italy, situated on a promontory on the southeast side of the Bay of Naples, 16 miles south-southeast of Naples and 10 miles west of Castellamare (Map: Italy, E 4). Its beautiful situation and mild, dry climate have made it a much-frequented resort both for summer and winter visitors, upon whom its prosperity depends. It has a cathedral, a seminary, and a marble statue of the poet Tasso, who was born here. There is a trade in the famous wine of Sorrento, and in olive oil and fruits. Sorrento was originally a Grecian colony. It was called *Surrentum* by the Romans, who embellished it with temples, the ruins of which still remain. Pop., 1911, 7124.

SORROWS OF WERTHER, vĕr'tĕr. A romance by Goethe (1774), embodying some of the author's own experiences. Just before its production Goethe was battling against unrequited love for Charlotte Buff, and was greatly affected by the suicide of a friend—a man slighted in love. Recognition of possible results in his own case led to the creation of Werther (himself) and his friend (Jerusalem), and of Lotte, typifying the object of the love of each. The romance at once created a sensation and established Goethe's fame.

SORSOGÓN, sôr'sô-gōn'. A province of the Philippine Islands, occupying the extreme southeastern portion of the island of Luzon (Map: Philippine Islands, E 4). Area, 755 square miles. It is surrounded by water on three sides, and almost cut into halves by the large Bay of Sorsogón. It is traversed lengthwise by a forest-covered mountain range culminating in the volcano of Bulusan. Sorsogón is a great hemp-producing province, its annual production averaging about 25,000,000 pounds. Copra is also a staple product. The province was created by the Philippine Commission in 1901, having previously been a district of the Province of Albay. Pop., 1903, 120,495, belonging almost entirely to the Vicol tribe. Capital, Sorsogón.

SORSOGÓN. The capital of the Province of Sorsogón, south Luzon, Philippines, at the head of the Bay of Sorsogón, 30 miles from the southeast extremity of the island (Map: Philippine Islands, E 4). The bay, which measures 6 by 12 miles, is entirely landlocked, with a narrow entrance from the Visayan Sea and is one of the best harbors in the archipelago. The town is very favorably situated near the Strait of San Bernardino on the route from Manila to the United States. Pop. (est.), 1903, 13,511.

SORTES (sôr'tēz) **VER'GILIA'NÆ.** See Bibliomancy; Sortilege.

SOR'TILEGE (ML. *sortilegium*, divination by lot). The casting of lots. This was an ancient way of distributing shares among several claimants. The choice of lots was performed in the presence of a deity, represented by his image, and accompanied with prayer and sacrifice, being often accomplished in the temple and by a priest. It was, therefore, presumed that the god determined the fall of the lots. Slips of wood, pebbles, potsherds, or arrows were drawn from a helmet, quiver, or pail, and were usually marked in some indicative manner. A favorite mode of forecasting was to open at random a sacred book and mark the passage first meeting the eye, the significance serving as a token of destiny awaiting the inquirer. As Vergil's *Æneid* came so to be used, the consultation was called *Sortes Vergilianæ*. The Scriptures were employed by Christians; the Arabs use the Koran and the Persians the poems of Hafiz. See Divination.

SOSIS'TRATUS. A founder and leader of the oligarchical party of 600, established at Syracuse in Sicily, about 20 years after the death of Timoleon. Shortly before this Sosistratus led an expedition to Italy to assist the citizens of Crotona against the Bruttii. Later, a revolution having taken place, Sosistratus was forced into exile. With others he appealed to Cleomenes, King of Sparta, for help against Syracuse, especially Agathocles, who, aided by Hamilcar, general of the Carthaginians, was now powerful in Syracuse. (See Hamilcar, 5.) Cleomenes sent his son, Akrotatus, who presently caused Sosistratus to be assassinated at a banquet. Consult G. Grote, *History of Greece* (new ed., 10 vols., New York, 1899).

SOSTEGNO, sôs-tā'nyô, Marquis di. See Alfieri, Cesare.

SOSTENUTO, sôs'tā-nōō'tô (It., sustained). A term used in music to indicate a sustained tone or a uniform rate of decreased speed.

SOTHEBY, sŭth'bĭ, William (1757–1833). An English translator, educated at Harrow and at the military academy at Angers in France. He was in the English army for a short period, but from 1780 devoted himself to letters, writing poems that fell flat, tragedies not destined to be played, and translations in which he occasionally succeeded. It is as the translator of Vergil's *Georgics* (1800) that he is to be remembered. With less success he turned into English heroic verse the *Iliad* (1830–31) and the *Odyssey* (1834).

SOTHERN, sŭth'ẽrn, Edward Askew (1826–81). An English comedian. He was born in Liverpool, and was educated for the Church, but the stage was more congenial to his tastes, and he made his début in Jersey in 1849. In 1852 he went to the United States and appeared at the National Theatre of Boston in the character of Dr. Pangloss. In 1854 he joined Wallack's company and afterward that of Laura Keene. In the character of Lord Dundreary in Tom Taylor's comedy *Our American Cousin* (1858) he made his great success. In 1864 he appeared in *David Garrick*, which was regarded as, next to Dundreary, his best part. His other chief successes were in *Brother Sam* (1865), Sidney Spoonbill in Byron's *Hornet's Nest*, and Fitzaltamont in *The Crushed Tragedian*, with which he appeared in London in 1878. Consult: Pemberton, *Memoir of E. A. Sothern* (London, 1890); C. Scott, *The Drama of Yesterday and To-day* (2 vols., ib., 1899); M. J. Moses, *Famous Actor-Families in America* (New York, 1906); William Winter, *Other Days* (ib., 1908); E. H. Sothern (q.v.), "My Remembrances," in *Scribner's Magazine* (ib., January, 1916 et seq.).

SOTHERN, Edward H. (1859–). An American actor, the second son of E. A. Sothern. He was born in New Orleans, La. In 1879 he appeared with his father in New York. His first real success was in *One of our Girls* at the Lyceum, New York, in 1885. During the next ten years his most popular plays were *The*

Highest Bidder, If I were King, The Three Musketeers, and *The Adventures of Lady Ursula.* In 1900 he appeared in *Hamlet;* and in 1904, in conjunction with Julia Marlowe, whom he married in 1911, he began a starring engagement in Shakespearean plays. He quickly took first rank among contemporary Shakespearean actors in America, appearing with great success as Hamlet, Macbeth, Jaques, Petruchio, Malvolio, Shylock, and Romeo. After the retirement of his wife in 1915 he appeared in *The Two Virtues* and in revivals. The next year he announced that he himself would retire at the end of the season, and that he and his wife would make their home in Warwickshire, England. Consult: McKay and Wingate, *Famous American Actors of To-day* (New York, 1896); Strang, *Famous Actors of the Day in America* (Boston, 1900); Wm. Winter, *Vagrant Memories* (New York, 1915); and especially Sothern's entertaining *My Remembrances* (*Scribner's Magazine,* ib., January, 1916 et seq.).

SOTO, sō'tō, Hernando (or Fernando) de (c.1500–42). A Spanish adventurer and explorer in America, born at Villanueva de la Serena, Badajoz. In 1514 he accompanied Pedrarias de Avila, his patron, to the Isthmus of Darien, distinguishing himself by daring and independence. In 1524 he joined Córdoba in the expedition to conquer Nicaragua, but remained loyal to Pedrarias when Córdoba rebelled. Leaving Pedrarias in 1528 he explored the coast of Guatemala and Yucatan, seeking for a supposed water communication between the Atlantic and the Pacific. In 1532 he was in Pizarro's expedition for the conquest of Peru, and used all his influence to prevent the murder of the Peruvian Inca. De Soto returned to Spain with a fortune and married the daughter of his former patron, Pedrarias. This was in 1536; De Soto was soon after appointed Governor of Cuba and Florida by Charles V, to whom he had advanced money. Florida had not been thoroughly explored. On May 12, 1539, De Soto sailed from Havana with nearly 600 men. Landing at Tampa Bay, May 25, 1539, he started inland on July 15. For over three years the little army of Spaniards explored the wild country, first penetrating as far north as the two Carolinas, then moving down the Alabama River, then north again, crossing the Mississippi at Chickasaw Bluffs, and finally returning southward to where the Red River joins the Mississippi. The Indians were everywhere brutally treated, the result being constant warfare. Several battles were fought, the most important near Mobile Bay, October, 1540, and, though the Spaniards were uniformly successful, yet over 200 of De Soto's men perished. He himself, worn out and discouraged, succumbed to a fever on the banks of the Mississippi, May 21 or June 25, 1542. His body was secretly sunk in the river lest the hostile Indians should get at it, and the shattered remnants of the expedition, after many further privations, succeeded in floating down the Mississippi to the Gulf of Mexico and reaching their countrymen at Pánuco.

Bibliography. A contemporary account of De Soto's expedition is the *Discovery and Conquest of Terra Florida by Don Fernando de Soto and Six Hundred Spaniards, . . . written by a Gentleman of Elvas, employed in all the action, translated . . . by Richard Hakluyt;* reprinted by the Hakluyt Society (London, 1851); and the *Narrative of the Career of Hernando de Soto in the Discovery of Florida by a Knight of Elva, etc.,* edited by Bourne (2 vols., New York, 1904); also: Garcilaso de la Vega, *Historia del Adelantado Hernando de Soto* (Madrid, 1723); Shipp, *History of H. de Soto* (Philadelphia, 1881); George Bancroft, *History of the United States* (6 vols., New York, 1883–85); Justin Winsor, *Narrative and Critical History of America* (8 vols., Boston, 1884–89); Woodbury Lowery, *The Spanish Settlements within the Present Limits of the United States, 1513–1561* (New York, 1911).

SOTTEVILLE-LES-ROUEN, sōt'vēl' lā rōō'äN'. A town in the Department of Seine-Inférieure, France, one mile south of the city of Rouen, of which it is a suburb (Map: France, N., G 3). Pop., 1901, 18,535; 1911, 18,246.

SOTTO VOCE, sōt'tō vō'chā (It., under the voice). A musical term denoting that a passage is to be sung or played very softly.

SOU, sōō (ML. *solidus,* sort of coin). A former French coin, originally of gold, then of silver, later of copper; towards the end of the eighteenth century struck in bell metal. At various times there were fourth (liard), half, two, and three sou pieces. Its value was 12 deniers (one-twentieth of a livre tournois or one-twenty-fifth of a livre parisis). The copper sou of the eighteenth century weighed 12.238 grains, and while its nominal value remained 12 deniers, it was actually worth only about two. Its coinage ceased upon the adoption of the present decimal monetary system, but the word sou is popularly applied to the five-centime piece—one-twentieth of a franc and worth about one cent.

SOUARI (sōō-ä'rē) **NUTS.** See Caryocar.

SOUBISE, sōō'bēz'. An ancient French family which became extinct in the male line in 1566, the female survivor marrying in 1575 Vicomte René II de Rohan. Two sons were the offspring of this marriage, of whom the elder was Henri, Duke de Rohan (q.v.), a celebrated leader of the Huguenots. The younger son, Benjamin, Sieur de Soubise (1583–1642), served under Maurice of Nassau in the Netherlands, joined his brother in the leadership of the Huguenots, and gained great distinction in the defense of La Rochelle (1627–28) against Richelieu. He died without issue, the title passing to François de Rohan, of whose descendants the best known was Charles de Rohan, Prince de Soubise (1715–87). He served in the War of the Austrian Succession, becoming lieutenant general in 1748. In the Seven Years' War he held important commands and led the French and Imperial forces in the disastrous battle of Rossbach (q.v.) in 1757. He was a field marshal in 1758. In the following year he became a Minister of State. After the Peace of Paris he retired from active participation in military affairs. He had the favor of Madame de Pompadour and afterward that of Madame du Barry. He died July 4, 1787, the last of his line. See Rohan.

SOUDAN, sōō-dän'. A region in northern Africa. See Sudan.

SOUFFLOT sōō'flō', Jacques Germain (1713–81). A French architect, born at Irancy (Yonne). In 1734 he went to Rome as a pensioner of the French Academy. After studying in Italy and Asia Minor he returned to Lyons, where he soon gained distinction. At this period he either constructed or collaborated in the design of every building of importance that was undertaken in Lyons. In 1749, having become a member of the Royal Academy of Architecture, he removed to Paris. In 1775 he was appointed controller of the buildings of Paris. He is chiefly noted as the architect of the Panthéon (q.v.), which has one of the finest cupolas in existence. Among his other works are the Ecole de Droit in Paris, the Hôtel Dieu in Lyons, the Hôtel de Ville in Bordeaux, and the cathedral of Rennes.

SOUFRIÈRE, sōō'frê-âr', LA. A volcano situated near the north end of the island of St. Vincent (q.v.) in the West Indies. Its height is 3700 feet. It has had three violent eruptions within the last two centuries. In 1718 there was a terrific explosive eruption which covered the whole island with débris. In 1812 another devastating outbreak took place in which a new crater was formed immediately beside the old one. During the next 90 years the volcano was dormant, the old crater being occupied by a lake. On May 7, 1902, there occurred, simultaneously with the eruption of Mont Pelée (q.v.) in Martinique, a violent outburst. The devastation of life was complete on the east and slight in other portions of the northern third of the island, and the ground covered with dust and rocks to the depth of 50 to 60 feet in some places. Two villages were annihilated and about 1350 persons killed. On September 3 there was another outburst almost as violent as the first.

SOUL (AS. *sâwl*, soul). A term which is used for at least three conceptions. In the most primitive sense the soul is conceived as a refined and intangible material being, often as a sort of diaphanous double of the physical body. In a later sense the term designates the human spirit, conceived to be an immaterial (and usually an immortal) being, which is the source of human life, intelligence, and personality. In a third sense it is used by psychologists to designate the totality of psychical phenomena connected with one individual or one body. In this sense the soul is equivalent either to consciousness considered as a whole or to those factors of consciousness which may be said to constitute the ego, but is not asserted to have any existence outside of or apart from consciousness.

By primitive man the soul was not carefully distinguished from the body; the conception was probably the result of observing the phenomena of dreams and of death. In dreams a man is conscious that he has gone to a distance and has met others, even those long dead, while his body has remained in one spot. In death his body, which has still the same appearance, has suddenly lost all power of motion and feeling. The soul has gone out of it and does not, as after sleep, come back. Beyond this primitive man does not seem to have gone in defining the soul.

The Egyptians developed very definite ideas of the existence of the soul and of its continuation after death, as the Book of the Dead shows; but its life seems to have been connected with the preservation of the body. The earliest philosophical discussions of the nature of the soul arose in India, where the writers of the Upanishads consider the soul (Atman) to be the principle of life, and to be of the same nature as the supreme Atman. Various theories arose in the later schools of philosophy, the most influential of which, the Vedanta, regarded the soul as a manifestation of the Supreme, and as having no reality except the reality of the single Supreme soul. In this pantheistic sense soul, while the principle of life, has no independent existence. Early Hebrew thought presents the ordinary primitive ideas of the soul as the principle of life, the seat of desires and passions, but laid no special emphasis upon its continuance after death. A trichotomy of body, soul, and spirit appears among the later Jewish and early Christian thinkers, in which "body" (σῶμα) is the material, "soul" (ψυχή) and "spirit" (πνεῦμα) the spiritual part of the human personality; but the tendency is to resolve this threefold division into a dualism in which body and soul are joined against the spirit. This part was regarded as having absolute worth, inasmuch as it is the seat of the divine spirit, and is opposed to the "flesh" (σάρξ), i.e., to human nature in estrangement from the divine.

We find a gradual distinction between body and soul in the history of Greek thought. In Homer the soul is a kind of image of the body (εἴδωλον), which escapes in death through the mouth or through an open wound. All natural objects are supposed to have souls. Anaxagoras (born 499 B.C.) was the first of the Greek thinkers to formulate the distinction in question in his theory of intelligence (νοῦς), which, he contended, is different from body because it is simple, mixes with nothing, is never passive, is infinite, and has absolute power over matter. Socrates added to this theory of Anaxagoras the idea of the good, which he regarded as equivalent to the absolute or God. The deeper reflection of Plato and Aristotle naturally discloses more satisfactory evidence of positive ideas. Plato in particular was much influenced by his general metaphysical theory. Thus in the *Timæus* he teaches that the soul is one of many modes of "the one and the many," by which he means the absolute mind and the phenomenal world of related things ruled by the *demiurgus*. According to Aristotle the soul is the formal, efficient, and final cause (ἐντελέχεια πρώτη) of the body (*De Anima*), the unity of three kinds of causality; and he distinguishes three kinds of soul, the vegetable, the sensitive, and the intellectual, which respectively represent the spiritual life of plant, animal, and human beings. As the "final cause" of the body, man's soul cannot be indeterminate; it must have individuality to organize it, direct its movements, and lead it to its true end. Here we approach very near to the modern conception of the soul as an individualized, self-conscious, self-determining reality; but not quite, for this idea was not fully attained by Greek thought.

Among the early Christian philosophers we find a mixture of Greek and Christian ideas. The writings of the Apologists, the Church fathers, particularly Clement of Alexandria and Origen, while they do not reveal any systematic doctrine of the soul, are replete nevertheless with the keenest insight. Anticipating Descartes, Augustine maintained that it is impossible for thought to be an attribute of that which does not think; even if I doubt, the doubt itself must be an act of the soul and therefore a real fact of spiritual significance. If the soul were corporeal, its functions would be limited to the perception of body; but now it has the power of reflection, of knowledge, of love, and is, above all, conscious of itself, and therefore cannot be an attribute of extended substance merely (*De Trinitate*). The theories developed under scholasticism are for the most part adaptations of the later Greek ideas to the necessities of Church doctrine and authority.

Descartes brought reflection back from scholastic metaphysics to the subjective side of the problem. Descartes discovered, as Augustine and William of Auvergne before him, that to doubt the existence of the soul is to contradict one's self; for doubt is a mental fact, and as such has reality. I think, therefore I am (*cogito, ergo sum*). If it be replied that my thinking does not imply reality then the reply is: God cannot deceive us, and His omnipotence can realize everything we conceive; therefore every *clear* and *distinct* idea we have must be real, and since I have a clear and distinct idea of myself and of my body in their distinction, it follows that soul and body are distinct and may exist without each other. Thought and extension are two attributes, and it is thought alone which it is impossible for us to doubt. Thus body and soul are left opposed to each other, so far, at any rate, as man is concerned. Spinoza sought to obtain a unity of the two (thought and extension) and formulated the conception of an underlying soul substance which, as God, differentiates itself in infinite and eternal modes or attributes, characterized under the categories of thought and extension. Leibnitz, not satisfied with the pantheism of Spinoza, sought, in his theory of atoms or monads, to retain the rights of finite personality and things and yet to avoid the crude dualism of Descartes. All things have souls according to Leibnitz; the world consists of an infinite number of them, in all degrees of perfection. If we ask for the nature of their life, inner experience reveals to us an active, real force, viz., our souls, and this is the type of all substance; so that in the world both kinds of reality, thought and extension, consist of perceiving soul life. With this view may be compared that of Berkeley, who carried idealism to its extreme expression in his dictum that the being of things is in their being perceived (*esse = percipi*).

The Empiricists, Hobbes, Locke, Hume, and Mill, developed their views of the soul along the lines laid down by Bacon. Hobbes is openly materialistic; but he is offset by the cautious psychology of Locke, who finds that inner feeling undoubtedly gives us the consciousness of self, though not the substance which underlies it, which is an unknown quantity whose real existence we can neither dogmatically affirm nor deny. These ideas Hume carried to their logical conclusion by denying any existence to the soul as a real or permanent subject: the only reality we know is the phenomenal stream of impressions and ideas. It was the merit of this analysis of Hume that it finally woke up Kant, whose views have greatly influenced recent thought. By an analysis of the human reason Kant sought to show that the real significance of the soul consists in the moral or practical activity, which an accurate knowledge of the laws of thought could do nothing successfully to overthrow. If the system of Kant caused a theoretical schism between the reason as the knowing activity and the will as the moral activity, the reflections of Fichte, Schelling, and Hegel, together with the labors of the modern school of psychology, have done much to heal the breach. On the whole, therefore, we may say that the hypothesis of a soul seems to be demanded both as a ground of the unity of self-consciousness and also of the universe.

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SÖUL. See Seoul.

SOULE, sōl, Gideon Lane (1796–1879). An American educator, born at Freeport, Me. He studied at Phillips Exeter Academy in 1813–16, and graduated from Bowdoin College in 1818. Nearly all of the remainder of his life was passed at Exeter as teacher and principal. This latter office he held from 1838 until 1873. The school under his management took a high rank among American preparatory schools.

SOULE, Joshua (1781–1867). A bishop of the Methodist Episcopal Church South, born at Bristol, Me. He began to preach at the age of 17 and was admitted to the New England Conference in 1799. He was elected book agent in 1816, and during his incumbency founded and edited the *Methodist Magazine*, since developed into the *Methodist Review*. He became Bishop in 1824. When the church divided in 1845 he adhered to the southern section and continued in the bishopric. Consult H. M. Dubose, *Life of Joshua Soule* (Nashville, 1911).

SOULÉ, sōō'lā', Pierre (1802–70). A French-American statesman, born at Castillon, France. He was trained for the priesthood at Toulouse, and afterward studied at Bordeaux. He was involved in a conspiracy against the Bourbons in 1817, and for some time took refuge in Béarn. Later he was permitted to return to France, but in 1825 was sentenced to imprisonment for articles in a radical newspaper reflecting on the ministry. He escaped and settled in New Orleans. There he was admitted to the bar. In 1847 he was appointed to the United States Senate to fill a vacancy, and was elected for the full term in 1849. He represented extreme Southern views, and was prominent in the debates on the compromise measures of 1850. President Pierce appointed him Minister to Spain in 1853. He favored the insurrection in Madrid in 1854 and united with Buchanan and Mason in the Ostend Manifesto (q.v.) of October of the same year relating to the annexation of Cuba. He returned to the United States in 1855. Soulé at first opposed the secession of Louisiana, but afterward joined the secessionists, and was arrested in 1862 for disloyalty and imprisoned. He was released on condition of leaving the country, but ran the blockade at Charleston, and for a short time served on the staff of General Beauregard. In 1863 he went to Havana, but after the close of the war he returned to New Orleans, where he died.

SOULIÉ, sōō'lyā', Melchior Frédéric (1800–47). A French dramatist and novelist, born at Foix. He was expelled from the law school in Paris for his radicalism. In 1824 he published poems, *Amours français*, and in 1828 his drama *Roméo et Juliette* was produced at the Odéon. In 1832 his play *Clotilde* was performed, followed by other successful pieces, the best known of which is perhaps *La closerie des genêts*

(1846). Among his novels may be cited *Les deux cadavres* (1832), *Mémoires du diable* (1837–38), *Le maître d'école* (1839), *Eulalie Pontois* (1842), and *Saturnin Fichet* (1847–48). Consult Champion, *F. Soulié, sa vie, ses ouvrages* (Paris, 1847).

SOULOUQUE, sōō'lŏŏk'. Emperor of Haiti. See Faustin I.

SOULT, sōōlt, Nicolas Jean de Dieu, Duke of Dalmatia (1769–1851). A French marshal, born at Saint-Amans-la-Bastide, Department of Tarn. He entered the army as a private in 1785, and became general of brigade (1794) for his conduct at Fleurus. In the retreat after the defeat of Stockach (March 25, 1799) he prevented the annihilation of the French army. Appointed general of division (April 21, 1799) under Masséna, whom he ably seconded in Switzerland and Italy, he was afterward appointed by Napoleon to a colonelship of the consular guards and became an ardent supporter of the First Consul. He was created marshal of France in 1804. He achieved success in the campaign against the Austrians, especially at Austerlitz (Dec. 2, 1805), where he pierced the Russian centre. Soult did good service in the Prussian campaign of 1806, fought at Eylau in 1807, and then was appointed Governor of Berlin and created Duke of Dalmatia. He was next placed at the head of the Second Corps in Spain, pursued the retreating British forces under Sir John Moore, attacked them at Corunna (January, 1809), and, though repulsed, forced them to abandon their munitions of war. He occupied Oporto and northern Portugal, but Wellesley's arrival made him retreat. In September, 1809, he became commander in chief in Spain, gained a victory at Ocaña on November 19, and the following year subdued Andalusia. In attempting to succor Badajoz, he was defeated by Beresford at Albuera (May 16, 1811). After the battle of Salamanca and the British advance on Madrid, Soult, his plans rejected for transferring the theatre of war to Andalusia, demanded and obtained his recall. In 1813 he fought in Germany, but when the news of French defeat at Vitoria reached Napoleon Soult was restored to the command of the army of Spain. Later, in France, by a system of able military tactics he neutralized the strategy of Wellington, and reduced the seven months' campaign to a trial of strength. After the entry of the allies into Paris, he unsuccessfully opposed Wellington at Toulouse on April 10, 1814. He became a Royalist after the abdication of Napoleon, and was made Minister of War; on the return of the Emperor from Elba he abandoned Louis XVIII and joined the Imperial army. After Waterloo he was banished and not recalled till May, 1819. He was finally restored to his honors, and took an active part in politics. In 1827 he was created a peer of France, and under Louis Philippe repeatedly held high offices. In 1845 he retired from active duty, and in 1847 was honored with the appointment of marshal-general of France, passing his last years at his residence of Soultberg, near Saint-Amans.

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SOUMET, sōō'mā', Alexandre (1788–1845). A French poet who belonged to the first group of Romanticists. He tried to combine classicism and romanticism and failed to produce a really great work. At different times he held various government positions. Besides several dramas, of which the best known were *Clytemnestre* and *Saül* (1822), he wrote an elegy, *Pauvre fille* (1814), and *Jeanne d'Arc* (1825), and his most pretentious work, a long poem entitled *La divine épopée*. He was elected to the Academy in 1824.

SOUND. See Acoustics.

SOUND, Recording of. See Phonograph.

SOUNDING LEAD. See Lead, Sounding.

SOUND, Reproduction of. The recording of sound, first realized by Leon Scott in the phonautograph constructed in 1855, and then developed by Cross, König, and other physicists, was naturally the forerunner of all attempts at reproduction which were realized in practical form in the telephone (q.v.), the phonograph (q.v.), and the various machines developed from this fundamental idea. Reproduction of sound depends on the impulses communicated to the air by a vibratory diaphragm which may be set in motion either electrically, as in the case of the telephone, or mechanically, as in the phonograph in one of its various forms. The response of the vibratory diaphragm to the variations in pitch and amplitude of the original sound vibration naturally conditions the faithfulness of the reproduction, and the nature of the diaphragm and its mounting have been the subject of unceasing study by experts of telephone and phonograph companies. When the movement of the diaphragm must be effected by an electric current, then a sheet of iron must be employed so that it will be attracted towards the poles of an electromagnet, depending of course on the variations in the intensity and frequency of the varying currents. On the other hand, if the movement of the diaphragm is effected mechanically, as through the agency of a needle which is in contact with a moving surface indented or otherwise marked, then the diaphragm can be of mica, glass, or other material which will vibrate according to the stimulation it receives through the needle.

In connection with the reproduction apparatus the stylus that traverses the record proof of the disk or cylinder of the phonograph must be considered. It will be recalled that, in a record designed for a cylinder or a disk where the wave line is recorded up and down in a vertical plane, the curve is U-shaped and varies in depth, whereas, if the curve is in a lateral direction, it is V-shaped and extends in a wavy direction along its spiral path. In the first type of instrument a diamond or sapphire point is used with the stylus, as it fits in the U-shaped curve, being ground to a spherical point. On the other hand, in the disk record the record is made laterally, and for reproduction a steel needle is employed, and it should be used but once and then discarded, as it wears itself and then damages the record. Such a needle, used for a second time, not only injures the record, but prevents the best results being obtained, as the needle itself becomes worn and has too long a base bearing for satisfactory tone rendering. In some of the modern machines, in most of which the resonance horn has been replaced by a sonorous cabinet of wood, the reproducing apparatus is arranged so that, by a transfer of sound-box mechanism, the machine can be made available for records with either lateral or vertical undulations, playing either with equal facility. See GRAMOPHONE; GRAPHOPHONE; PHONOGRAPH, and bibliography there given.

SOUND, SOUNDING (probably from Lat. *sub*, under + *undare*, to undulate). The operation of ascertaining the depth of water. In shallow waters (less than 20 fathoms) the depths are ascertained with the lead and line (see LEAD, SOUNDING); in greater depths the deep-sea lead and line are used or else a sounding machine. Beyond a depth of 200 fathoms soundings are not used for the purpose of navigating vessels; but "deep-sea" soundings are taken in all depths in order to ascertain the shape and character of the ocean bottom and its organisms, living and dead. See DEEP-SEA EXPLORATION.

Few attempts to ascertain the depth of the ocean were made before the beginning of the nineteenth century, and it was not until about 1850 that the investigations were at all systematic. The disadvantages under which earlier expeditions labored were such as to preclude not only rapid but reliable work. For the lines rope of ordinary character was used, and the sinkers employed were generally too light. The weight of the rope after it became water-soaked was great, and its bulk, with that of the reels, very troublesome. Inadequate sinkers caused the line to run out very slowly, and the reeling in was both laborious and tedious. Many soundings were made from boats, which still further reduced the speed, especially that of preparing to cast and of reeling in. The first attempt (so far as known) to use wire for the line was that of the well-known exploring expedition sent out by the United States Navy Department in 1838. The wire was of copper, about $\frac{3}{32}$ of an inch in circumference, with soldered and twisted splices. Owing to lack of appliances for handling, it always broke at 500 to 1000 fathoms, and its use was abandoned. In August, 1894, Captain Barnet, R. N., made a sounding in 2000 fathoms with iron wire. This also broke, and no more attempts with it were made. Three months later, Lieut. J. C. Walsh, U. S. N., in the United States schooner *Taney*, tried to use steel wire, but his efforts were unsuccessful, the wire being too large and the sinkers too small. He reported soundings of 5700 fathoms and no bottom, but the depth was actually less than half as great.

Much work continued to be done with rope lines both before and after these experiments, but especially afterward. In 1840 Captain James F. Ross first noted time intervals in sounding; he also used heavy sinkers, and his results were exceedingly accurate for those days. The question of time intervals was taken up and perfected by Lieutenant (afterward Admiral) Taylor, and other officers of the United States navy, and their observations were of great importance in determining the accuracy of deep-sea work before the invention of the Thomson sounding machine. For a time the United States Navy Department abandoned the use of both wire and rope, and, at the instance of Lieutenant Maury, adopted waxed flax twine, weighing only nine pounds to the statute mile. Between 1851 and 1853 much of the Atlantic was explored by United States vessels and hundreds of soundings taken (using the twine mostly) with fairly accurate results, though, as no specimens of the bottom were obtained, they were open to question. In 1853-54 Passed Midshipman J. M. Brooke, U. S. N., brought out his cup and detachable sinker, which enabled specimens of the bottom to be obtained while using a heavy weight to keep the line taut when running out. Brooke also developed his table of "standard casts" utilizing the time interval and weight of line out and much improved the sounding apparatus.

The Civil War put an end to the deep-sea work of the United States navy for many years, but it was carried on most successfully by the British, especially by Captain (afterward Admiral) F. P. Shortland, who improved the Brooke sounding machine, and was one of the first to enunciate the important rule in regard to tension on the line: "A sounding line should not be permitted to run free, but should be resisted by a force equal to the weight in water of a length of the line equal to the depth to be determined." The success of the Brooke device and its modifications in bringing up specimens of the bottom and its organisms attracted the attention of naturalists and geologists, and dredging in great depths was attempted. The results of the early (1867-69) work of Count Pourtales under the direction of the United States Coast Survey brought about renewed interest by showing, as Pourtales says, "that animal life exists at great depths in as great an abundance as in shallow water." In 1872 the British government fitted out the celebrated *Challenger* expedition (q.v.) for investigating everything connected with the ocean depths. Although Sir William Thomson had invented his sounding machine and submitted it to the British Admiralty months before the *Challenger* was ready, it was rejected for imperfections which might have been easily corrected, and the *Challenger* sailed with her antiquated outfit of sounding material, whereby time was lost as well as space for supplies and specimens. The United States ship *Tuscarora* under Captain Belknap sailed from San Francisco only four months after the *Challenger*, but the United States Navy Department was wise enough to supply her with one or more Thomson machines in addition to the ordinary rope outfit. The new machines were easily brought into working shape by the *Tuscarora's* officers, and after a few trials entirely superseded the old apparatus. Since that time all deep-sea work has been done by machines, and thousands of soundings have been taken to determine the location for submarine cables which have now become so numerous.

The Thomson sounding machine is of two types, deep-sea and coasting. The latter is now used by nearly all large steamers and by many small ones. It consists of an iron-braced wooden framework or casing which incloses a steel drum about 18 inches in diameter and three inches thick. The disks forming the sides of the drum project beyond the circumference, forming a broad, deep groove for carrying the wire (3-stranded galvanized wire rope is now generally used). On each side are cranks for winding in, and on one side there is a friction brake and clutch, while on the other there is a dial, showing the number of fathoms (0 to 200) out, which is operated by gearing from the axle of the drum. The sinker consists of a lead of the usual shape, weighing about 22 pounds, through which is thrust an iron rod, the whole sinker being 46 inches long from bottom of lead to top of rod. The wire rope is made fast to a fathom or two of small soft line, which is secured at the other end to an eye in the upper end of the sinker rod. The manner of obtaining the depth is independent of the length of wire out, and the depth is registered by means of a Thomson chemical tube, a Tanner-Blish tube, or the depth recorder. The Thomson tube is a slender glass tube, about two feet long, closed at one end, and filled with chromate of silver. It is placed in a slightly larger brass tube, which has holes in it to admit the sea water freely and is lashed to the sinker. The machine is installed near the stern or on the ship's rail. To sound, the sinker is lowered over the stern, the line dropped in a fair leader to insure free running, and when all is ready the brake is tripped by a movement of the crank. The sinker drops rapidly to the bottom and the moment it reaches it the line slacks perceptibly and the reel is stopped. The line is then reeled in. If the Thomson tube is used, it is removed from the brass receptacle and laid against a special scale. The sea water has forced itself in the open end to a distance depending upon the pressure (i.e., the depth); as far as it reaches the chemical in the tube is discolored, and this point falls abreast the division of the scale which corresponds to the depth of water. Since the measurement is independent of the amount of wire out, the sounding may be taken with the ship going at full speed if the depth is not too great. The Tanner-Blish is similar to the Thomson tube, except that it contains no chemical. If the tubes are kept carefully dried the distance the water has risen is easily noted; and by redrying the tubes they may be used over and over again. The depth recorder works on a similar principle, and is attached to the sinker in the same way. The pressure of the water acts against a piston which compresses a spring and carries a sliding index. When the pressure is slacking the piston returns to its initial position under pressure of the spring, but the index remains at the point of the scale to which it is pushed, so that the depth is read off at once.

The Thomson sounding machine for great depths is similar to the small one, but has a special form of brake which adjusts the tension in accordance with Captain Shortland's rule, and has of course a much greater length of line. The Sigsbee machine is much used in the United States navy. It differs from the Thomson chiefly in having an automatic spring governor to ease the strain on the wire due to the motion of the ship; though there are other points of dissimilarity. It is the invention of Admiral C. D. Sigsbee, of the United States navy, who did much deep-sea, depth, and current work in the Atlantic and Gulf of Mexico. See BATHOMETER; DEEP-SEA EXPLORATION; HYDROGRAPHY; OCEANOGRAPHY.

SOUP-FIN SHARK. See OIL SHARK.

SOURES, GEORGE. See ROMAIC LITERATURE.

SOUR GUM. See BLACK GUM; GUM TREE.

SOUR SOP. See CUSTARD APPLE.

SOUSA, sō′zȧ, FREI LUIZ DE (MANOEL DE SOUSA COUTINHO) (1555–1632). A celebrated Portuguese monk and a writer of polished prose. He belonged to the powerful family of Sousa Coutinho. Without finishing his studies at the University of Coimbra, he joined the Order of Malta, saw service against the Moorish pirates in the Mediterranean, and was sent a prisoner to Argel. After reaching home again he spent the years 1584–99 quietly in literary pursuits and military duties; but national disasters drove him into exile for some years, and domestic sorrows finally (1613) led him to join the Dominican Order. His principal works are the *Historia de S. Domingos* and *Annaes d'el rei D. João terceiro*. Consult Sousa Viterbo, *Manoel de Sousa Coutinho* (Lisbon, 1902).

SOUSA, sōō′zȧ, JOHN PHILIP (1854–). An American bandmaster and composer. He was born in Washington, D. C., and was educated there. He held the position of bandmaster of the United States Marine Corps at Washington from 1880 until 1892, and during that period made the organization one of the finest military bands in America. In 1892, in conjunction with David Blakely, he formed the organization now known as Sousa's Band, with which he toured the United States and Europe. In 1910–11 he made a tour of the world, meeting with phenomenal success everywhere. During the season of 1915–16 he played at the New York Hippodrome. His compositions, both operatic and instrumental, have been eminently successful. His ability as a composer of marches soon secured for him the popular title of "The March King." His compositions include the following operas: *The Smugglers* (1879), *Désirée* (1884), *The Queen of Hearts* (1886), *El Capitán* (1893), *The Bride Elect* (1897), *The Charlatan* (1898), *Chris and the Wonderful Lamp* (1900); five suites; a symphonic poem; and numerous stirring marches, which have become immensely popular. His collection of arranged "National, Patriotic, and Typical Airs of All Countries" has been officially adopted by the United States Navy Department, and is in the collection of service bands throughout the civilized world.

SOUSA, sō′zȧ, or **SOUZA,** MARTIM AFFONSO DE (c.1500–64). A Portuguese colonizer and administrator, born at Bragança, Province of Trasos-Montes. In 1530 he was sent with five ships and a force of 400 to explore the coast of New Lusitania (Brazil), of which he was appointed Governor, and to found there a colony and distribute land. It has been said that he was the discoverer of the bay which he entered on Jan. 1, 1531, and which, supposing it to be a river, he named Rio de Janeiro. (The same story is told in connection with the supposed discovery by André Gonçalves, on Jan. 1, 1502.) Sousa surveyed the coast, and on Jan. 22, 1532, founded on São Vicente Island, near the present Santos, the first Portuguese colony in Brazil. The Colony of Piratininga, the present São Paulo, on the bank of the Piratininga River, was founded under his direction. In 1533 he returned to Portugal, where he received São Vicente, the foremost of the captaincies into which Brazil was divided. This he ruled as absentee proprietor.

SOUTER, sou′tẽr, ALEXANDER (1873–). A British classical scholar, born at Perth, Scotland. He was educated at Robert Gordon's College, Aberdeen University, and Gonville and Caius College, Cambridge. At Aberdeen University he held various positions, after 1911 being regius professor of humanity and after 1913 lecturer in mediæval paleography. In

1903–11 he served as Yates professor of New Testament Greek and exegesis at Mansfield College, Oxford. Besides editions of Robert Ogilvie's *Horæ Latinæ* (1901) and, with George Middleton, of Livy, Book XXVIII (1902), he published: *De Codicibus Manuscriptis Augustini Quæstionum* (1905); *A Study of Ambrosiaster* (1905); *The Commentary of Pelagius on the Epistles of Paul* (1907); *Novum Testamentum Græce* (1910); *Text and Canon of the New Testament* (1913).

SOUTH, Sir James (1785–1867). An English astronomer, born in Southwark. He was a member of the College of Surgeons and displayed great professional abilities, but later inclined to astronomy. In conjunction with the younger Herschel (q.v.) he undertook a series of observations which were presented to the Royal Society in a memoir containing micrometrical measurements of 380 double stars, and confirming the elder Herschel's inferences regarding orbital motion. For this he received the gold medal of the Astronomical Society in 1826. In the same year he was also awarded the Copley medal of the Royal Society. In 1835 he removed his observatory to Passy, near Paris. Here he made a series of observations on 458 compound stars, of which 160 were new, and convinced Laplace of the reality of revolving stars. South was one of the founders of the Astronomical Society and its first president. He was knighted in 1830. He observed Encke's comet (1828 and 1838), Mauvais's (1844), and Vico's (1845). His observation of a sharp occultation by Mars of a small star in Leo disproved the existence of an extensive Martian atmosphere.

SOUTH, Robert (1634–1716). An Anglican preacher, born at Hackney. In 1663 he was promoted to a prebendal stall at Westminster, and in 1670 became a canon of Christ Church, Oxford, and was later chaplain in ordinary to Charles II. When the revolution of 1688 was accomplished he gave his adhesion to it, but refused preferment. A stanch adherent of the Church of England, he waged unsparing war against Romanism and against Puritanism and other forms of dissent. He is now chiefly remembered by his sermons, masterpieces of vigorous sense and sound English, abounding in lively and witty matter. The best edition of his sermons is that by W. G. T. Shedd (New York, 1866–71), with a memoir. Consult also W. C. Lake, "South the Rhetorician" in *Classic Preachers of the English Church* (London, 1877).

SOUTH, University of the. An institution for higher education founded at Sewanee, Tennessee, in 1857 under the auspices of the Protestant Episcopal church in the South. A tract of 8000 acres was secured as a site, $500,000 was subscribed for an endowment fund, and the corner stone of the central building was laid just previous to the Civil War. At the end of the war the pledges of the endowment could not be realized, but funds were secured to begin the institution on a small scale, and it was opened in 1868 with a grammar school and an academic department. A theological department was opened about 1878, a medical department in 1892, and a law department in 1893. The two latter were discontinued in 1910. The college domain, mostly covered with virgin forests, is situated on a plateau of the Cumberland Mountains, about 100 feet above the surrounding valleys. The permanent buildings, 12 in number, stand in a reserve of 100 acres, and are valued at $800,000. The degrees conferred by the university are B.A. (20 courses), M.A. (15 courses), B.C.E., C.E., and in theology, B.D. The work is mostly prescribed. All students who have passed a certain number of university examinations, and are of sufficient maturity in age and character are formed into a body of gownsmen, distinguished by the academic dress, and enjoy certain privileges and immunities. In 1915 the faculty numbered 26, and the student body 273. The library contained 41,000 volumes. The president in 1916 was Right Rev. A. W. Knight, D.D.

SOUTH AFRICA. The part of Africa south of the Zambezi River; an area with so much in common in the character of the physical features, the climate, and the circumstances determining the economic development that it is conveniently considered a distinct unit. With an area of 1,100,000 square miles and a seaboard of more than 3000 miles, it is commercially a single trade region. Its collective commerce is known technically as the "Cape trade." The colonies and protectorates which are wholly or in part in South Africa are: Portuguese East Africa, German Southwest Africa, and the British possessions, the Union of South Africa comprising the provinces of the Cape of Good Hope, Natal, the Orange Free State and the Transvaal, the Bechuanaland Protectorate, Basutoland, and Rhodesia (Southern) (qq.v.).

Topography. The coasts, like those of the rest of Africa, are chiefly straight and unbroken. They are deficient in harbors and thus beaten by never-ceasing ocean surf. The west shore is different in aspect from the south and east, it being low and sandy and the lands behind are barren and dismal. The south and east shores, though on the whole as regular and unbroken as the west coast, are attractive in appearance, with evergreen slopes, picturesque bays, and wooded kloofs. All west coast ports are roadsteads excepting Saldanha Bay, a splendid natural harbor but lacking a hinterland and therefore undeveloped, and Cape Town, which, at enormous expense, has been made safe for shipping. On the south coast Port Elizabeth and East London have been made available for large trade by artificial improvements, but the strong southeasterly summer winds often prevent large ships from lying alongside the ends of the piers, especially at the former port. The east coast has in Delagoa Bay the only first-class harbor in Africa, and one of the finest in the world. The port of Durban on this coast has been rendered good artificially, and the port of Beira and the Chinde branch of the Zambezi delta are also available for large shipping. Most of the interior of South Africa consists of high plateaus, elevated so far above the sea level that the influences of the temperate zone are extended hundreds of miles to the north of the Tropic of Capricorn. The high elevation of the most of South Africa is the chief element in its geographic unity. It is estimated that the area of the region which, in respect of temperature, is well adapted to become a home of the white race, is one-fifth as large as the area of the United States (exclusive of Alaska).

The rise of the surface from the coast of all South Africa to considerable altitudes in the interior is rapid. From the western half of the south coast, the ascent is made in well-marked terraces, the innermost of which form table-lands of 3000 feet or more in height, known as Karroos. The Southern Karroo and the Bokkevelt are 1000 to 2000 feet high. Next come the Great Karroo (average, 3000 feet); then the loftiest of the Cape plateaus, the Northern Karroo (2700 to 6000 feet); then the diamond fields country and the wide plains of the Orange Free State Province (4000 to 5000 feet); the still more extensive plateau of the Transvaal (5000 to 7000 feet); and the more diversified uplands of the Matabeleland and Mashonaland region at a little lower level, sloping gradually to the plain of the Zambezi. In the west the irregular highlands of Damaraland and Namaqualand rise steeply from the Atlantic coast plain, and merge indefinitely with the vast central plains of Bechuanaland and the dreary expanse of the Kalahari Desert, once the floor of an inland sea and now about 4000 feet above the sea level. In the east and southeast the lowlands of Portuguese East Africa and the coast plain and plateau of Natal are skirted inland precipitously by the mighty rampart of the Drakensberg and other ranges that wall the lofty interior plateaus. Many of the mountains at the edge of the plateaus or rising within them have an altitude of 6000 to 10,000 feet. The culminating points appear to be the Montaux Sources (11,150 feet), Cathkin Peak (12,000), and Giant's Castle (11,000).

Hydrography. The Zambezi alone is important for navigation although it is interrupted by falls and its mouth is checked with sand. The Orange is the only other river of any length but is navigable only a few miles up. The smaller rivers are not navigable excepting the Buffalo River, which with great difficulty has been made available for ocean steamers to East London, near its mouth. The Zambezi is navigable for about 260 miles from the sea. The north central portion of the region is an area of interior drainage; the waters disappear in many "salt pans," where evaporation leaves an incrustation of salt on the surface.

Climate. There are only two seasons: summer (October to March) and winter (April to September). Except in the south and east coastal regions the low average of atmospheric humidity is a marked characteristic. Pulmonary invalids from Europe prolong their lives in the dry, bracing air of the plateaus. January is usually the hottest month, with average maximum temperatures of 82° F. to 100° F. July is usually the coldest month, with temperatures ranging from 20° F. to 10° F. The Transvaal Province, although partly within the tropics, stands so high above the sea that the mean annual temperature is only 68.64° F., or only about 6.30° above the mean summer temperature of England. Although entirely within the tropics, the annual temperature range in Matabeleland and Mashonaland is from 36 to 86 degrees, so that these regions are by no means tropical. The Zambezi valley and Portuguese East Africa are low, moist, and very unhealthful. More than half of South Africa is deficient in rainfall. The semiarid region includes the entire western half of the country, which is dry because South Africa depends for most of its rain upon the winds of the Indian Ocean, and the east coastlands and highlands receive the larger part of the precipitation, as the winds move westward. The Great Karroo and Great Namaqualand have less than 6 inches of rain in the year. With the exception of the Portuguese coastlands and the Zambezi belt, South Africa is one of the most healthful and salubrious regions in the world.

Flora. The veldt and the karroo are the distinctive features of South Africa. The word veldt (= field) is applied to the enormous areas of rolling pasture lands found in the provinces of the Cape of Good Hope, the Orange Free State and the Transvaal, and parts of Bechuanaland, covered with rough scrubby grass, mimosa, acacia, and other bushes; also to the herbage itself, as the sweet veldt and the sour veldt. The name karroo is taken from the little karroo plant, relished by sheep and goats and the best kind of bush for the domesticated ostrich. The largest tract of karroo is a region about two-thirds as large as Scotland, in the interior of the Cape of Good Hope Province. All South African plains and plateaus that are intermediate between the grass and bush-covered veldt and absolute desert are karroos. Both the karroo and the Kalahari desert need only the rain that sometimes falls on them to be quickly clothed with grass and shrubs. The plant life common to deserts and the vegetation of the veldt and the karroo are the distinctive features of the flora; to which are to be added the tropical vegetation which girdles South Africa along its low, hot north and east fringes, and the belt of European flora, including the northern cereals and the vine, across the south end of Africa.

Fauna. The animal life is perhaps matchless, and is certainly unsurpassed. It includes the lion, elephant, hippopotamus, rhinoceros (black and white), buffalo, zebra, numerous varieties of antelope, the giraffe, wart hog, hyena, and jackal. Slaughter of wild animals has been ruthless all over the settled parts of the country, but there are still wide areas known as "sportsmen's paradises." In the Cape of Good Hope Province is the greatest centre of ostrich farming, and during 1912 a yield of over $10,000,000 in feathers was realized.

For further information, see the component parts of South Africa; also Union of South Africa.

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SOUTH AFRICA, Union of. See Union of South Africa.

SOUTH AFRICA COMPANY, British. See Rhodes, Cecil; Rhodesia.

SOUTH AFRICAN REPUBLIC. A former republic of South Africa, since 1910 a province (the Transvaal) of the Union of South Africa. See Transvaal.

SOUTH AFRICAN WAR. The conflict for supremacy in South Africa between Great Britain and the Boer republics of the Transvaal and the Orange Free State from 1899 to 1902. For the causes that led to the struggle and the diplomatic negotiations preceding its outbreak, see Transvaal. The following account deals exclusively with its military operations and the terms of peace at its end. On the outbreak of war, Oct. 11, 1899, the British strength in South Africa comprised a body of about 12,000 men in Natal; 2500 at Kimberley, on the western frontier of the Orange Free State; 1000 at Mafeking, on the Bechuanaland border; and about 1000 on the Rhodesian frontier. The railway crossings on the Orange River and the northern part of Cape Colony were guarded by some 5000 men. The number of Boers mobilized on the Natal frontier in early October, 1899, was about 20,000. On the day following the declaration of war Transvaal and Orange Free State forces entered Natal. Laing's Nek and Ingogo Heights, in the extreme north of the colony, were seized and the Boers pressed down the Durban railway and attacked the British line from Ladysmith to Dundee. On October 20 the British drove a Boer force from Talana Hill, near Dundee, and the next day they routed the Boers at Elaandslaagte, but on October 30 they met a serious reverse at Nicholson's Nek, and by November 2 the Boers, under Petrus Joubert (q.v.), had completely invested Ladysmith, which was held by about 9000 troops under Sir George White. At the same time Kimberley was besieged by a Boer force of 6000 under Prinsloo, and 1000 British under Colonel Baden-Powell were locked up in Mafeking by Cronje (q.v.) with 6000 men. The early progress of the war aroused alarm in Great Britain, and preparations were made for carrying on a struggle which now appeared to be of a serious nature. Large reënforcements were dispatched to South Africa under command of Sir Redvers Buller, who with 16,000 men was intrusted with the task of relieving Ladysmith, while Lord Methuen with 9500 was to make his way to Kimberley from the south, and some 5000 men under General French and 4500 men under General Gatacre were sent to operate against the Boers in the north of Cape Colony. On November 23 Lord Methuen defeated the Boers at Belmont, and on the 25th he won a victory at Enslin or Graspan, but on the 28th he suffered severely in his attempt to cross the Modder River near the Riet, and on December 11 was decisively defeated by Cronje in trying to storm the Boer position at Magersfontein. On December 10 General Gatacre met with a setback at Stormber Junction, in Cape Colony. The most obstinate fighting, however, occurred around Ladysmith, and at Colenso on December 15 the British encountered severe reverses.

This succession of disasters spurred the British authorities to greater exertions. Late in December Lord Roberts of Kandahar was ordered to Africa as commander in chief, with Lord Kitchener of Khartum as chief of staff. The fighting had revealed on the part of the British officers great ignorance of the nature of the country and of the enemy. The Boers were excellent marksmen, many of them were mounted, and they combined rapidity of cavalry with stability of infantry. The British were handicapped by the absence of cavalry, and for want of adequate transport facilities were compelled to cling to the lines of railway, thus narrowing their field. Before the end of January, 1900, British forces in South Africa were estimated at about 130,000 men. Lords Roberts and Kitchener arrived at Cape Town January 10, and a month was devoted to organizing newly landed troops and establishing the transport and train on an adequate basis. The cavalry was made an important arm and much attention given to the mounted infantry, composed of volunteers from Australia, New Zealand, and Canada. The new plan provided for the invasion of the Orange Free State by the main army under Lord Roberts, which, after relieving Kimberley, was to advance upon Bloemfontein. At the same time three smaller forces setting out from Cape Colony were to advance northward across the Orange River and to converge on Bloemfontein. The Boer forces, crowded in the northern part of the Orange Free State, were then to be driven across the Vaal and surrounded in the mountains of eastern Transvaal. No attempt was made greatly to reënforce the troops operating around Ladysmith, for it was thought a successful advance on Bloemfontein and Pretoria would compel the Boers to raise the siege of that town. At Ladysmith, meanwhile, desperate fighting had taken place during January. On the 6th the Boers made an assault on the redoubts near the town, but were repulsed. On the 11th Sir Redvers Buller began a great flanking movement westward along the Tugela River, to compel the Boers to abandon their position on the north side of the stream and south of Ladysmith. On the 18th a division under General Warren crossed the Tugela, and on the night of the 23d–24th stormed Spion Kop, which was considered the key of the enemy's position. While encamped on the hill, however, the British were exposed to a fire from surrounding hills, and at evening on the 24th were compelled to abandon the position, losing 1700 men. On the 27th General Warren recrossed the Tugela.

Lord Roberts's advance on Kimberley began on February 11. He had about 23,000 infantry, 11,000 mounted men, and 98 guns. On the 13th of February the cavalry under General French passed the Modder River, and on the 15th entered Kimberley. Cronje, now in danger of being cut off from Bloemfontein, abandoned his position at Magersfontein, and retreated to the northeast, pursued by the British cavalry and mounted infantry; from the 16th to the 18th he carried on a fierce rear-guard fight. On the 19th he was brought to a standstill at Paardeberg on the Modder River. There the Boers intrenched themselves in the bed of the stream. From the 19th to the 27th their position was bombarded by the British artillery, and Cronje's men found shelter by burrowing into the banks of the river. The British lines were advanced until within 85 yards of the Boer position, and on the morning of the 27th Cronje surrendered with 4000 men and six guns. British advance on Bloemfontein was quickly begun, the cavalry and mounted infantry operating in advance and on the wings, the infantry holding the centre. On the level of the veldt British numbers were decisive, and the Boers could make no effective stand. On March 7 they offered battle at Poplar Grove, 60 miles west of Bloemfontein, but were outflanked and driven from their intrenchments. On March 10 a hard fight occurred at Driefontein, about 30 miles from Bloemfontein. On March 13 Roberts entered the capital, President Steyn having fled to Kroonstadt. For about six weeks Lord Roberts remained at Bloemfontein before resuming the advance upon Pretoria, his reason being lack of horses. The Boers for a time made no demonstration in force, but contented themselves with active guerrilla warfare with considerable loss to their opponents. On May 1 the Pretoria advance began. On May 12 the British entered Kroonstadt after encountering the Boers under General Botha on the Vet River May 5, and on the Zand May 10. From Kroonstadt the British advanced in the form of a crescent 40 miles across, driving the Boers before them. The Vaal River was crossed between the 24th and 27th of May, Johannesburg entered on May 31, and June 5 Pretoria was occupied. President Kruger fled to Machadodorp, while General Botha with 8000 men took up a strong position 15 miles east of the capital. On June 11–12 he was attacked by the British advance guard and slowly driven back. On July 23 Lord Roberts set out from Pretoria for the final campaign.

In Natal, meanwhile, General Buller on February 5 had made a third attempt to cross the Tugela and break the Boer lines. He failed and on the 7th was driven back across the river. On the 14th the fourth and final dash for Ladysmith began. The Boer positions at Horsar Hill, Cingolo, Monte Cristo, Hlongwane, and Colenso were taken between the 14th and the 20th, the Tugela crossed on the 21st; Peter's Hill, the key of the enemy's position, was taken on the 27th; and the next day the British cavalry entered Ladysmith. General Buller's forces advanced northward into the Transvaal, where they coöperated with Lord Roberts in the final campaign. On May 18 Mafeking, the last of the three towns invested by the Boers at the outbreak of the war, was relieved.

In the eastern Transvaal the main Boer force under General Botha was driven into the mountains on the Portuguese frontier. They made a desperate stand at Bergendal August 27, but were driven from their position by General Buller. At Spitzkop, southeast of Lydenberg, General Botha fought the last set battle of the war, September 8, but was defeated, and the greater part of the Boers, about 3000, crossed into Portuguese territory on September 14 and surrendered to the authorities there. On October 19 President Kruger sailed for Holland from Lourenço Marques on a Dutch man-of-war.

From this time until the war's end, May, 1902, the struggle of the Boers took the form of a desperate resistance by guerrilla bands against superior forces and inevitable defeat. It was the task of the British under Lord Kitchener, who succeeded Lord Roberts in the command of the British, Nov. 29, 1900, to pacify the country they had overrun, and he employed a plan of campaign adapted to the conditions under which the conflict was now to be fought out. Flying columns traversed the Orange Free State and the western Transvaal in an effort to hunt down the Boer commandos, which, under leaders like Christian De Wet and Jacobus Hendrick De la Rey (qq.v.), caused the British forces much annoyance, if not actual harm. De Wet evinced splendid talents as a leader, and his astonishing rapidity of movement, boldness, and good fortune in eluding capture served to make the end of the South African War dramatic.

The activity of the Boers was limited to the repeated capture of isolated outposts or of small detachments of the enemy, whom they were usually compelled to release for lack of facilities to keep them captive. At times the danger of a rising among the Dutch inhabitants of Cape Colony seemed imminent, as when a number of Boer commandos entered Cape Colony in the winter of 1900–01 and threw the inhabitants of Cape Town into alarm. The struggle ultimately resolved itself into a campaign of so-called "attrition" on the part of the British, a process, e.g., of steadily weeding out the enemy by unceasing pursuit and capture of one Boer commando after another. Their task was made more difficult by the active assistance rendered the Boers by the non-belligerent population, and because of this concentration camps were established in the Transvaal, Cape Colony, and the Orange River Colony, into which were gathered all Boer noncombatants as well as British loyalists who desired the protection of the authorities. The high rate of mortality that prevailed among the children in these camps aroused bitter criticism of British methods in the foreign press.

The uselessness of protracting the struggle was recognized by a number of the Boer leaders before the beginning of 1902, and negotiations for peace were begun in January of that year. The British government declined to take into consideration the question of the independence of the Boer states, and the articles of peace as signed at Pretoria on May 30 were substantially those offered by the government in 1901. By the terms of the treaty the Boers in the field agreed to lay down their arms and to acknowledge allegiance to Great Britain, on condition that no burgher should be deprived of liberty or property, or be subjected to civil or criminal proceedings for acts during the war. It was provided that the Dutch language be taught in the public schools and its use permitted in the courts. Military administration in the colony was to be succeeded by civil rule at the earliest opportunity, to be followed by representative government. No special tax was to be imposed on landed property to defray the expenses of the war. The number of Boers who surrendered after the conclusion of peace was more than 20,000.

Figures issued by the War Office showed that the British forces engaged in South Africa during the war numbered nearly 450,000, of which number 9940 were in South Africa on Aug. 1, 1899. The reënforcements after that date dispatched to South Africa from Great Britain included nearly 247,000 regular troops and 110,000 volunteers, militia, and yeomanry. The number of volunteers from the British colonies was nearly 31,000, and more than 52,000 men were raised in South Africa. The casualties were 1100 officers and 22,800 men killed, wounded, or missing, and 3116 officers and 40,500 men sent home as invalids. The cost of the war was placed at £206,224,000. The Boer enlistment, according to estimates of Lord Kitchener, was approximately 95,000. Their casualties were placed at 3700 killed and 40,000 prisoners.

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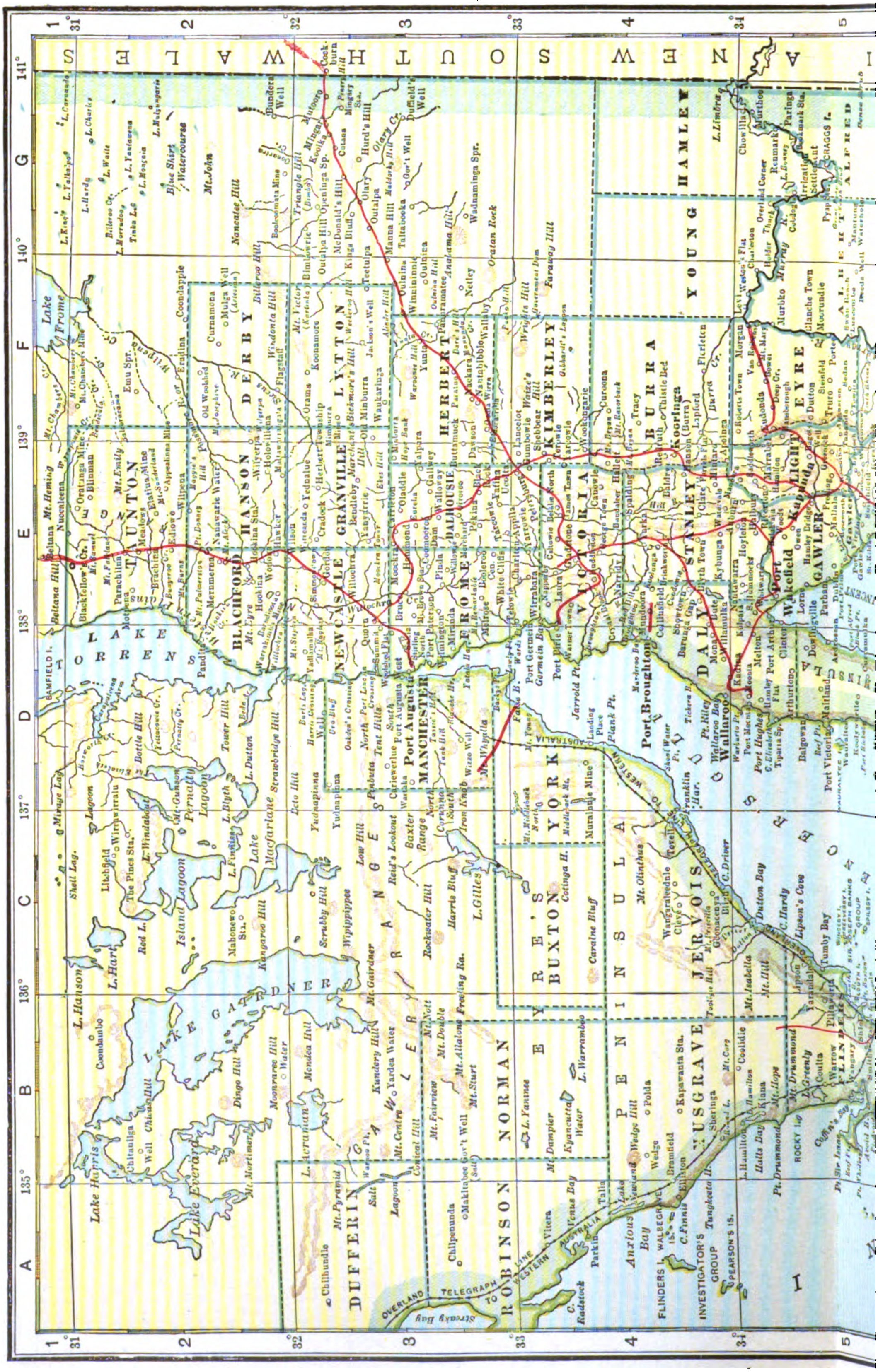
NEW SOUTH WALES
LAKE TORRENS
LAKE GAIRDNER
Lake Frome
Lake Everard
Lake Harris
Island Lagoon
Pernatty Lagoon
Lake Macfarlane
GAWLER RANGES
EYRE'S PENINSULA
DUFFERIN
ROBINSON
NORMAN
BUXTON
YORK
MANCHESTER
JERVOIS
MUSGRAVE
FLINDERS
TAUNTON
BLACHFORD
HANSON
DERBY
NEWCASTLE
GRANVILLE
LYTTON
FROME
DALHOUSIE
HERBERT
KIMBERLEY
VICTORIA
DALY
STANLEY
BURRA
YOUNG
HAMLEY
LIGHT
EYRE
GAWLER
ALFRED
Port Augusta
Port Pirie
Port Germein
Port Broughton
Wallaroo
Kadina
Moonta
Port Wakefield
Kapunda
Kooringa
Quorn
Hawker
Streaky Bay
Franklin Har.
Tumby Bay
OVERLAND TELEGRAPH TO WESTERN AUSTRALIA
INVESTIGATOR'S GROUP
135°
136°
137°
138°
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140°
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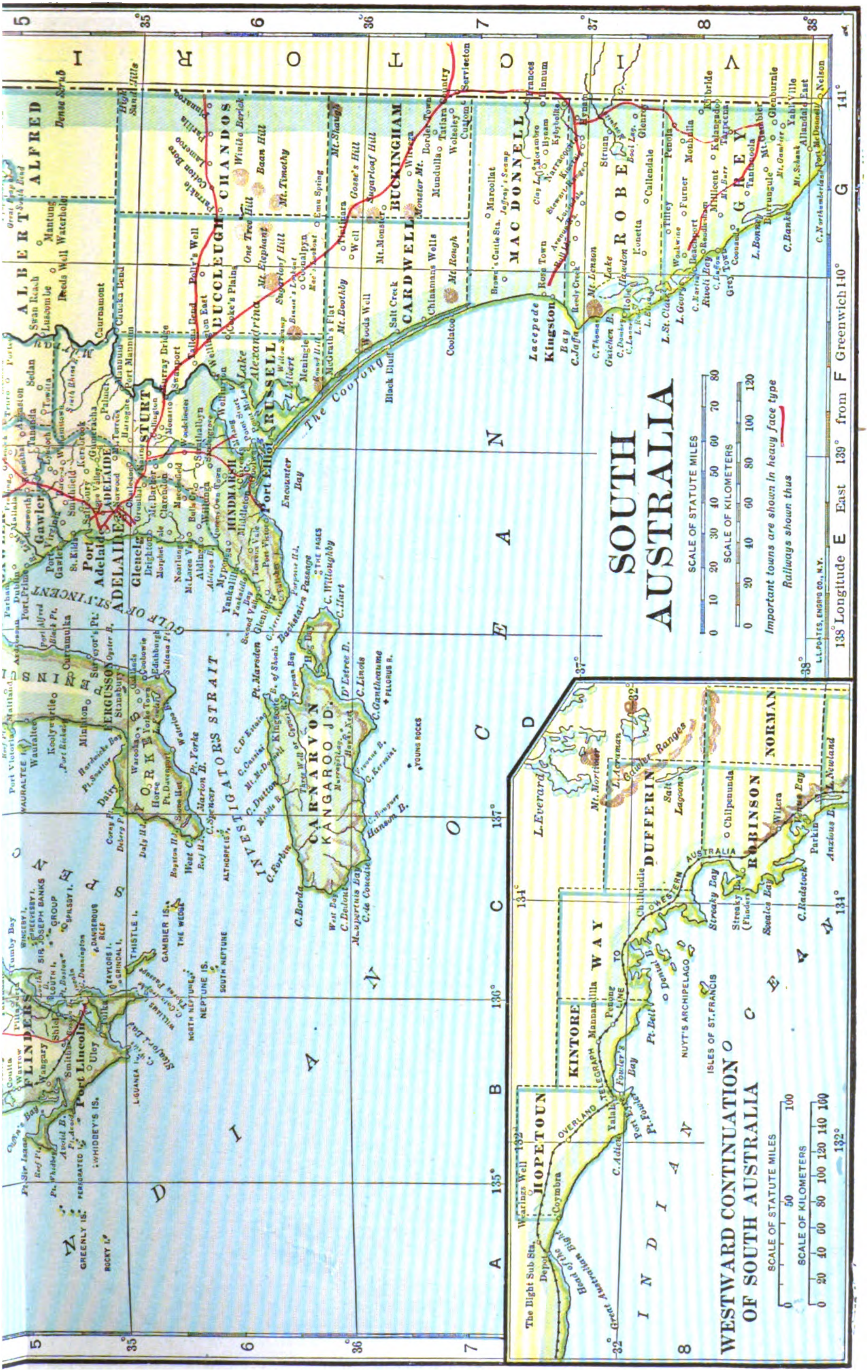

SOUTH AUSTRALIA
SCALE OF STATUTE MILES
0 10 20 30 40 50 60 70 80
SCALE OF KILOMETERS
0 20 40 60 80 100 120
Important towns are shown in heavy face type
Railways shown thus
L.L. POATES, ENGR'G CO., N.Y.
138° Longitude E East 139° from F Greenwich 140° G 141°
WESTWARD CONTINUATION OF SOUTH AUSTRALIA
SCALE OF STATUTE MILES
0 50 100
SCALE OF KILOMETERS
0 20 40 60 80 100 120 140 160
INDIAN OCEAN
ALBERT
ALFRED
CHANDOS
BUCCLEUGH
BUCKINGHAM
CARDWELL
MAC DONNELL
ROBE
GREY
RUSSELL
STURT
ADELAIDE
HINDMARSH
FERGUSSON
YORKE
CARNARVON
KANGAROO ID.
FLINDERS
HOPETOUN
KINTORE
WAY
DUFFERIN
ROBINSON
NORMAN
GULF OF ST. VINCENT
INVESTIGATOR'S STRAIT
SPENCER GULF
Encounter Bay
The Coorong
Lacepede Bay
Kingston
Port Adelaide
Adelaide
Gawler
Glenelg
Port Elliot
Port Lincoln
Mt. Gambier
Robe
Streaky Bay
Fowler's Bay
Great Australian Bight
Nuyt's Archipelago
Isles of St. Francis
Overland Telegraph Line to Western Australia
Gawler Ranges
L. Everard
Anxious B.
Denial B.
Venus Bay
Backstairs Passage
Young Rocks
Thistle I.
Gambier Is.
Neptune Is.
Whidbey's Is.
Greenly Is.
Sir Joseph Banks Group
135° 136° 137° 134° 132°
35° 36° 37° 38° 32°
A B C D E F G
5 6 7 8

1902); G. B. Beak, *The Aftermath of War* (London, 1906); J. F. Maurice, *History of the War in South Africa* (ib., 1906); G. W. Forrest, *The Life of Lord Roberts* (New York, 1914).

SOUTH AM′BOY. A city in Middlesex Co., N. J., on the Raritan River and Bay, at their confluence with Staten Island Sound, directly opposite Perth Amboy, and on the Pennsylvania, the Central of New Jersey, and the Raritan River railroads (Map: New Jersey, D 3). A railroad bridge and a trolley bridge connect it with Perth Amboy. The city is important as the centre of a region containing large quantities of sand and clay. Pottery, terra cotta, asphaltum, clothing, underwear, cigars, and brick are the most important manufactures. Coal is extensively shipped from this port by the Pennsylvania Railroad. Pop., 1900, 6349; 1910, 7007.

SOUTH AMERICA. See AMERICA.

SOUTHAMPTON, south-ămp′ton. A county borough, parliamentary borough, and a seaport in the south of Hampshire, England, 79 miles southwest of London (Map: England, E 6). The town occupies a peninsula near the head of Southampton Water, between the estuary of the Test or Anton on the west and south and the mouth of the Itchen on the east.

The Domus Dei, or God's house, dates from the end of the twelfth century, and is one of the oldest hospitals in England. In the vicinity are picturesque ruins of Netley Abbey, a Cistercian foundation of the thirteenth century, and the Netley Military Hospital accommodating 1000 patients. Southampton was incorporated by Henry I and received several privileges confirmed by subsequent monarchs. Henry VI constituted the town a county in itself, and its area included a "little" place called Portsmouth. The guild merchants controlled affairs and the municipal transactions are recorded in the famous "oak book," the most treasured object in the town archives. The town has owned its markets since its incorporation, and the water supply since 1420 and its slaughter houses since 1698. The borough's boundaries were extended in 1895, since when much economic progress has been made. Artisans' dwellings and a municipal lodging house have been built, sewage and draining works carried out, and an electric-lighting plant and street railways acquired. The town maintains a large isolation hospital, fine public baths, a free public library, a cemetery, and extensive parks, and makes abundant provision for technical instruction.

Yacht building, shipbuilding, and engine making are actively carried on, and there is an extensive general trade. Southampton is a fashionable summer resort. It owes its importance to its sheltered harbor and to the phenomenon of double tides, which prolong high water for three hours. (See ENGLISH CHANNEL.) There is considerable traffic between Southampton and the Channel Islands and French coast, and also a large cattle trade with Spain and Portugal. Its docks include six large dry docks, two tidal basins (16 and 18 acres in area), and a closed dock. The total tonnage entered and cleared, excluding coastwise vessels, was 11,797,973 in 1913.

Southampton supplanted the ancient *Clausentum*, which stood one mile to the northeast, and its foundation is ascribed to the Anglo-Saxons. A great part of it was burned by the combined French, Spanish, and Genoese fleets in 1338, and in the following year its defenses were strengthened. Pop., 1901, 104,824; 1911, 119,012. Area, 4604 acres. Consult Davies, *History of Southampton* (Southampton, 1883).

SOUTHAMPTON. A village in Suffolk Co., N. Y., 92 miles by rail east of New York City, on the Atlantic Ocean and on the Long Island Railroad (Map: New York, C 2). It is an attractive and popular summer resort, having a fine beach, excellent fishing, and many beautiful residences. There are also a new high school and the Rogers Memorial Library. Pop., 1900, 2289; 1910, 2509.

SOUTHAMPTON. Another name for the English county of Hampshire (q.v.).

SOUTHAMPTON, HENRY WRIOTHESLEY, third EARL OF (1573–1624). An English statesman, the patron of Shakespeare. He was born at Cowdray House, near Midhurst, educated at St. John's College, Cambridge, and studied law at Gray's Inn. He was attached to Queen Elizabeth's suite, and received the dedications of various poets, including Shakespeare, who in 1593 addressed to him *Venus and Adonis* and next year *The Rape of Lucrece*. He is also supposed by some to be the anonymous patron of Shakespeare's *Sonnets*. He was a friend of the Earl of Essex, taking part in Essex's insurrection and was condemned to death. His sentence was commuted to imprisonment for life, and this was reversed by Parliament early in the reign of James I. In 1605 he became active in the colonization of America, being Governor of the Virginia Company from 1620 until its dissolution in 1624. In 1621 he was imprisoned in the Tower for opposing Charles I. After his release he commanded a regiment for the Dutch against the Spanish, and both he and his son died of fever contracted in the Netherlands.

SOUTHAMPTON INSURRECTION. See TURNER, NAT.

SOUTHARD, sŭth′ẽrd, SAMUEL LEWIS (1787–1842). An American legislator and cabinet officer, born at Basking Ridge, N. J. He graduated at Princeton in 1804, and was admitted to the bar in 1809. In 1811 he settled in Flemington, N. J. From 1814 to 1819 he was a justice of the Supreme Court of New Jersey, and in 1821 was elected to the United States Senate. In 1823 he resigned to become Secretary of the Navy, holding the position throughout J. Q. Adams's administration. In 1830 he was elected Attorney-General of New Jersey and in 1832 Governor. From 1833 until just before his death, he was again a member of the United States Senate. In the 27th Congress (1841–43) until his resignation he was president pro tem., and presided over the Senate after Vice President Tyler had succeeded President William H. Harrison. He published *Reports of the Supreme Court of New Jersey, 1816–20* (1820); *Centennial Address* (1832); and *Discourse on William Wirt* (1834).

SOUTH AUSTRALIA. A state of the Commonwealth of Australia occupying the central part of the southern portion of the continent, extending from the 26° S. parallel to the Indian Ocean, with a width of about 700 miles. Its area is 380,070 square miles. On Jan. 1, 1911, the Northern Territory (q.v.) was transferred to the Commonwealth.

Physical Features. The state lies in three provinces of Australia: a small area in the extreme southeast drained mostly by the Murray; an extensive area from the south coast reaching to lat. 20° S. of interior drainage; and a smaller area in the north, well drained, with rivers flowing to the northern waters. The whole is a vast plain of no great elevation, in some places, as about Lake Eyre, lying below sea level. Many short ranges of mountains are distributed over the state, culminating in the south in the Flinders Range (3000 feet) and in the interior in the Baget, Stuart, and Musgrave ranges. In the interior there are a number of river courses, which are dry for a great part of the year, and even in the wet season are lost in marshes or salt lakes. Several of these lakes, the largest being found in the depression north of Spencer Gulf, are over 100 miles in length. They are brackish and shallow, being reduced during the dry season to marshes or mud flats covered with salt crusts.

Climate, Soil, and Flora. Though the state has a range of nearly 13 degrees of latitude, its climate is remarkably uniform. It is in general hot and dry; the temperature even on the south coast may remain at 110° F. or 115° F. for days. The annual rainfall in the southeast, at Adelaide, is about 24 inches, but sometimes falls to 15 inches. In the interior it is always scanty, 5 to 11 inches per year; at the head of Spencer Gulf it averages 9 inches, and at Eucla, on the west coast, 11 inches. Rain is generally confined to the winter, which is mild. There are areas of good agricultural and pastural land in the south. The interior consists largely of treeless plains, in some parts absolutely barren, stony or sandy, or covered with scrub, but here and there producing good pasture grass during the wet season. Large areas are covered with spiny grass unfit for pasture. Trees are found only near the mountains or larger river courses, but the hilly region east of the southern range is well timbered. The flora is not so rich as that of the eastern states. The prevailing timber trees of South Australia are eucalyptus and acacia, with some pines, while *Pandanus* and palms are found in the north.

Fossils and Fauna. The remains of many hugh extinct marsupials have been found, as the *Diprotodon*, the *Macropus*, the *Titan*, etc. The marsupial mole (q.v.), a new animal, discovered in 1890, is found in the state.

Geology. The greater part of the surface is covered with recent formations, Cretaceous in the east, but in the main Tertiary. There are, however, numerous outcrops and extensive areas of ancient rocks. Thus the mountain region from Spencer Gulf northward and the greater part of Eyre's Peninsula consist mainly of Silurian strata. Granite crops out in the mountains of the interior. No active volcanoes are known to exist in Australia, but in the extreme southeastern section of this state there are evidences of recent action, which increase eastward.

Mining. The mineral deposits thus far developed are chiefly copper, gold, and silver, the principal being copper, the production in 1913 being valued at £461,500. In the same year the gold output was valued at £28,000, and the total value of minerals produced was £634,318. Iron, lead, and bismuth are also found in considerable quantities.

Agriculture. South Australia ranks second among the Commonwealth states in acreage under cultivation. It amounted in 1913–14 to 4,679,500. Of this, 2,267,800 acres, producing 16,938,988 bushels, were under wheat, the chief source of wealth. In the same year there were 90,552 acres of barley, 116,732 of oats, 568,550 of hay, 10,809 of potatoes. Vine cultivation is a prosperous industry, the area having increased from 12,314 acres in 1891 to 26,208 in 1913, the wine production amounting to 2,759,665 gallons. The small rainfall confines farming mainly to the southeast. The state has adopted the policy of repurchasing large estates and selling them to farmers in blocks of convenient size. Some progress has been made in irrigation, the water being drawn from both rivers and artesian wells. The number of sheep declined from about 7,000,000 in 1890 to 5,073,057 in 1913. The wool product in 1913 was 48,035,906 pounds, valued at £1,809,517. The cattle in the year numbered 359,905. There were 283,641 horses.

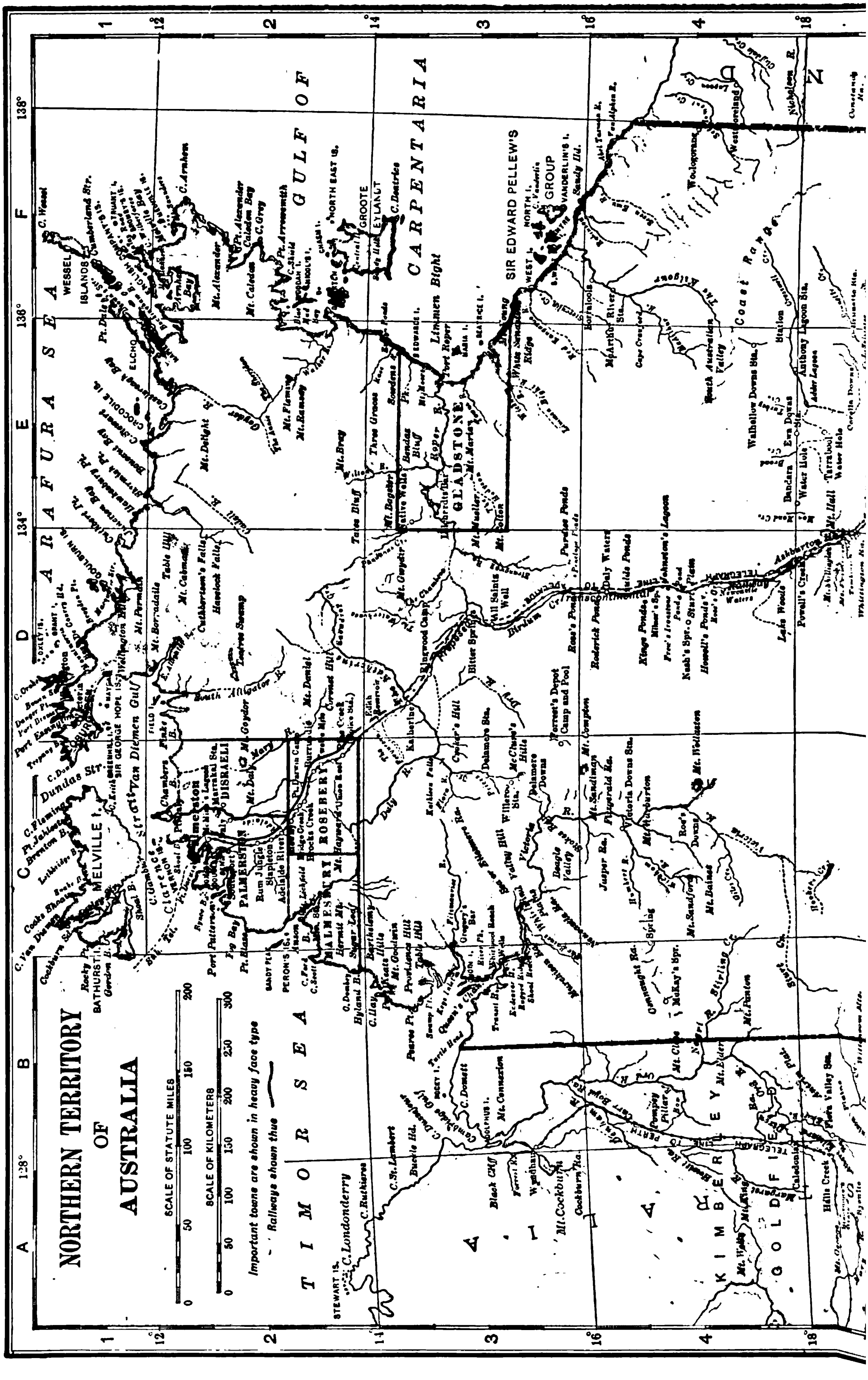
Manufactures. In 1913 there were 1353 factories, employing 28,511 hands, with salaries and wages amounting to £3,034,537 and an output of £13,998,370. The manufacturing industry is confined mainly to production for local consumption or of food products, especially flour, for export.

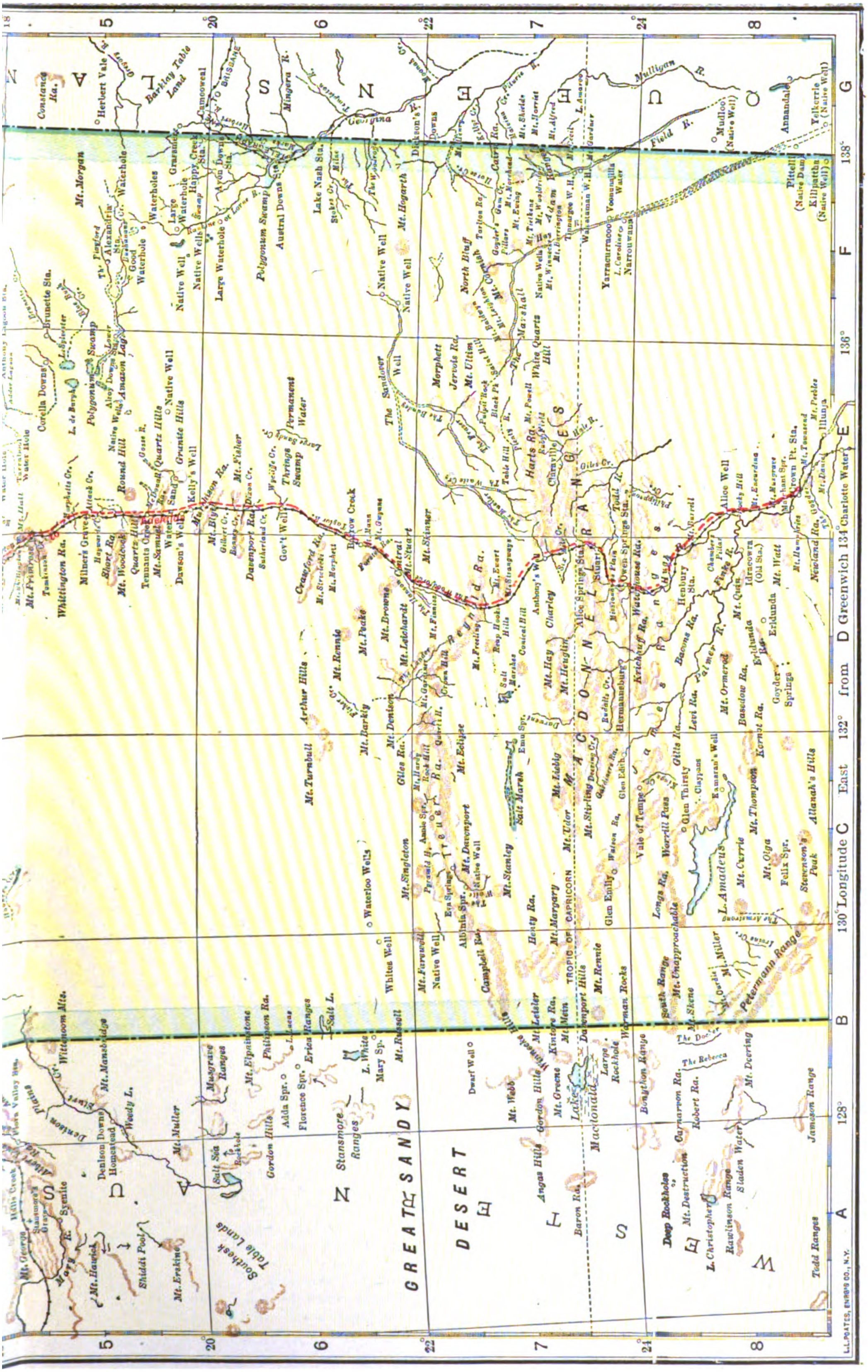
Commerce. Almost from the beginning railroads were constructed and operated by the government, and practically all of the 1845 total mileage belongs to the state. The government realizes a profit of about 4 per cent upon its railways. A transcontinental line is being constructed between Port Augusta in South Australia and Kalgoorlie in Western Australia, and about 450 miles of this will be in South Australia. When completed it will connect Brisbane on the east coast with Kalgoorlie. The imports in 1913 amounted to £7,348,340 and the exports to £9,809,763. Adelaide, the chief port, ranks third among the Australian ports. The exports of domestic produce in 1913 amounted to £9,809,673. The principal articles exported were grain and flour, wool, silver, lead, spelter (these two latter items are principally the produce of the Broken Hill Mines in New South Wales), and bullion and coin. The other Australian states and the United Kingdom handle nearly all the trade.

Government. The Governor is appointed by the British government. The Executive Council is composed of six responsible ministers and the Chief Justice of the Supreme Court. The Legislature consists of a Legislative Council of 18 elected members and a House of Assembly of 40 elected members. The state has extended the right of suffrage to women.

Finance. The total revenue in 1914 was £4,822,766; expenditure, £4,604,129; balance of Commonwealth revenue returned to the state, £540,113. Most of the revenue is from territorial receipts, railways, and inland revenue. The public debt of the state was, in 1914, £33,564,332, of which about one-half was for the construction of railways, telegraphs, and water works.

State Activities. The government has been very progressive with enterprises that are generally left to private initiative. The state has tried to foster industries by the establishment of produce depots, by performing the function of agent in the marketing of produce, and also by the establishment of cyanide works and smelters. A state bank supplies capital to farmers on easy terms. Laws have been passed to secure the compulsory settlement of industrial disputes.


NORTHERN TERRITORY
OF
AUSTRALIA
SCALE OF STATUTE MILES
0 50 100 150 200
SCALE OF KILOMETERS
0 50 100 150 200 250 300
Important towns are shown in heavy face type
Railways shown thus
A B C D E F
1 2 3 4
12° 14° 16° 18°
128° 130° 132° 134° 136° 138°
TIMOR SEA
ARAFURA SEA
GULF OF CARPENTARIA
Van Diemen Gulf
Dundas Str.
MELVILLE I.
BATHURST I.
WESSEL ISLANDS
CROCODILE IS.
GOULBURN IS.
GROOTE EYLANDT
SIR EDWARD PELLEW'S GROUP
Limmen Bight
PALMERSTON
Palmerston
DISRAELI
ROSEBERY
MALMESBURY
GLADSTONE
Port Darwin
Adelaide River
South Alligator R.
Daly R.
Roper R.
Victoria R.
Katherine
Pine Creek
Powell's Creek
Daly Waters
Ashburton
Transcontinental
TELEGRAPH LINE
Coast Range
KIMBERLEY GOLDFIELD
Cambridge Gulf
C. Londonderry
Hall's Creek
Wyndham


130° Longitude East from Greenwich 134°
132°
136°
138°
128°
TROPIC OF CAPRICORN
GREAT SANDY DESERT
MACDONNELL RANGES
WEST AUSTRALIA
SOUTH AUSTRALIA
QUEENSLAND
Barklay Table Land
Camooweal
TO BRISBANE
Georgina R.
Mulligan R.
Field R.
Polygonum Swamp
Austral Downs
Lake Nash Sta.
Mt. Morgan
Corella Downs
Brunette Sta.
Powell Creek
Tennants Creek
Barrow Creek
Central Mt. Stuart
Alice Springs Sta.
Stuart
Henbury Sta.
Hermannsburg
Alice Well
Charlotte Waters
Idracowra (Old Sta.)
Erldunda
Goyder Springs
Crown Pt. Sta.
L. Amadeus
Petermann Range
Musgrave Ranges
Mt. Olga
Stevenson's Peak
Allanah's Hills
Salt Marsh
Waterloo Wells
Whites Well
Mt. Rennie
Mt. Russell
Lake Macdonald
Gordon Hills
Angas Hills
Baron Ra.
Deep Rockholes
L. Christopher
Rawlinson Range
Todd Ranges
Jameson Range
Carnarvon Ra.
Stansmore Ranges
Denison Downs Homestead
Southesk Table Lands
Mt. Erskine
Mt. Hassel
L.L. POATES, ENGR'G CO., N.Y.

Population. The population increased from 14,600 in 1840 to 319,145 in 1890 and 408,558 in 1911. The majority are in the southeastern part of the state. Nearly the whole population is of British origin. In 1913 Adelaide and its suburbs had a population of 200,117.

Religion. In 1911 the membership of the principal churches was: Church of England, 113,781; Roman Catholic, 50,964; Methodist, 100,402; Lutheran, 26,681; Baptist, 21,863; Presbyterian, 22,567; Congregationalist, 13,357.

Education. Primary education is free, and is compulsory between the ages of 7 and 13. Religious instruction may be given, but not during ordinary school hours. In 1913 there were 815 state schools, with an enrollment of 58,656. There is a secondary school for girls at Adelaide, and fees are charged. All other secondary schools are private or denominational. In 1913 there were 11,012 scholars enrolled in 168 private schools. The University of Adelaide and a number of technical schools are aided by the state.

History. The explorations of Flinders in 1802 and of Stuart in 1830 first called attention to South Australia. Its real settlement was due to an association formed to put into operation the colonization theories of Edward Gibbon Wakefield (q.v.). In 1834 permission was given for the formation of the province on condition that no expense should attach to the home government. In 1836 settlers landed and founded the town of Adelaide, which was incorporated in 1840—the first proclaimed city of Australia. South Australia became a crown colony in 1841. The early basis for the prosperity of South Australia was agricultural, though in 1838 galena deposits were discovered and in 1842 copper. When Governor Grey assumed office in 1841 the population was 14,562; when he left in 1845 it had increased to 21,759. The Torrens land system was adopted in 1857. The first representative constitution was proclaimed in February, 1851. Responsible government was proclaimed in 1856. The explorations of Eyre in 1839 opened up the cattle region of the interior, and those of Stuart in 1859–62 the way to the Indian Ocean. The Northern Territory was annexed in 1863. The telegraph line, opened in 1872, followed substantially the line of Stuart's explorations and first gave Australia cable communication with the rest of the world.

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SOUTH BEND. A city and the county seat of St. Joseph Co., Ind., 84 miles east by south of Chicago, Ill., on the St. Joseph River, and on the New York Central, the New Jersey, Indiana, and Illinois, the Lake Erie and Western, the Grand Trunk, the Vandalia, and the Michigan Central railroads (Map: Indiana, E 1). It is the seat of the University of Notre Dame (q.v.), of St. Mary's Academy, and of St. Joseph's Academy. Noteworthy are the courthouse, city hall, Oliver Hotel, public library, orphan asylum, historical society, Epworth Hospital, and St. Joseph's Hospital. South Bend is the centre of a rich farming region and is an important industrial city. In 1909 its 218 industrial establishments represented an invested capital of $41,467,000 and an output valued at $27,855,000. There are large wagon, automobile, and carriage works, an enormous plow factory, lumber and flouring mills, foundries and machine shops, wood-turning plants, and manufactories of shirts, sewing machines, agricultural implements, toys, patent medicines, woolens, clover hullers, underwear, boilers, furniture, concrete machinery, cutlery, electrical appliances, harness, lathes, ranges, linseed oil, varnish, steel skeins, sheet iron products, spark arresters, and other industries. Pop., 1900, 35,999; 1910, 53,684; 1915 (U. S. est.), 67,030.

The site of South Bend was occupied by the Miami and Potawatami Indians. In 1824 Alexis Coquillard established a trading post here; in 1831 a town was laid out, which in 1835 was incorporated.

SOUTH BERWICK, bĕr'wĭk. A town in York Co., Me., 40 miles southwest of Portland, on the Boston and Maine Railroad (Map: Maine, B 5). Interesting features are the Berwick Academy, an institution which was founded in 1791, and the Fogg Memorial Library. The chief manufactured products are shoes, woolen goods, and horse blankets. Pop., 1900, 3188; 1910, 2935.

SOUTH BETH'LEHEM. A borough in Northampton Co., Pa., 57 miles by rail north by west of Philadelphia, on the Lehigh Canal, on the Lehigh River, opposite Bethlehem, and on the Lehigh Valley, the Central of New Jersey, and the Philadelphia and Reading railroads (Map: Pennsylvania, L 6). Lehigh University (q.v.) occupies a site overlooking the borough. Other noteworthy institutions are the Bishopthorpe Manor (a school for girls); Moravian College for Women; Moravian Theological Seminary; and St. Luke's Hospital. South Bethlehem is known for its iron and steel manufactures. The total capital invested in the various industries in 1909 was $41,121,000, and the value of their output was $26,417,000. There are the large establishment of the Bethlehem Steel Company, and brass works, foundries and machine shops, coke works, zinc works, and manufactories of silk, knit goods, brick, etc. Pop., 1900, 13,241; 1910, 19,973; 1915 (U. S. est.), 23,522.

SOUTH BEVELAND. See BEVELAND.

SOUTH'BRIDGE. A town, including two villages, in Worcester Co., Mass., 20 miles south by west of Worcester, on the Quinebaug River, and on the New York, New Haven, and Hartford Railroad (Map: Massachusetts, D 4). It has large optical works and manufactories of shuttles and shuttle-irons, knives, and cotton and woolen goods. Pop., 1900, 10,025; 1910, 12,592; 1915 (State census), 14,202. Originally a part of Charlton, and popularly called "Honest Town," it was incorporated as a town, under its present name, in 1816. Consult Davis, *A*

Historical Sketch of Sturbridge and Southbridge (Brookfield, 1856).

SOUTH CAROLINA (popularly called the "Palmetto State"). A South Atlantic State of the United States, lying between lat. 32° 2′ and 35° 13′ N., and between long. 78° 33′ and 83° 21′ W., roughly triangular in shape, with a base extending 190 miles in a straight line along the Atlantic shore and a somewhat blunted apex resting upon the summit of the Blue Ridge, 240 miles to the northwest. Its area is 30,989 square miles, of which 30,495 square miles are land surface. It ranks as the thirty-sixth State in size.

Topography. The State extends across the coastal plain and the piedmont plateau, two well-marked topographic belts which are separated from each other by an old shore line crossing the middle of the State, parallel to the present shore. This old shore line passes through Augusta, Ga., Columbia, Camden, and Cheraw. The width of the coastal plain is about 125 miles and that of the piedmont plateau is nearly as great. Two-thirds of the State is included in the coastal plain, the remainder is in the piedmont plateau. From the North Carolina line southwest to Winyah Bay the shore has an unbroken sandy beach. South of that point the shore becomes more and more broken by inlets and estuaries and is fringed with low, sandy islands (the Sea Islands) that in the Port Royal region form tiers three or four deep, separated by irregular cross channels bordered with salt marshes. The outer part of the coastal plain is low and flat with large areas of swamp. Inland, the coastal plain surface rises slowly for the first 100 miles, reaching an elevation of only 150 to 250 feet, but in the remaining 25 miles of its width the rise is much more rapid and an average elevation of 500 feet is reached along its inner edge, which is marked by a belt of sand hills, partly of dune origin, but now fixed and covered with pines. To the west the transition to the piedmont plateau is gradual, and its surface rises gently from an elevation of 500 feet along its eastern margin to 1000 or 1200 feet in the extreme northwest, where an eastward-facing escarpment rises abruptly 2000 feet to the summit of the Blue Ridge, which forms the northwest boundary. Rich Mountain, on this boundary, 3569 feet in elevation, is the highest point in the State.

Hydrography. The general course of rivers is to the southeast. The longer ones rise in the mountains of North Carolina. The Great Pedee, with the Waccamaw, Little Pedee, and Lynch's as tributaries, flows into Winyah Bay in the east; the Santee, formed by the Wateree and Congaree, is in the centre; and the Savannah forms the southwest boundary. The largest river entirely within the State is the Edisto. It is between the Santee and the Savannah and is confined to the coastal plain. The waters of the piedmont streams are usually turbid with red clay, while those of the coastal plain are either clear or are darkened by the decaying vegetation of the swamps. The streams of the piedmont have numerous rapids where they cross upturned ledges of hard rocks. Their descent from the hard rocks of the piedmont to the soft sands of the coastal plain is also marked by rapids and is known as the fall line. These rapids afford much water power. The larger rivers are navigable only across the coastal plain to the fall line.

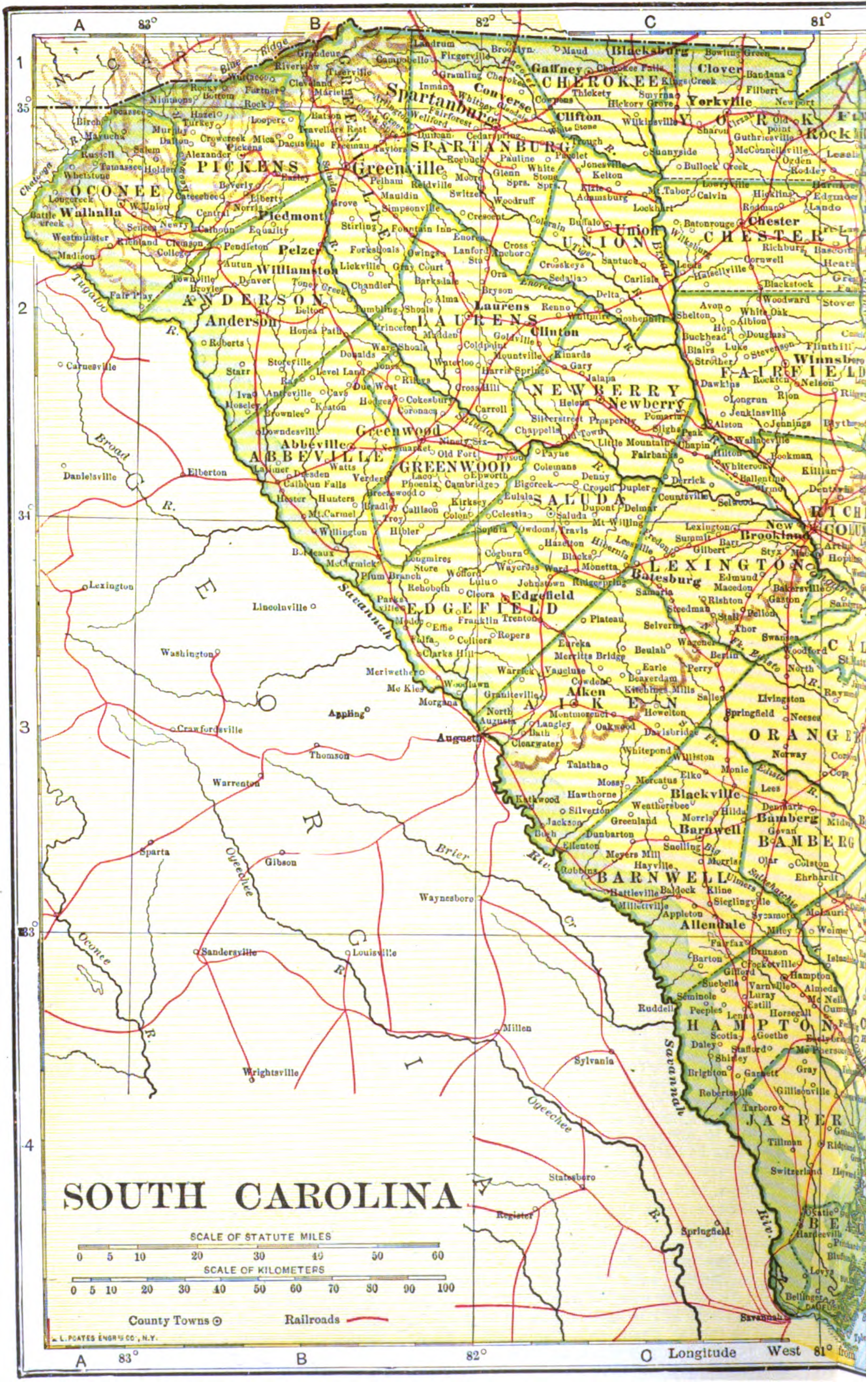
Climate. The climate ranges from a semitropical one on the south Sea Islands to cold-temperate along the Blue Ridge. The mean annual temperature of the State varies from 58° F. at Greenville to 66° F. at Beaufort. The mean summer and winter temperatures at Greenville are 85° F. and 52° F.; and at Beaufort 89° F. and 59° F. respectively. The temperature of the coast is somewhat more equable than the rest of the State. The annual rainfall is about 49 inches and its distribution by localities and seasons is fairly uniform. Light snow sometimes falls along the coast, but it very rarely accumulates. In the middle and western sections of the State several snows each 5 to 10 inches deep may occur in a winter and may remain on the ground from a few days to a week or more. Hurricanes from the West Indies occasionally visit the coast, especially in the autumn, and are sometimes destructive.

Soils. The soils of the piedmont have resulted from the deep weathering of the crystalline and metamorphic rocks of that region. The most common soil is a red clay, though sandy and gravelly soils also occur abundantly, and there are occasional dark clay soils from the weathering of trap and similar igneous rocks. Along the inner edge of the coastal plain there is a belt, 10 to 30 miles wide, of very poor, white, sandy soil known as the Sand Hills. Southeast of this there is a somewhat narrower, broken belt of red, sandy clay soil; while the soil of the middle and outer part of the coastal plain is a light-colored sand or loam of moderate fertility, with swampy muck and clayey soils along the rivers and on the Sea Islands.

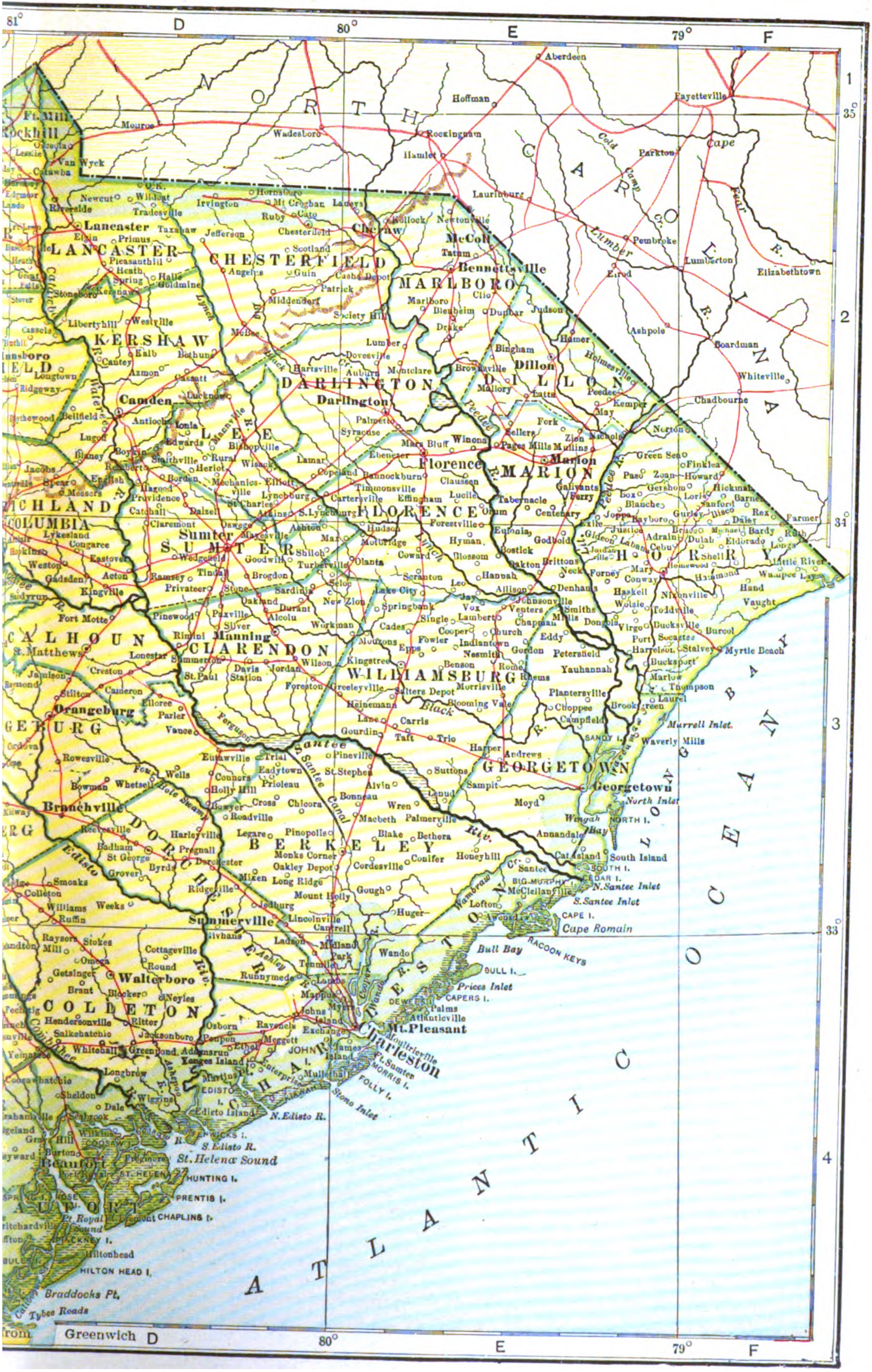
Vegetation. The vegetation of the Sea Islands is semitropical in aspect, the palmetto, live oak, and magnolia being characteristic. On the outer part of the coastal plain cypress and gum characterize the swamps, and long-leaf pine and oak the uplands. On the inner part of the coastal plain short-leaf pine, hickory, poplar, elm, and oak appear, and on the piedmont plateau, these, with chestnut, locust, walnut, persimmon, maple, and other hard woods, become dominant. Wild grapes, strawberries, and various small fruits are abundant.

Geology. The rocks of the piedmont are almost all of Pre-Cambrian age. A few schists and slates with narrow included belts of marble are probably Cambrian. Some trap dikes and a small area of red sandstone of Triassic age also occur. The rocks of the coastal plain are unconsolidated sands and clays and soft limestones and marls. The oldest are Cretaceous, the younger are of Tertiary and recent age.

Mineral Resources. Phosphate rock was, until 1912, the leading mineral product, production declining since because of the exhaustion of the river beds and the growing scarcity of land deposits. The State ranks next to Florida and Tennessee in the output of phosphate rock, in 1914 amounting to 106,919 tons, valued at $415,039. In 1913 clay products took first place in the value of production among the State's mineral resources, the main output being common brick, and most of the rest "paper clay," used by paper manufacturers. The total value of the clay products (raw and derived) was $701,696 in 1914. The output of stone, almost entirely granite, was valued at $357,657 in 1914. The exhaustion of the Hails mine has about ended South Carolina's career as a gold-producing State, production in 1914 being valued



SOUTH CAROLINA


81°
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NORTH CAROLINA
Aberdeen
Hoffman
Fayetteville
Wadesboro
Rockingham
Hamlet
Monroe
Laurinburg
Parkton
Cape Fear R.
Lumber R.
Pembroke
Lumberton
Elizabethtown
Ashpole
Boardman
Whiteville
Chadbourne
Ft. Mill
Rockhill
Van Wyck
Catawba
Lancaster
LANCASTER
CHESTERFIELD
Chesterfield
Cheraw
MARLBORO
Bennettsville
McColl
KERSHAW
Camden
DARLINGTON
Darlington
DILLON
Dillon
LEE
Bishopville
Florence
FLORENCE
MARION
Marion
Mullins
HORRY
Conway
Little River
SUMTER
Sumter
RICHLAND
COLUMBIA
CALHOUN
St. Matthews
CLARENDON
Manning
WILLIAMSBURG
Kingstree
Lake City
ORANGEBURG
Orangeburg
Branchville
DORCHESTER
St George
BERKELEY
Summerville
GEORGETOWN
Georgetown
Santee Canal
Santee Riv.
Black R.
Pee Dee R.
Lynch R.
Edisto R.
Myrtle Beach
Long Bay
Murrell Inlet
Waverly Mills
North Inlet
Winyah Bay
NORTH I.
South Island
SOUTH I.
CEDAR I.
N. Santee Inlet
S. Santee Inlet
CAPE I.
Cape Romain
RACOON KEYS
Bull Bay
BULL I.
Prices Inlet
CAPERS I.
DEWEES I.
Mt. Pleasant
Charleston
CHARLESTON
Moultrieville
Ft. Sumter
MORRIS I.
FOLLY I.
Stono Inlet
JOHNS I.
EDISTO I.
Edisto Island
N. Edisto R.
S. Edisto R.
St. Helena Sound
HUNTING I.
PRENTIS I.
CHAPLINS I.
ST. HELENA I.
Beaufort
BEAUFORT
Port Royal
Pt. Royal Sound
PICKNEY I.
Hiltonhead
HILTON HEAD I.
Braddocks Pt.
Tybee Roads
COLLETON
Walterboro
ATLANTIC OCEAN
Greenwich

at only $7360. Other mineral products in order of value of output are mineral waters, sand and gravel, tin, occasional gems, barytes, and fuller's earth. The total value of all mineral products in 1914 was $1,414,294.

Agriculture. The land area of South Carolina in 1910 was approximately 19,516,800 acres, of which 13,512,028 acres were in farms, 6,097,999 acres in improved land. There were 176,434 farms, averaging 76.6 acres each. The total value of farm property, including land, buildings, implements and machinery, domestic animals, poultry, and bees, was $392,128,314. The average value of land per acre in that year was $19.89 and the average value per farm including implements was $2223. In 1910, 65,213 farms were operated by owners and managers, and 111,221 by tenants. There were 79,636 white farmers (34,926 tenants) and 96,798 nonwhites (76,295 tenants), all but 26 of whom were negroes. The acreage owned and operated by whites was 7,458,417, and by nonwhites, 1,140,498. The land operated by tenants measured 2,113,135 and 2,799,978 acres, for whites and nonwhites respectively. Of the white farmers 212 were foreign born, 101 of them Germans.

The following table shows the acreage, production, and value of some of the principal crops as estimated by the United States Department of Agriculture in 1915.

PRODUCT	Acreage	Prod. bu.	Value
Cotton	2,400,000	*1,160,000	$62,578,000
Corn	2,155,000	35,558,000	30,935,000
Wheat	225,000	2,430,000	3,353,000
Oats	525,000	9,975,000	6,683,000
Potatoes	11,000	880,000	1,012,000
Sweet potatoes	65,000	6,825,000	4,436,000
Hay	220,000	‡286,000	4,462,000
Tobacco	65,000	†37,700,000	2,639,000
Rice	3,700	90,000	81,000

* Bales of 500 pounds gross weight. † Pounds. ‡ Tons.

The total value of crops in 1909 was $141,983,354 and the combined acreage of crops for which acreage was reported, 5,182,845, about 84.5 per cent of the total improved land. The leading crops in order of their importance were cotton, corn, cotton seed, oats, hay and forage, sweet potatoes and yams, and tobacco. Cotton is the predominant crop, not only in agriculture, but also in South Carolina's industrial, commercial, and financial activities. In 1909 the acreage devoted to cotton was 2,556,467, producing 1,279,866 bales, valued at $80,337,945, and 639,933 tons of cotton seed, valued at $16,043,122. In 1909 14,573 bales of the valuable long-fibred Sea Island cotton, grown mostly in the counties of Beaufort and Charleston, were ginned. The farmers have realized the advantage of diversifying crops, and corn is receiving more attention every year, bidding fair to rival cotton both in acreage and value. In 1909 the area under corn was 1,565,832 acres, which produced 20,871,946 bushels, valued at $20,682,632. The acreage devoted to oats in 1909 was 324,180 and the production amounted to 5,745,291 bushels, valued at $3,809,345. To hay and forage were devoted 209,767 acres, producing 186,131 tons, valued at $3,189,122. Sweet potatoes and yams had an acreage of 48,878 in 1909, the production was 4,319,926 bushels, valued at $2,606,606. In 1909, 30,082 acres of tobacco were harvested, producing 25,583,049 pounds, valued at $2,123,576. (See table above for 1915 figures.) At one time among the largest producers of rice in the United States, South Carolina farmers are gradually permitting this crop to languish. The acreage in 1909 was 19,491, and the production 541,570 bushels, valued at $520,000. Sugar and sorghum cane and their products are important; in 1909 the acreage devoted to sugar crops was 15,498, the production 87,477 tons, and the total value of products, including cane, sugar, sirup, molasses, etc., was $619,992. To vegetables other than potatoes and sweet potatoes and yams were devoted 51,994 acres, producing crops valued at $3,705,991.

Peaches, apples, pears, plums, and prunes are the State's most important orchard fruits, the total value of the orchard products being $956,376 in 1909. Small fruits had a total production of 1,408,099 quarts, valued at $113,254. The most important of these were strawberries and blackberries and dewberries.

Live Stock and Dairy Products. The total number of domestic animals on farms in 1910 was reported as 162,846, valued at $43,790,143. The number and value of various classes of live stock on farms on Jan. 1, 1916, were estimated by the United States Department of Agriculture to be: horses, 84,000, value $11,340,000; mules, 171,000, value $27,531,000; milch cows, 189,000, value $6,520,000; cattle other than milch cows, 215,000, value $3,311,000; sheep, 30,000, value $81,000; swine, 817,000, value $7,794,400. The total value of dairy products, exclusive of milk and cream used on the producing farms, was $2,801,000 in 1909. The milk sold amounted to 919,745 gallons; butter to 1,752,209 pounds, and cream to 11,282 gallons. The total number of fowls reported in 1910 was 146,855, and the eggs produced amounted to 9,722,160 dozen, valued at $1,902,993. Honey produced on farms amounted to 653,119 pounds, valued at $75,941, and wax to 12,440 pounds of $2995 value.

Fisheries. The fisheries products of South Carolina are less in value than any other of the South Atlantic States, the total value of all fishing products in 1908 being only $288,000. Shad is the most important species caught. In 1908 the total number of persons employed in fisheries was 2559, and the capital invested, $113,000.

Forest Products. In 1908 the area of forest land in South Carolina was 18,750 square miles. Lumbering activity increases with the distance on each side of the "Fall line," the swamp lands near the coast containing the largest stands of virgin forest, chiefly cypress. The mountains at the other extreme contain forests of oak, chestnut, black locust, and short-leaf pine. The most important species is the yellow pine. In 1913, 497 mills reported having cut 752,184 M feet board measure, of which over 550,000 M feet were yellow pine. (See paragraph on *Manufactures.*) In 1909, forest products produced on farms were valued at $4,513,092, of which $3,092,453 were used on the farms themselves.

Manufactures. In value of manufactured products South Carolina ranked thirty-second among the States in 1909, with a per capita value of products of $75. The following table gives the most important figures relative to manufactures for the 10 leading industries in 1909 and 1904, as given by the United States Bureau of the Census.

In 1914 the aggregate capital invested was $161,889,384, the value of products was $135,-

270,872, the average number of employees, 75,629, of which 3089 were salaried. Cotton holds the dominating position in manufactures, South Carolina ranking third among the States in the value of cotton products in 1909. In point of value, cotton contributed 58.2 per cent of all manufactured products. In that year there were consumed 324,385,778 pounds of raw cotton, costing $35,533,209. The most important product was plain cloth, of which were produced 561,861,267 square yards, valued at $26,848,377. The number of spindles was reported at 3,754,251 in 1909, the number of looms, 94,205. Lumber and timber products rank second in importance. Great quantities of timber are imported, saw and planing mills utilizing about seven-eighths of the timber consumed. It is estimated that the wood-working industries of South Carolina consume about 423,670 M feet board measure annually. No inconsiderable products of the pine forests of South Carolina are used in the manufacture of naval stores. The State has long been one of the chief sources of turpentine and resin, and is one of the leading States in the distillation of soft wood. In 1909, 460,000 gallons of turpentine, valued at $205,000, and 15,000 barrels of resin, valued at $199,000, were produced. The manufacture of cotton-seed oil and cake ranks third in importance, and in 1909 produced 15,745,552 gallons of oil, and 156,729 tons of meal and cake.

In 1909 there were 56,264 male wage earners, and 16,782 female, 9405 under 16 years of age. For the great majority of wage earners the prevailing hours of labor were 60 a week. A comparatively small percentage of the manufacturing industries are located in the large cities. There were four cities in 1909 with a population of over 10,000, and from these were reported but 16.1 per cent of the total value of products. In 1914 wage earners in Charleston, the largest city, numbered 2739, employed in 120 establishments which reported products valued at $5,852,000. Columbia ranks second among the cities of the State, and in 1914, 71 establishments employed 2228 wage earners, and produced products valued at $6,765,000. Spartanburg and Greenville rank third and fourth, respectively, among the cities of the State. See also articles on these cities.

Transportation. The Savannah River, navigable for 202 miles and connecting Savannah with Augusta, Ga., is the most important inland waterway. Considerable sums have been spent for the general improvement of navigation. The total mileage of first track of steam railways in 1914 was 3686. The principal roads and their mileage of first track in that year were the Southern, 1122; the Atlantic Coast Line, 886; the Seaboard Air Line, 363; the Charleston and Western Carolina, 319; and the Carolina Atlantic and Western (Seaboard Air Line), 187.

Banks. The State Bank of South Carolina had an exceptionally successful career. It was established in 1812 to remedy the financial disturbances caused by the impending war with England. It was entirely under State control, and its president and directors were chosen by the Legislature. The capital was furnished by the State, and the bank was the repository for all State funds. In 1852 its charter was renewed and it continued to do a most satisfactory business until 1870, when it was put in liquidation. The table on the following page gives the State banking statistics, as reported, as to principal items in 1914.

Government. The present constitution was enacted in 1895, and has been since amended in unimportant particulars. Concurrence of two-thirds of the members elected to each house of two successive legislatures, and a majority of the electors is necessary to carry an amendment. A constitutional convention may be convened by a vote of two-thirds of the members elected to each branch of the General Assembly, if a majority of the voters approve at the next election. The seat of government is situated at Columbia.

SUMMARY OF MANUFACTURES FOR 1909 AND 1904

THE STATE — TEN LEADING INDUSTRIES

INDUSTRY	Census	Number of establishments	PERSONS ENGAGED IN INDUSTRY		Capital	Wages	Value of products	Value added by manufacture
			Total	Wage earners (average number)	Expressed in thousands			
All industries	1909	1,854	78,040	73,046	$173,221	$20,361	$113,236	$46,885
	1904	1,399	63,071	59,441	113,422	13,869	79,376	29,407
Bread and bakery products	1909	63	521	369	394	119	1,100	376
	1904	52	397	311	278	99	618	248
Brick and tile	1909	45	990	888	935	233	731	463
	1904	7	963	875	517	184	656	479
Cars and general shop construction and repairs by steam-railroad companies.	1909	10	1,481	1,418	518	687	1,499	753
	1904	8	1,222	1,131	300	577	1,081	648
Cotton goods, including cotton small wares.	1909	147	46,342	45,454	125,549	11,661	65,930	24,627
	1904	127	38,038	37,271	82,337	7,702	49,438	15,130
Fertilisers	1909	26	2,057	1,851	11,857	671	9,025	3,396
	1904	20	1,221	1,071	7,087	304	3,638	946
Foundry and machine shop products	1909	34	477	417	703	194	547	369
	1904	37	517	450	511	212	542	371
Hosiery and knit goods	1909	7	864	839	755	152	655	321
	1904	14	1,103	1,058	824	187	1,079	493
Lumber and timber products	1909	851	16,330	14,604	15,010	4,378	13,141	9,160
	1904	502	11,654	10,641	8,194	2,873	8,279	5,773
Oil, cottonseed, and cake	1909	103	2,190	1,765	6,880	467	10,903	2,183
	1904	100	1,626	1,282	5,177	320	5,463	910
Printing and publishing	1909	161	1,294	834	1,664	412	1,601	1,261
	1904	150	985	623	945	268	1,038	824

Executive.—The department consists of the Governor, in whom is vested supreme executive authority, the Lieutenant-Governor, the Secretary of State, Comptroller General, State Superintendent of Education, Commissioner of Agriculture, Commerce and Industries, Adjutant and Inspector General, State Treasurer, and Attorney-General, all elected at the same time as the Governor, and holding office for the same period, viz., two years.

Legislative.—The legislative power is vested in the Senate and House of Representatives, which together form the General Assembly. The House of Representatives consists of 124 members. The Senate is composed of one member from each county, elected for a term of four years. The senators must be at least 25, and the representatives at least 21 years of age. Members of both houses are biennially elected. The General Assembly convenes annually on the second Tuesday in January.

Judiciary.—The judicial power is vested in a supreme court, two circuit courts, which comprise a court of common pleas, and a court of general sessions, established by the Legislature. The supreme court consists of one chief justice, and four associate justices. They are elected by the General Assembly, for a term of 10 years. The State is divided into judicial circuits, and for each of these a judge (holding office for four years) is elected by vote of the General Assembly.

ITEMS	National banks	State banks	Savings banks	Trust companies
Number	55	284	26	17
Capital	7,485,000	10,445,190	1,500,437	990,640
Surplus	2,556,000	3,986,977	617,050	221,100
Cash, etc.	1,194,000	1,194,966	133,639	110,517
Loans	32,266,000	48,348,986	10,958,824	4,239,336
Deposits	20,542,000	9,556,118	10,873,393	3,175,437

Suffrage and Elections.—Voters must have resided in the State for two years, in the county for one year, and in the polling precinct for four months, and have paid a poll tax six months before any election. Ministers in the service of an organized church, and teachers of schools are entitled to vote after six months residence in the State, if otherwise qualified. Electors must be enrolled once in every 10 years. All persons of voting age who applied for registration up to Jan. 1, 1898, and who could read any section in the Constitution submitted to them, or understand or explain it when read, are entitled to subsequent registration. Any person who applies for registration after that date must be able to read and write any section of the Constitution submitted to him, or show that he owns and has paid taxes, collectable during the previous year, on property in the State assessed at $300 or more. General elections for Federal, State, and county officers are held in each second year of even date on the Tuesday following the first Monday in November. It is unlawful for any person to sell, barter, or give away to any voters intoxicating liquor within one mile of any voting precinct during any primary or any election day.

Local and Municipal Government.—Each county must contain at least one hundred and twenty-fourth part of the population, must have assessed taxable property of at least 1½ millions of dollars, and may not be less than 400 square miles in size. No city or town shall be organized without the consent of the majority of the electors, entitled by law to vote within the district proposed to be incorporated.

Miscellaneous Constitutional and Statutory Provisions.—Every corporation organized and doing business, except religious, educational, and benevolent associations, and corporations selling by sample, must have and maintain at least one agent upon whom process may be served, and at least one business office. No discrimination in charges for the facilities and transportation on the same classes of freight and passengers, or for the transmission of intelligence within the State, or coming from or going into any other State, may be made. Divorce is not permitted.

No person who denies the existence of the Supreme Being may hold office under the Constitution. The hours of employment in cotton and woolen establishments are limited to 10 a day with certain exceptions. On Sept. 14, 1915, an amendment effective Jan. 1, 1916, providing for State-wide prohibition was adopted.

Finances. The debt of South Carolina at the outbreak of the Civil War amounted to $3,814,862. In 1870 it was $6,314,000. There were also outstanding against the State bonds to the amount of $20,827,608, and a railroad debt of $6,787,608. In 1880 the debt amounted to $7,175,454, and in 1915 it was $5,673,085. On Dec. 31, 1914, there was a cash balance of $352,718, the disbursements during the year amounted to $3,447,423, and the receipts to $3,645,363, leaving a total cash balance on Dec. 31, 1915, of $550,658.

Militia. The number of males of militia age, in 1910, was 276,188. The organized militia on Jan. 1, 1914, included 1794 enlisted men and 164 officers, and was composed of a brigade of three regiments of infantry, and sanitary troops which included a field hospital.

Population. The population in certain census years was as follows: 1790, 249,073; 1810, 415,115; 1830, 581,185; 1850, 668,507; 1870, 705,606; 1890, 1,151,149; 1900, 1,340,316; 1910, 1,515,400. In 1915 the population was estimated to be 1,607,745. In 1910 South Carolina ranked twenty-sixth, with 49.7 per square mile. There were 679,161 whites and 835,843 negroes. Native-born whites numbered 673,107 and foreign-born whites 6054. The urban population in 1910 was 224,832, and rural 1,290,568. There were 751,842 males and 763,558 females. Of the natives, 94.8 per cent were born in South Carolina, 2.8 per cent in North Carolina, and 1.1 per cent in Georgia. The number of males of voting age was 335,046 in 1910; of these 165,769 were white. There are six cities of over 8000; these with their populations in 1910, and estimated for 1915, were: Charleston, 58,833 and 60,427; Columbia, 26,319 and 34,058;

Spartanburg, 17,517 and 20,745; Greenville, 15,741 and 17,788; Anderson, 9654 and 11,845; Sumter, 8109 and 9392.

Education. South Carolina has a very large negro population, and the widely scattered rural schools offer problems difficult to solve. As a result the State had, in 1910, a higher percentage of illiterates than any other State, with the exception of Louisiana. Of the total population of the age of 10 years or over 276,980 or 25.7 per cent were illiterates. In 1900 the percentage was 35.9. This percentage, however, is not limited to the negro population. Among whites of native parentage the percentage was 10.5, which is exceeded only by four other States. Among the negroes the percentage of illiteracy was 38.7. In 1900 it was 52.8. The total population, ages 6 to 20, in 1910 was 564,260. Of these 291,307 attended school. Among native whites the school population was 229,204, and among negroes 331,429. According to the report of the State Superintendent of Public Instruction, the total enrollment in the schools in 1914–15 was 372,841. The average daily attendance was 256,685. In the same year the teachers numbered 8070. The total expenditures for educational purposes amounted to $3,295,506. White teachers number about 4500 and the colored teachers about 2800. The average annual salary of white male teachers is $530.28, and of women teachers, $382.48. The average annual salary of male colored teachers is $126.87, and of women, $123.90.

The administration of the educational system is in the hands of a State Board of Education. Each county has a superintendent, a board of education, and a supervisor of schools. The normal schools are the Winthrop Normal College at Rock Hill, and the Colored Normal Industrial, Agricultural, and Mechanical College of South Carolina at Orangeburg. The institutions of collegiate rank include the University of South Carolina (coeducational), at Columbia, College of Charleston at Charleston, Clemson Agricultural College at Clemson College, Furman University at Greenville, Wofford College at Spartanburg, Presbyterian College of South Carolina at Clinton (coeducational), Erskine College at Due West (coeducational), Newberry College at Newberry (coeducational), Columbia College at Columbia (women), College for Women at Columbia, Women's College at Due West, Chicora College (women) at Greenville, Greenville Female College at Greenville, Lander College (women) at Greenwood, Coker College for Women at Hartsville, Converse College for Women at Spartanburg. Colleges for colored students are Allen University at Columbia, Benedict College at Columbia, Claflin University at Orangeburg, Ferguson-Williams College at Abbeville, Friendship College at Rock Hill, Harbison College at Ermo, and Vorhees College at Denmark.

Charities and Corrections. The Legislature of 1915 created a State Board of Charities and Corrections. The State penal institutions are the Penitentiary at Columbia, the Reformatory for Negro Boys at Columbia, the Farm at Boykin, and the South Carolina Industrial School at Florence. The charitable institutions are the State Hospital for the Insane and the Confederate Infirmary, both at Columbia.

Religion. In the religious census of 1906 about half of those reporting were Baptists, closely followed in numbers by the Methodists, which denominations constitute the bulk of the church membership.

History. In 1562 Jean Ribaut (q.v.), acting for Admiral Coligny, attempted to form a colony of French Huguenots at Port Royal. This was abandoned the next year, and other attempts were made farther south. Charles I granted in 1630 to Sir Robert Heath all the territory between 31° and 36° extending from sea to sea. No settlement was made, and in 1663 Charles II granted the same to eight Lords Proprietors, favorites at court. In 1665 the limits were extended to 29° and 36° 30′, and proprietary rights were given, but the Proprietors were to legislate "by and with the advice, assent, and approbation of the freemen." Permission to grant religious freedom was given, and subinfeudation was allowed. The terms to settlers were at first liberal, but in 1669 the attempt was made to put into effect the "Fundamental Constitution" drawn by John Locke. (See NORTH CAROLINA.) An expedition consisting of 200 persons under William Sayle settled upon the Ashley River in 1670. A "parliament" consisting of the five deputies of the Proprietors and 20 members elected by the freeholders was established in 1671. In 1680 the settlement was removed to the present site of Charleston. Immigration was rapid, and by 1700 the colony contained 5500 inhabitants.

The colony was turbulent. It refused to adopt the Fundamental Constitution, quarreled over quitrents, and in 1693 secured the right of initiative in legislation. In May, 1704, the Proprietors ordered the enforcement of the Test Act requiring conformity to the Church of England, but an appeal to the Whig House of Lords led to the annulment of the Test Act in 1706, though the Church was still established. The colony was divided into North and South Carolina in 1710. The Yemassee Indians, instigated by the Spanish at St. Augustine, attacked the settlements in 1715, and the Proprietors refused to grant aid. When appeal was made to the crown it was shown that no aid could be given unless the government was vested in the King. Numerous other grievances led to the assembling of a convention which assumed government, and James Moore (q.v.) was chosen to act as Governor until the King's pleasure was known. The Royal Governor, Sir Francis Nicholson, arrived in 1721 and in 1729 the crown purchased the proprietary rights. From this time the assembly never relinquished a single right it gained, and before the Revolution claimed all the rights and privileges of the British Parliament. The first printing press was set up in 1730, and the *South Carolina Gazette* established two years later. The colony joined Oglethorpe's unsuccessful expedition against the Spaniards in 1740, and was occupied with Indian troubles in 1755, 1760, and 1765. The Cherokees ceded their lands in 1755, and the Scotch-Irish began to fill them up. The colony was prompt in its resistance to the Stamp Act, and troops were quartered in Charleston. It agreed to the nonimportation agreement in 1769–70, and sent money and supplies to Boston in 1774. Delegates were sent to the Continental Congress in 1774 and the Provincial Congress met Jan. 11, 1775. At the second session in June, 1775, troops were voted, and Lord William Campbell tried in vain to restore royal authority. In March, 1776, sovereignty was claimed and a government established. Fort Moultrie (q.v.) was unsuccessfully attacked by the British, June 28. Several battles (among them Camden, King's Mountain, Cowpens, and Eutaw Springs) were fought within the State during the Revolution. Famous leaders of irregular bands of patriots were Sumter and Marion. Charleston was captured by the British in 1780 and held until 1782. The State adopted the Federal Constitution May 23, 1788, Columbia was made the capital in 1790, and a new constitution adopted, giving the Legislature practically all power. Differences began between sections. The eastern part of the State had the wealth and was strongly Federalist. The western part had the population and was strongly Anti-Federalist. In 1808 a compromise was effected which lasted until 1868. By its terms the Lower House of the Legislature was to consist of 124 members, 62 to represent population and 62 wealth. Each district was given as many representatives as it had sixty-seconds of population and wealth. With the adoption of this compromise State politics ceased to trouble.

The State early became dissatisfied with the tariff policy of the general government, and as early as 1828 the "South Carolina Exposition" was adopted by the Legislature. On the passage of the Clay Tariff Bill in 1832 a convention was called which declared, November 24, that no duties should be collected after Feb. 1, 1833. President Jackson was resolved to enforce the law, but an actual conflict was averted by a compromise. (See Calhoun, John C.; Nullification.) On the election of President Lincoln in 1860 a convention was called on December 20, which unanimously passed an ordinance of secession. The attack on Fort Sumter in April, 1861, precipitated the Civil War. (See Civil War.) The State furnished 60,000 soldiers to the Confederate armies, though her voting population was only about 47,000. Charleston withstood the Federal attacks until February, 1865, when the Confederates were finally compelled to evacuate it. South Carolina suffered from Sherman's march northward. A provisional governor was appointed at the close of the war and a new constitution adopted. On the refusal of the State to ratify the Fourteenth Amendment a military government was established. In 1868 another constitution allowing negro suffrage was adopted and the State was readmitted June 25. The next years were full of corruption. Illiterate negroes and carpetbaggers filled high offices and the debt increased from $5,407,306 in 1868 to $20,333,901 in 1873. The campaign of 1876 was bitter, with intimidation and bloodshed. Both sides claimed victory, and there were for a time rival State governments. When President Hayes withdrew the Federal troops from the State the Republican claimant, Governor Chamberlain, gave up the contest and Wade Hampton (q.v.) was recognized as Governor. Several of the State officers were tried on charges of malfeasance and sentenced to imprisonment. Since this time the negro majority in the State has been powerless in elections. A severe earthquake, of which Charleston seemed to be the centre, destroyed property valued at $8,000,000, Aug. 31, 1886. In 1893 a great storm on the coast caused the loss of more than 1000 lives. The growth and development of the Farmers' Alliance led to the capture of the Democratic party in 1890, when B. R. Tillman was elected Governor after a campaign of bitterness second only to that of 1876. In 1901–02 the South Carolina Interstate and West Indian Exposition was held at Charleston. Largely owing to charges of corruption, the Legislature in 1907 passed measures permitting the abolition of the State liquor dispensaries, which had entire charge of the sale of liquors prior to that time. In the election of November, 1908, Governor Ansel was reelected. For president, Bryan received 62,288 votes, and Taft 3963. Prohibition was the chief issue in the campaign of 1910, but Coleman L. Blease, an antiprohibitionist, was elected Governor. Shortly after his accession to the office he came into conflict with the State Supreme Court over the appointment of special judges. Blease declared that he would not commission judges who were not his friends, and refused commissions to the nominees of the court. Chief Justice Jones resigned from his office and became a candidate for Governor against Blease in 1912. In 1911 Governor Blease began pardoning convicts on a large scale, continuing this practice throughout his term. He also vetoed more acts of the Legislature than had been vetoed in the previous 20 years. Most of these were passed over the veto. In his annual message to the Legislature in 1912 he took a strong stand against negro education and urged a law to prevent white persons from teaching negroes. He also indirectly defended lynching. In spite of a strong feeling against him throughout the State he was renominated and elected for a second term, defeating Judge Jones by about 3000 votes. In the presidential election of this year Wilson received 348,355 votes, Roosevelt 1293, and Taft 4764. There was no Republican nominee for Governor. Governor Blease continued his notorious course by a wordy war with the Legislature and by wholesale pardoning of prisoners. On Jan. 9, 1915, he issued a blanket pardon for 1100 convicts, whom he had previously paroled (total number of pardons during his four years' term nearly 3000). On January 11 he disbanded the organized militia of the State, over which he had differences with the Federal War Departments, and on the following day resigned, giving no reason. Richard I. Manning, Democratic Governor-elect, took office on January 19 and at once reversed the disbanding order of Governor Blease. In the elections held in this year the State voted for prohibition. In national elections the State has been always Democratic, except in 1792, when the Federalists secured the electors, and during the Reconstruction period, 1868–76, when the vote was given for the Republican candidates. See Electoral Commission.

GOVERNORS OF SOUTH CAROLINA

UNDER THE PROPRIETORS

Sir John Yeamans, Lieutenant General and Gov.	1665
William Sayle	1669–70
Joseph West (acting)	1670–72
Sir John Yeamans	1672–74
Joseph West	1674–82
Joseph Morton	1682–84
Richard Kyrle	1684
Robert Quarry (acting)	1684–85
Joseph West	1685
Joseph Morton	1685–86
James Colleton	1686–90
Seth Sothell (Southwell)	1690–91
Philip Ludwell	1691–93
Thomas Smith	1693–94
Joseph Blake (acting)	1694
John Archdale	1694–96
Joseph Blake	1696–1700

GOVERNORS OF SOUTH CAROLINA—*Continued*

James Moore (acting)	**1700–02**
Sir Nathaniel Johnson	**1702–08**
Edward Tynte	**1708–09**
Robert Gibbes (acting)	**1709–12**
Charles Craven	**1712–16**
Robert Daniel (acting)	**1716–17**
Robert Johnson	**1717–19**
James Moore (chosen by convention)	**1719–21**

UNDER THE CROWN

Sir Francis Nicholson	1721–25
Arthur Middleton (acting)	1725–30
Robert Johnson	1730–35
Thomas Broughton (Lieutenant Governor)	1735–37
William Bull (acting and Lieutenant Governor)	1737–43
James Glen	1743–56
William Henry Littleton	1756–60
William Bull, 2d (Lieutenant Governor)	1760–61
Thomas Boone	1761–64
William Bull, 2d (Lieutenant Governor)	1764–66
Lord Charles Greville Montagu	1766–68
William Bull, 2d (Lieutenant Governor)	1768
Lord Charles Greville Montagu	1768–69
William Bull, 2d (Lieutenant Governor)	1769–71
Lord Charles Greville Montagu	1771–73
William Bull, 2d (Lieutenant Governor)	1773–75
Lord William Campbell	1775

STATE

John Rutledge	**President**	1776–78
Rawlins Lowndes	“	1778–79
John Rutledge	**Governor**	1779–82
John Mathews		1782–83
Benjamin Guerard		1783–85
William Moultrie		1785–87
Thomas Pinckney	**Democrat-Republican**	1787–89
Charles Pinckney	“ “	1789–92
Arnoldus Vanderhorst		1792–94
William Moultrie		1794–96
Charles Pinckney	**Democrat-Republican**	1796–98
Edward Rutledge	**Federalist**	1798–1800
John Drayton	**Democrat-Republican**	1800–02
James B. Richardson	“ “	1802–04
Paul Hamilton	“ “	1804–06
Charles Pinckney	“ “	1806–08
John Drayton	“ “	1808–10
Henry Middleton	“ “	1810–12
Joseph Alston	“ “	1812–14
David R. Williams	“ “	1814–16
Andrew Pickens	“ “	1816–18
John Geddes	“ “	1818–20
Thomas Bennett	“ “	1820–22
John L. Wilson	“ “	1822–24
Richard I. Manning	“ “	1824–26
John Taylor	“ “	1826–28
Stephen D. Miller	**Democrat**	1828–30
James Hamilton	“	1830–32
Robert Y. Hayne	“	1832–34
George McDuffie	“	1834–36
Pierce M. Butler	“	1836–38
Patrick Noble	“	1838–40
B. K. Hennegan (acting)		1840
John P. Richardson	**Democrat**	1840–42
James H. Hammond	“	1842–44
William Aiken	“	1844–46
David Johnson	“	1846–48
W. B. Seabrook	“	1848–50
John H. Means	“	1850–52
John L. Manning	“	1852–54
James H. Adams	“	1854–56
Robert F. W. Allston	“	1856–58
William H. Gist	“	1858–60
Francis W. Pickens	“	1860–62
M. L. Bonham	“	**1862–64**
A. G. Magrath	“	**1864–65**
Benjamin F. Perry	**Provisional**	**1865**
James L. Orr	**Democrat**	**1865–68**
Robert K. Scott	**Republican**	**1868–72**
Franklin J. Moses, Jr.	“	**1872–74**
Daniel H. Chamberlain	“	**1874–77**
Wade Hampton	**Democrat**	**1877–79**
W. D. Simpson (acting)	“	**1879–80**
T. D. Jeter (acting)	“	**1880**
Johnson Hagood	“	**1880–82**
Hugh S. Thompson	“	**1882–86**
John C. Sheppard (acting)	”	**1886**
John P. Richardson	**Democrat**	**1886–90**
Benjamin R. Tillman	“	**1890–94**
John Gary Evans	“	**1894–97**
William H. Ellerbe	“	**1897–99**
M. B. McSweeney	“	**1899–1903**
Duncan C. Heyward	“	**1903–07**
M. F. Ansel	“	**1907–11**
Coleman L. Blease	“	**1911–15**
C. A. Smith (interim)	“	**1915**
Richard I. Manning	“	**1915–**

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SOUTH CAROLINA, UNIVERSITY OF. A coeducational nonsectarian institution, chartered in Columbia, South Carolina, in 1801, and opened in 1805. It was closed in 1863 during the Civil War, but reopened in 1866 under its present name. In 1878 the university was divided into two branches: one the South Carolina College, the other Claflin College for Negroes at Orangeburg. Its charter was amended in 1870 and in 1890. In 1894 women were admitted to all courses. In connection with the university is a system of accredited schools, their certificate admitting students without examination. The university has departments of law and of engineering. The total attendance in 1915–16 was 540, and the faculty numbered 33. The library contained in the same year 55,000 volumes, and the annual income was about $104,000. The president in 1916 was William S. Surrell.

SOUTH CAROLINA INTERSTATE AND WEST INDIAN EXPOSITION. An exposition held in Charleston, S. C., from Dec. 1, 1901, to June 2, 1902, the site covering about 250 acres. The principal buildings were: Administration, Agriculture, Art, Auditorium, Commerce, Cotton Palace, Fisheries, Machinery, Mines and Forestry, Negro, Transportation, and Women's. The larger buildings were constructed in Spanish Renaissance style, and finished in staff, coated with a dull white. State buildings of Illinois, Maryland, Missouri, New York, and Pennsylvania, city buildings representing Cincinnati and Philadelphia, and structures for exhibits of Cuba, Porto Rico, and Guatemala were erected. The total attendance was 674,086; the cost of the exposition was $1,250,000, while the receipts were $313,000.

SOUTH'COTT, JOANNA (1750–1814). An English religious visionary, born at Gittisham, Devonshire, of humble parentage. In youth she was a domestic servant, chiefly in Exeter. In 1792 she declared herself to be the woman driven into the wilderness (Rev. xii. 6), and began to claim the gift of prophecy. She gave forth predictions and, though illiterate, wrote many pamphlets. Her followers were numerous, and the sect lasted for about 50 years after her death. Her writings include *The Strange*

Effects of Faith (1801), with continuations (1802–20); books of *Prophecies and Visions* (1803); *Letters* (1804); *The True Explanation of the Bible* (1804–10); the *Book of Wonders* (1813–14). Several *Lives* were published in 1814 and 1815. Consult also her *Memoirs* (London, 1814), and Alice Seymour, *The Express: containing the Life and Divine Writings of Joanna Southcott* (2 vols., ib., 1909).

SOUTH DAKOTA. A north central State of the United States. It is 380 miles long by 200 miles wide. The Missouri River, entering the State near the middle of the north boundary, runs nearly straight south to the centre, and then flows to the extreme southeast corner, where it receives the waters of the Big Sioux, thus dividing the State into two parts, of which the western is slightly larger than the eastern. The latter portion, however, because of the evenness of its prairies and the more copious rainfall, contains most of the population. The total area is 77,615 square miles, of which all but about 747 square miles are land surface. South Dakota is fourteenth in size among the States of the Union.

Topography and Hydrography. The James River traverses the State from north to south, joining the Missouri about 50 miles above its junction with the Big Sioux; and cuts the eastern part into two nearly equal portions. The broad valley thus formed, like that of the Big Sioux, is gently rolling—all except a small territory about lakes Traverse and Big Stone being between 1000 and 1400 feet above sea level. West of the Missouri the country is much more rugged, with many swift streams. The largest of these is the Cheyenne, which, with its main branch, the Belle Fourche, incloses the Black Hills (q.v.) in the extreme southwest, that rise to a height of over 7000 feet. It then flows northeast, dividing this part of the State into two nearly equal portions. The southern of these sections is divided equally by the White River, and the northern portion is cut into thirds by the Grand and Moreau rivers. The various tributaries of these four rivers have cut the surface into deep ravines, and in places left high ridges and buttes. Between the headwaters of the White and those of the Cheyenne are the famous Bad Lands, giant masses of bare rock and clay destitute of vegetation. The Missouri, receiving the silt carried by streams from the west, is colored a deep yellow, and flows in a very tortuous channel. Its valley rises in terraces, in contrast to the broad slopes of the James and the Big Sioux. South Dakota has few lakes, and they are all in the extreme eastern part of the State.

Climate. The annual temperature is about 44.3° F. For July the mean is 72.2° F. and for January 15° F. The first settlers were terrified by the blizzards, storms of fine snow driven by the north wind, but now that the roads are well marked these storms are regarded as incidental. Really they are infrequent occurrences; it is a common thing for cattle to feed out all the winter. The annual rainfall averages 20 inches. Because there is little winter precipitation, and little rain when the frost leaves the ground, seeding is accomplished in South Dakota earlier and easier than in some eastern States.

Soil. The soil of South Dakota, excepting a few barren spots in the butte country, is a rich loam overlying the glacial subsoil, itself overlaid by vegetable mold. The Missouri River bottom lands are especially fertile. Settlers found South Dakota a treeless country, except in the Black Hills, where pine is growing above an altitude of 4000 feet, and along the banks of the streams and lakes, where cottonwood, ash, elm, and maple abound. But they proceeded to plant trees, and now many of the towns are buried in green, and farmhouses well protected against severe weather by groves of cottonwood, box elder, or elm.

Geology. Nearly every geological age is represented in South Dakota. The earliest rocks (Archean) are observed in three places. The first is a ridge extending from Sioux Falls to the James River, composed of quartzite; the second a small area near Big Stone Lake, of granite; the third, the centre of the Black Hills, where is exposed a granite core. Around this core are the narrow bands of the various ages of the secondary formations—sandstone (Potsdam) and two kinds of limestone (Silurian and Carboniferous). About this last appear sandstone, limestone, clays, and marls of the earliest secondary period, and about the whole is the Cretaceous or latest system of the secondary period which covers the whole State. Nearly all of the eastern half is covered by what is called the Colorado formation of this Cretaceous system, consisting of marl, clay, and limestone. The Laramie formation occupies the northwest quarter, and Dakota sandstone underlies the valley of the James. In the southwest quarter occur clay and conglomerate of the Tertiary period (Miocene). Over all of these older formations in the eastern part is the drift left by the glaciers. West of the Missouri running water has deposited some of the Pleistocene, or most recent, formations. The sandstone underlying the James River valley is a water-bearing stratum supplying powerful artesian wells; these wells have been utilized for many purposes.

Mineral Resources. Gold, the most important mineral product of South Dakota, occurs mainly in the Black Hills region in Lawrence County and was discovered by members of Custer's expedition in 1874. Owing to poor water and rail facilities, deposits remained unworked for about 10 years. In 1914 the production amounted to 354,758 fine ounces, valued at $7,333,508. The greater part of the output came from the famous Homestake Mine. In 1913 there were produced 172,642 fine ounces of silver, valued at $97,683. The value of the output of stone in 1914 was $156,907. South Dakota is the only source of lithium ore in the United States. This is found in Custer and Pennington counties, but production is small. Other minerals found in varying, and as a rule small, quantities are clays, lime, mica, tin, lead, copper, gypsum, natural gas, tungsten, and occasional gems. The total value of the mineral production of South Dakota in 1914 was $7,861,601.

Agriculture. South Dakota is essentially agricultural. Rainfall is sufficient to grow large grain crops without irrigation, though a small area in the Black Hills region is so treated. Of a total area of approximately 49,195,000 acres, 26,016,892 were in farms in 1910, these numbering 77,644 in that year. The acreage of improved land in farms was 15,827,208; average acres per farm, 335. The total value of all farm property, including land, buildings, implements and machinery was $1,166,096,980 in 1910, and the average value of land per acre, $34.69. The number of farms operated by owners and managers in 1910 was 58,413. In that year native-born white farmers numbered 49,360, foreign-born white 25,476, and the non-whites, 2808. Of the foreign-born farmers, 6523 were born in Germany, 5381 in Norway, and 3240 in Russia.

The following table shows acreage, production, and value of the principal crops as estimated by the United States Department of Agriculture for 1915.

PRODUCT	Acreage	Prod. in bushels	Value
Corn	3,250,000	94,250,000	$46,182,000
Wheat	3,725,000	63,762,000	54,835,000
Oats	1,725,000	72,450,000	20,286,000
Hay and forage	610,000	*1,220,000	6,466,000
Barley	750,000	24,000,000	11,040,000
Flaxseed	150,000	1,650,000	2,756,000

* Tons.

The total value of all crops in 1909 was $125,507,249, and the total area of all those reporting such was 12,226,772 acres. In order of importance the principal products were wheat, corn, oats, hay and forage, barley, flaxseed, emmer and spelt, and potatoes. Wheat is the leading crop, and, compared with other States, South Dakota ranked fourth in acreage and fifth in value in 1909, holding the same relative ranks in 1915. The acreage devoted to this crop was 3,217,255, with a production of 47,059,590 bushels, valued at $42,878,223. Of corn, the next in rank, were harvested 2,037,658 acres, which produced 55,558,737 bushels, valued at $26,395,985. In that year, oats had an acreage of 1,558,643 and a production of 43,565,676 bushels, valued at $16,044,785. The area under hay and forage in 1909 was 3,435,656 acres, producing 3,651,024 tons, valued at $15,243,664. Barley had an acreage of 1,114,531 and a production of 22,396,130 bushels, valued at $10,873,522. Emmer and spelt (a species of wheat used almost entirely for fodder) had an acreage of 259,611, and a production of 6,098,982 bushels, valued at $2,627,533; South Dakota led all States in this crop. In 1909 the State ranked second in the Union in acreage and value of production of flaxseed. The area devoted to this crop in that year was 518,566 acres, producing 4,759,794 bushels, valued at $7,001,717. The acreage under flaxseed has been steadily decreasing and in 1915 South Dakota ranked fourth in its production. The production of potatoes on 50,052 acres planted in 1909 amounted to 3,441,692 bushels, valued at $1,967,550. Other vegetables in that year had an acreage of 15,150 and a production valued at $1,033,163. In 1909 the total value of orchard fruits, of which apples were the most important, was $209,339. The production of small fruits was valued at $47,263, strawberries predominating.

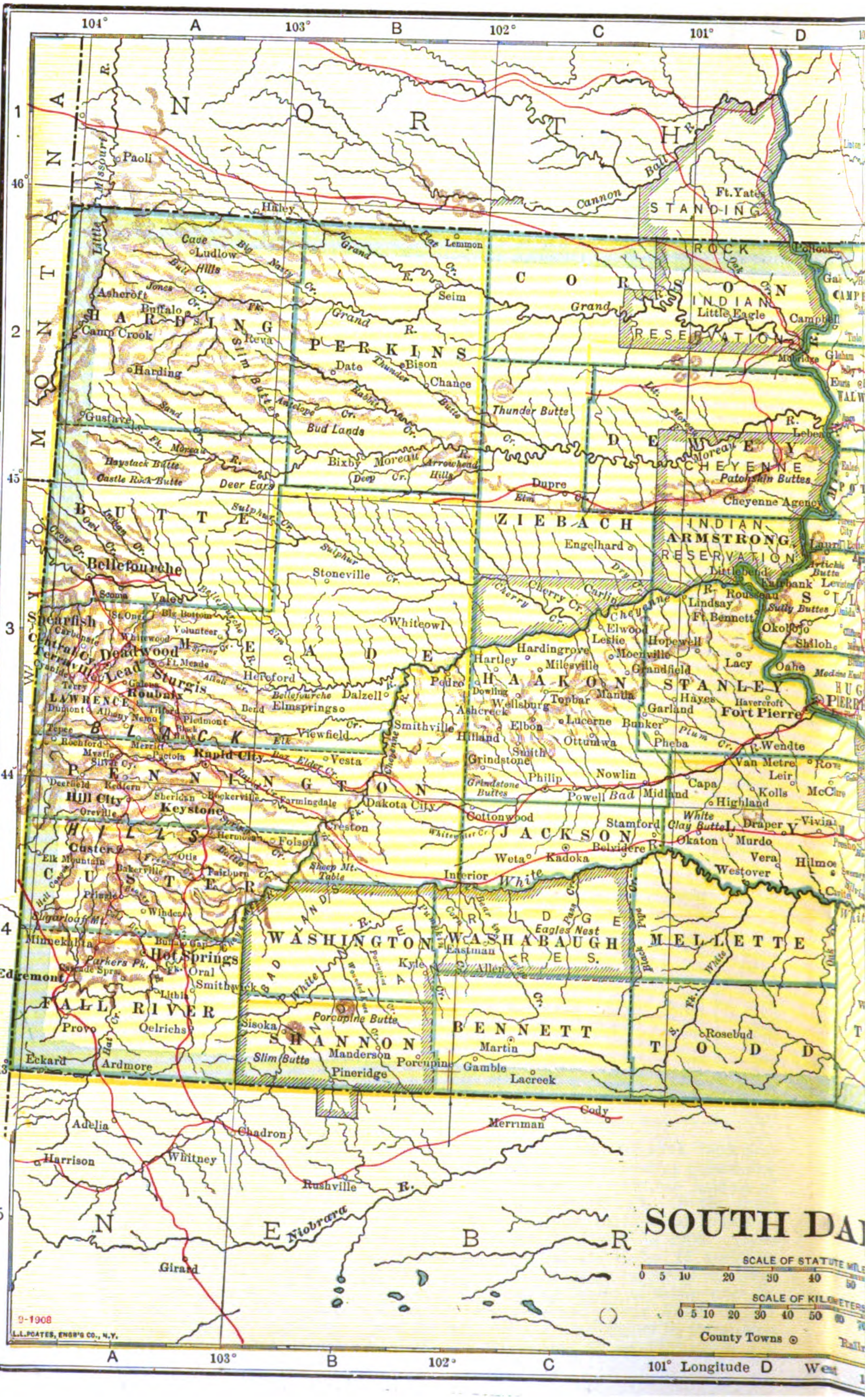
Live Stock and Dairy Products. The total value of live stock on farms in 1910 was $127,229,000. This includes domestic animals and bees, the former contributing $124,841,000. The number and value of the various domestic animals on farms as estimated by the United States Department of Agriculture in 1916 were: horses, 759,000, $70,587,000; mules, 15,000, $1,635,000; milch cows, 485,000, $28,615,000; cattle, 1,064,000, $40,858,000; sheep, 604,000, $3,141,000; swine, 1,314,000, $13,271,000. The total value of fowls of all kinds in 1910 was $2,356,465. Eggs produced in 1909 were reported at 22,396,021 dozens, valued at $3,791,973. In 1909 the value of dairy products sold was estimated at $6,193,000. The milk produced was reported at 82,428,514 gallons, and the butter made at 13,629,647 pounds.

Manufactures. In 1909 South Dakota ranked forty-sixth in value of manufactured products. The following table gives the most important data regarding manufactures, for 1914, 1909, and 1904 for the State and for five leading industries. In 1909 there were produced 962,840 barrels of white flour valued at $5,041,149. Of the total number of wage earners engaged in industry, 3145 were male and 457 female in 1909. There were only 46 wage earners under 16 years of age, all male. For a large majority of wage earners, the prevailing hours of labor were 60 per week. Aberdeen and Sioux Falls (qq.v.) were the only cities of over 10,000 in population in 1910. In the former 37 establishments em-

SUMMARY OF MANUFACTURES FOR 1914, 1909, 1904

THE STATE — FIVE LEADING INDUSTRIES

INDUSTRY	Census	Number of establishments	PERSONS ENGAGED IN INDUSTRY		Capital	Wages	Value of products	Value added by manufacture
			Total	Wage earners (average number)	Expressed in thousands			
All industries	1914	898	5,346	3,788	$15,060	$2,628	$24,139	$7,060
	1909	1,020	5,226	3,602	13,018	2,298	17,870	6,394
	1904	686	3,582	2,492	7,585	1,422	13,085	4,388
Bread and other bakery products	1909	92	431	286	500	151	1,161	440
	1904	32	169	116	170	49	388	170
Butter, cheese, and condensed milk	1909	95	252	139	633	112	2,686	378
	1904	97	350	192	484	125	2,183	350
Flour-mill and gristmill products	1909	95	454	285	2,873	187	6,208	872
	1904	96	521	347	2,428	293	6,519	1,161
Lumber and timber products	1909	58	534	451	941	301	945	596
	1904	26	227	191	244	114	377	280
Printing and publishing	1909	392	1,387	825	2,159	493	1,976	1,520
	1904	279	1,001	592	1,344	312	1,222	980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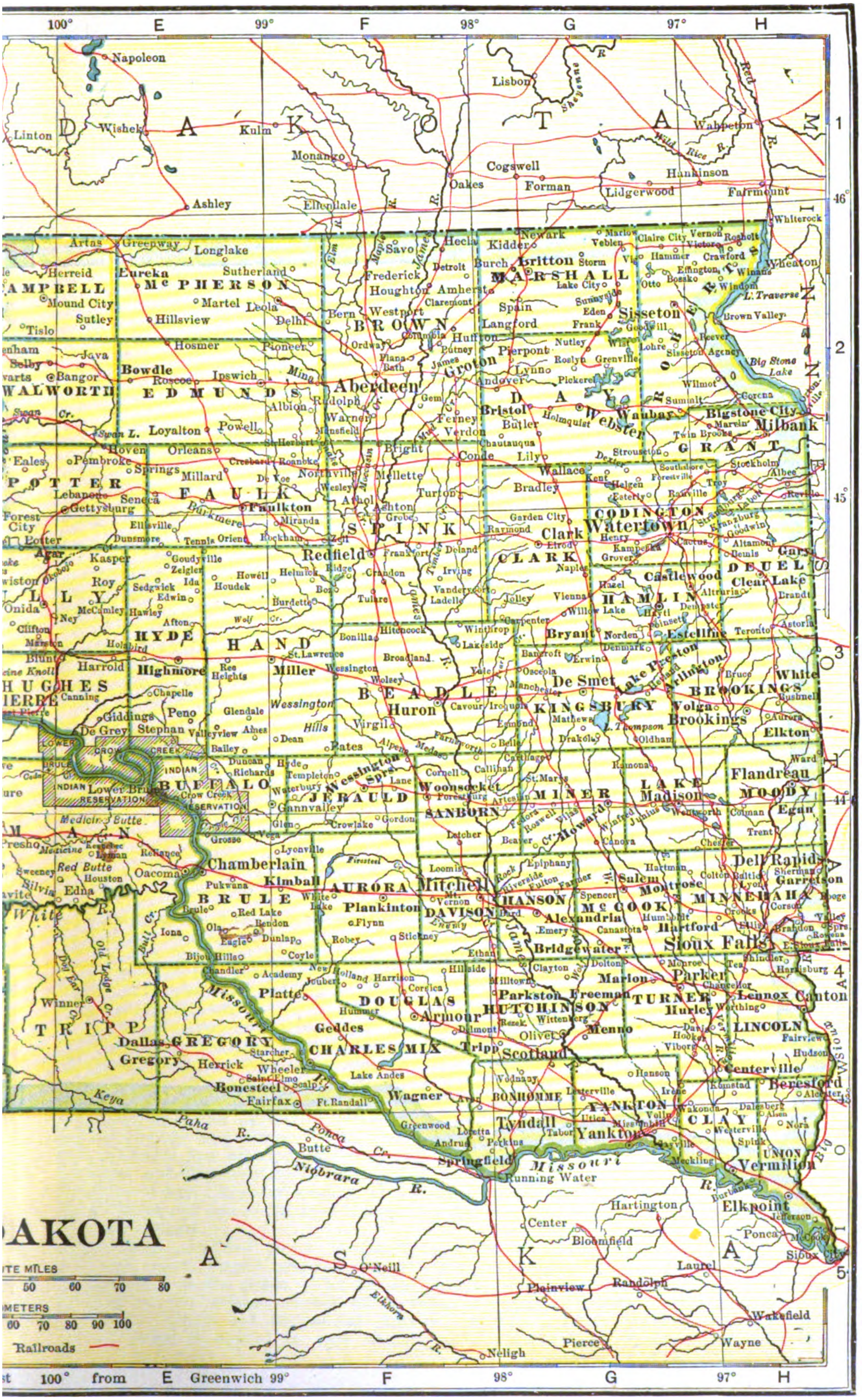
Haley
Cannon Ball R.
STANDING ROCK INDIAN RESERVATION
Ft. Yates
Pollock
Lemmon
Cave
Ludlow
Bull Hills
Ashcroft
Buffalo
Camp Crook
HARDING
Reva
Slim Buttes
Harding
Gustave
PERKINS
Date
Bison
Chance
Seim
Grand R.
Thunder Butte
Bud Lands
Bixby
Moreau R.
Deep Cr.
Arrowhead Hills
CORSON
Little Eagle
Campbell
Mobridge
DEWEY
CHEYENNE
Patohkin Buttes
Cheyenne Agency
Dupre
Haystack Butte
Castle Rock Butte
Deer Ears
BUTTE
Bellefourche
Scoma
Vale
Spearfish
St. Onge
Big Bottom
Volunteer
MEADE
Stoneville
Whiteowl
ZIEBACH
Engelhard
ARMSTRONG
INDIAN RESERVATION
Littlebend
Fairbank
Lindsay
Rousseau
Ft. Bennett
Sully Buttes
Okobojo
Shiloh
Central City
Deadwood
Terraville
Lead
Sturgis
Ft. Meade
Hereford
LAWRENCE
Roubaix
Dalzell
Elmsprings
Viewfield
Vesta
Rapid City
BLACK HILLS
PENNINGTON
Hill City
Keystone
Rockford
Mystic
Sheridan
Rockerville
Farmingdale
Dakota City
Creston
Folsom
Hartley
Hardingrove
Milesville
Leslie
Moenville
Hopewell
Grandfield
Lacy
Oahe
HAAKON
Pedro
Dowling
Wellsburg
Topbar
Manila
STANLEY
Hayes
Havercroft
Fort Pierre
PIERRE
Garland
Ashcreek
Hilland
Elbon
Lucerne
Bunker
Ottumwa
Pheba
Wendte
Smithville
Grindstone
Smith
Philip
Nowlin
Midland
Capa
Van Metre
Leir
Kolls
Highland
McClure
Powell
Cottonwood
JACKSON
Stamford
White Clay Butte
Okaton
Draper
Murdo
Vivian
Weta
Kadoka
Belvidere
Vera
Westover
Hilmoe
Interior
White R.
Sheep Mt. Table
CUSTER
Custer
Elk Mountain
Bakerville
Otis
Fairburn
Pierie
Windcave
Sugarloaf Mt.
Minnekahta
Buffalo Gap
Hot Springs
Parkers Pk.
Cascade Spr.
Oral
Smithwick
Edgemont
FALL RIVER
Provo
Oelrichs
Eckard
Ardmore
WASHINGTON
Kyle
Porcupine Butte
Sisoka
SHANNON
Slim Butte
Manderson
Pineridge
Porcupine
WASHABAUGH
Eastman
Allen
Eagles Nest
BENNETT
Martin
Gamble
Lacreek
MELLETTE
TODD
Rosebud
Adelia
Chadron
Harrison
Whitney
Rushville
Merriman
Cody
Niobrara
Girard
SCALE OF STATUTE MILES
0 5 10 20 30 40 50
SCALE OF KILOMETERS
0 5 10 20 30 40 50 60
County Towns ◎
9-1908
L.L.POATES, ENGR'G CO., N.Y.
101° Longitude D West

100°
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Napoleon
Linton
Wishek
Kulm
Lisbon
Sheyenne R.
Monango
Oakes
Cogswell
Forman
Wahpeton
Wild Rice R.
Hankinson
Ashley
Ellendale
Lidgerwood
Fairmount
Red R.
Whiterock
D A K O T A
M I N N E S O T A
Artas
Greenway
Longlake
Herreid
Eureka
Sutherland
CAMPBELL
Mc PHERSON
Mound City
Martel
Leola
Sutley
Hillsview
Tislo
Delhi
Hecla
Savo
Frederick
Houghton
Detroit
Claremont
Amherst
Westport
Bern
B R O W N
Columbia
Ordway
Hufton
Putney
Elm R.
Moccasin Cr.
James R.
Kidder
Newark
Britton
Burch
M A R S H A L L
Storm
Lake City
Veblen
Marlow
Claire City
Vernon
Victor
Rosholt
Hammer
Crawford
Effington
Bossko
Otto
Winans
Windom
Wheaton
L. Traverse
R O B E R T S
Spain
Langford
Sunnyside
Eden
Sisseton
Frank
Goodwill
Brown Valley
Wilmot
Summit
Peever
Sisseton Agency
Big Stone Lake
Lohre
Corona
Hosmer
Pioneer
Java
Selby
Bangor
WALWORTH
Bowdle
Roscoe
Ipswich
Mina
E D M U N D S
Aberdeen
Rudolph
Albion
Warner
Mansfield
Powell
Loyalton
Swan L.
Groton
Pierpont
Nutley
Roslyn
Grenville
Lynn
Andover
Pickerel
D A Y
Webster
Waubay
Bristol
Butler
Holmquist
Verdon
Ferney
Gem
Chautauqua
Lily
Bigstone City
Milbank
Marvin
Twin Brooks
Strouseton
G R A N T
Stockholm
Albee
Revillo
Eales
Pembroke
Hoven
Orleans
Springs
Millard
P O T T E R
Lebanon
Seneca
F A U L K
Faulkton
Miranda
Gettysburg
Forest City
Potter
Ellisville
Dunsmore
Tennis
Orient
Creeback
Roanoke
De Voe
Northville
Wesley
Bright
Mellette
Ashton
Conde
Turton
Frankfort
S P I N K
Redfield
Zell
Doland
Bradley
Wallace
Kent
Helgen
Estelline
Southshore
Troy
Rauville
C O D I N G T O N
Watertown
Garden City
Raymond
Clark
Elrod
C L A R K
Naples
Henry
Kampeska
Grover
Hazel
Castlewood
Altamont
Kranzburg
Goodwin
Gary
D E U E L
Clear Lake
Brandt
Agar
Kasper
Goudyville
Zeigler
Howell
Houdek
Helmick
Ridge
Crandon
Tulare
Irving
Vanderveer
Ladelle
Jolley
Vienna
Willow Lake
H A M L I N
Hayti
Altruria
Dempster
Toronto
Astoria
Roy
Sedgwick
Ida
Edwin
Hawley
McCamley
Afton
Ney
Onida
Clifton
Burdette
Wolf Cr.
H Y D E
H A N D
Bonilla
Hitchcock
Winthrop
Lakeside
Carpenter
Bryant
Norden
Denmark
Estelline
Poinsett
Holabird
Harrold
Highmore
Ree Heights
St. Lawrence
Miller
Wessington
Wolsey
Broadland
Bancroft
Erwin
Osceola
De Smet
Lake Preston
Arlington
Bruce
White
B R O O K I N G S
Bushnell
H U G H E S
Pierre
Canning
Chapelle
Giddings
Peno
Stephan
Valleyview
Ames
De Grey
Glendale
Dean
Wessington Hills
B E A D L E
Huron
Cavour
Iroquois
Virgil
Pates
Manchester
K I N G S B U R Y
Mathews
Volga
Brookings
Aurora
Elkton
Esmond
L. Thompson
Oldham
Drakola
Belle
Farnsworth
Medaos
Bailey
Lower Brule
Crow Creek Indian Reservation
Duncan
Richards
Hyde
Templeton
Waterbury
Wessington Springs
Lane
Cornell
Callihan
Carthage
St. Mary
Ramona
L A K E
Madison
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Woonsocket
Forestburg
Artesian
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Fedora
Roswell
Howard
Winfred
Junius
Wentworth
Colman
Trent
Medicine Butte
Gannvalley
Glen
Crowlake
Gordon
Letcher
Beaver
Canova
Chester
Dell Rapids
Sherman
Garretson
Presho
Reliance
Lyman
Kennebec
Vega
Grosse
Lyonville
Chamberlain
Kimball
Firesteel
Mitchell
Loomis
Rock
Epiphany
Riverside
Fulton
Spencer
Salem
Hartman
Colton
Baltic
Lyon
Oacoma
Red Butte
Houston
Sweeney
Edna
Pukwana
B R U L E
White Lake
A U R O R A
Plankinton
Mt. Vernon
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H A N S O N
Alexandria
M c C O O K
Montrose
M I N N E H A H A
Corson
Valley Springs
Brule
Red Lake
Iona
Ola
Bendon
Eagle
Dunlap
Flynn
Robey
Stickney
Ethan
Emery
Canastota
Humboldt
Hartford
Sioux Falls
Brandon
Rowena
E. Sioux Falls
White R.
Old Lodge Cr.
Dog Ear Cr.
Bull Cr.
Bijou Hills
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Chandler
Academy
New Holland
Harrison
Joubert
Corsica
Hillside
Clayton
Dolton
Marion
Monroe
Parker
Tea
Shindler
Harrisburg
Platte
D O U G L A S
Hummer
Armour
Milltown
Parkston
Freeman
T U R N E R
Chancellor
Lennox
Canton
Worthing
Hurley
Winner
Geddes
Delmont
H U T C H I N S O N
Wittenberg
Olivet
Menno
Davis
Hooker
Viborg
L I N C O L N
Fairview
Hudson
T R I P P
Dallas
G R E G O R Y
Gregory
Starcher
C H A R L E S M I X
Tripp
Scotland
Herrick
Wheeler
Lake Andes
Vodnany
Lesterville
Hanson
Irene
Centerville
Beresford
Bonesteel
Saint Elmo
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Fairfax
Ft. Randall
Wagner
Avon
Wakonda
Dalesburg
Alsen
Keya
Paha R.
Greenwood
Loretta
Tyndall
Utica
Tabor
Yankton
Volin
Missionhill
C L A Y
Westerville
Spink
Nora
Andrus
Perkins
Ponca Cr.
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Springfield
Missouri R.
Running Water
Gayville
Meckling
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Vermillion
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ployed 295 wage earners and turned out products valued at $1,575,000. In the latter, 83 establishments employed 174 wage earners and produced material valued at $2,889,000.

Transportation. Adequate railroad transportation is afforded the region east of the Missouri River and the Black Hills mining section in the extreme southwest. Except for the two roads (the Chicago and Northwestern and the Chicago, Milwaukee, and St. Paul), crossing the State from east to west, the intermediate portion is comparatively lacking in steam railway communication. The total mileage of first track in 1914 was 4240. The principal roads with their mileage in that year are the Chicago, Milwaukee, and St. Paul, 1795; the Chicago and Northwestern, 1063; the Chicago, Burlington, and Quincy, 281; the Minneapolis and St. Louis, 269; the Great Northern, 262; the Pierre, Rapid City, and Northwestern, 165; the Chicago, St. Paul, Minneapolis, and Omaha (Chicago and Northwestern), 88; the Chicago, Rock Island, and Pacific, 83; the Minneapolis, St. Paul, and Sault Ste. Marie, 34.

Banking. In 1872 the first national bank was organized in Yankton. In the following 20 years banks multiplied, and in 1889, when division came and the Territory was organized as a State, South Dakota had 33 national and over 100 private banks, which figures included also the banks organized under the general incorporation law. In 1891 the first banking law of the State was passed, making the shareholders responsible for an amount equal to their stock in addition to their actual investment, allowing dividends on net profits only, etc. In 1915 further legislation provided for a guarantee system of deposits. The condition of the banks in 1915 was as follows:

ITEMS	National banks	State banks
Number	117	523
Capital	$5,010,000	$8,295,000
Surplus	1,631,000	2,030,000
Cash, etc.	1,097,000	1,092,000
Deposits	47,698,000	63,299,000
Loans	36,037,000	52,155,000

Government. The constitution was adopted by popular vote on Oct. 1, 1889, and has been amended in important details. Concurrence of a majority of the members of each branch of the State Legislature and the voters is necessary for amendment.

Executive.—The executive department consists of the Governor, Secretary of State, auditor, treasurer, superintendent of public instruction, commissioner of schools and public lands, and Attorney-General. All hold office for two years.

Legislative.—The legislative power is vested in the Senate and House of Representatives. The initiative and referendum are in full force. Senators and Representatives must be at least 25 years of age. Regular sessions of the Legislature must not exceed 60 days, except in cases of impeachment.

Judiciary.—Judicial power is vested in the supreme court, circuit courts, county courts, and justices of the peace. The supreme court consists of five judges, elected for a term of six years. There are 12 judicial circuits. A county judge is elected in each county for a term of two years.

Suffrage and Elections.—Every male resident of the age of 21 years, who is a citizen of the United States, or a person of foreign birth who has declared his intention to become a citizen, has the right to vote, provided he has resided in the United States for one year, in the state for six months, in the county 30 days, and in the election precinct 10 days. All candidates for elective offices and for the office of United States Senator are nominated at a primary election. A new primary election law was enacted by the Legislature of 1915. Women may vote at elections held solely for school purposes, and may hold office in the State, except as otherwise provided in the constitution.

Local and Municipal Government.—New counties must have an area of not less than 24 congressional townships. Cities may surrender their charters and organize under a general law.

Miscellaneous Constitutional and Statutory Provisions.—A railroad doing business in the State must have and maintain an office at a public place for the transaction of business, and may not consolidate its stock, property, or franchise with another railroad owning a parallel or competing line. Bank deposits are protected by a bank guaranty law enacted by the Legislature of 1915. Married women have the right of action against liquor dealers, for damages from the sale to their husbands of intoxicating liquors. A portion of a convict's earnings must be devoted to the support of his dependent family. There is an employers' liability law.

Finances. At the time of admission as a State, the public debt amounted to $710,200, but in addition South Dakota was obliged to pay North Dakota in settlement of accounts over $150,000. In 1895 the debt was $1,562,800. The income in the beginning came mainly (almost 85 per cent) from a State tax. Later the sale and lease of public lands developed into an important source of income, which by a special provision of the constitution must go into the permanent school fund, while the interest on deferred payments must be devoted to current school expenses. On July 1, 1913, the cash on hand was $925,135. The total receipts for the year were $4,337,928 and the disbursements $4,444,939, leaving a balance on hand, June 30, 1914, of $818,123. On July 1, 1913, the State debt amounted to $370,000, being entirely revenue warrants.

Militia. The males of militia age, 18 to 44 years, in 1910 numbered 140,635. The organized militia on July, 1, 1915, included 741 enlisted men and 62 officers, and was composed of a regiment and three separate companies of infantry, a detachment of sanitary troops, mounted scouts, machine gun platoon, and supply company.

Population. The population by periods since its admission into the Union was: 1890, 348,600; 1900, 401,570; 1910, 583,888; and 1915 (est.), 680,046. The density per square mile in 1910 was 7.6. The State ranked thirty-sixth in population among the States in that year. In 1910, of the total population, 563,771 were white, 19,137 Indian, and 817 negro. Native-born whites numbered 463,143 and foreign-born whites, 100,628. Of the foreign born, 21,543 came from Germany, 20,918 from Norway, 13,189 from Russia, and 9998 from Sweden. The rural population in 1910 numbered 507,215.

There were 317,112 males and 266,776 females. The males of voting age numbered 178,189 in 1910. The three cities with populations of over 8000 in 1910, with their populations in that year and as estimated for 1915, are: Sioux Falls, 14,094 and 16,111; Aberdeen, 10,753 and 14,510; and Lead, 8392 and 9542.

Education. The excellence of the educational conditions is shown by the fact that in 1910 the total number of illiterates of 10 years of age and over numbered only 12,750. Of this number 4896 were foreign-born whites. The total school population in the same year was 183,969 and of these 122,642 attended school. The school population, according to statistics furnished by the State Superintendent of Education on May 1, 1915, was 175,092. The total enrollment in classes below high schools in 1914 was 139,068, of which 87,206 were in the rural districts. The total number of teachers was 7161, of whom 5813 were female. The average monthly salary for females in the rural districts was $51.08 and in independent districts $63.41; for males, rural, $56.55; independent, $108.35. The enrollment in high schools was 10,085, of which 1680 were in rural districts. The total expenditure was $5,413,063. Considerable progress has been made in consolidation of rural schools, and the length of school terms has also been increased. State normal schools are at Spearfish, Springfield, Aberdeen, and Madison. The South Dakota Training School is at Plankinton. Other training and normal schools are the Kindergarten Training School at Sioux Falls, Lutheran Normal School at Sioux Falls. The universities and colleges are Augustana College at Canton, Columbus College at Chamberlain, Dakota Wesleyan University at Mitchell, Eureka Lutheran College at Eureka, Freeman College at Freeman, Huron College at Huron, Redfield College at Redfield, Sioux Falls College at Sioux Falls, Yankton College at Yankton, the State School of Mines at Rapid City, and the University of South Dakota at Vermilion. The last two are State institutions. The schools for the instruction of the Indians are the Pierre Indian Industrial School at Pierre, Riggs Institute at Flandreau, and the United States Industrial School and Academy at Rapid City. Special schools are the School for the Blind at Gary, School for the Deaf at Sioux Falls, and State College of Agriculture and Mechanic Arts at Brookings.

Charities and Corrections. The institutions under the control of the State Board of Charities and Corrections include the Penitentiary and the State School for Deaf Mutes at Sioux Falls, the State Training School at Plankinton, the State Hospital for the Insane at Yankton, the State School for the Blind at Gary, the State School for the Feeble-Minded at Redfield, and a State Tuberculosis Sanitarium at Custer.

Religion. According to the religious census of 1908, the Roman Catholics are the leading denomination, and these are closely followed by the Lutherans. Together they are equal to about two-thirds of the total communicants reported.

History. The State was formed on the division of Dakota Territory and was admitted to the Union November 3, 1889. (For early history, see North Dakota.) The convention which met July 4 adopted the "Sioux Falls Constitution," framed in 1885, with a few changes. A prohibitory amendment was adopted at the first election in October, 1889, but, on account of the "original package decision" of the United States Supreme Court, did not go into effect. The Sioux Indians by treaty ceded large tracts of land, which were opened for settlement in February, 1890. Other reservations were opened in 1892 and 1895. In the elections of 1908 the Republicans carried the State, Robert S. Vessey being elected Governor. For President, Taft received 67,352 votes and Bryan 40,223. In 1910 Governor Vessey was reëlected. The Progressives developed great strength in South Dakota in 1912 and elected Frank M. Byrne Governor. For President, Roosevelt received 58,811 votes and Wilson 48,942. Taft electors did not appear on the ballot. In 1914 Governor Byrne was reëlected. The democrats elected their candidate for United States Senator, E. S. Johnson, defeating Senator Coe I. Crawford, a candidate for reëlection. The Legislature of 1915 passed a measure abolishing the death penalty.

GOVERNORS

Arthur C. Mellette	Republican	1889–93
Charles H. Sheldon	"	1893–97
Andrew E. Lee	Populist	1897–1901
Charles N. Herreid	Republican	1901–05
Samuel H. Elrod	"	1905–07
Coe I. Crawford	"	1907–1909
Robert S. Vessey	"	1909–19
Frank M. Byrne	Republican-Prog.	1913–

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SOUTH DAKOTA, University of. A coeducational institution for higher education founded in 1882 at Vermilion, S. Dak. It is supported almost entirely by appropriations of the State Legislature, but has an endowment of about 86,000 acres of land, which yielded in 1914–15 about $10,000. The total income of the university in that year was $146,000. A tuition fee of six dollars per semester is charged. The university confers the bachelor degree in law, arts, science, mechanical, civil, and electrical engineering, and chemistry. A degree is also given for full courses in education and music. The estimated value of the property under control of the university in 1915 was $500,000, and the grounds, buildings, and equipment were valued at $500,000. It carries on the State Geological Survey. The total enrollment in the regular courses in 1915 was 515, and there were 200 in the summer school. The faculty had 60 members. In the library were 27,000 bound volumes. The president in 1916 was Robert L. Slagla, M.A.

SOUTH DAKOTA STATE COLLEGE OF AGRICULTURE AND MECHANIC ARTS. A State institution at Brookings, S. Dak., established by the Legislature and opened for instruction on Sept. 24, 1884. The college receives appropriations from the Legislature and from the Federal government. The college farm includes 460 acres, about 60 of which are used by the Agricultural Experimental Station as an experimental farm. The courses of study leading to degrees are pharmacy, agriculture, home economics, mechanical, electrical, and civil engineering, and general science. There are also special courses in several important and practical lines of work. The degrees given are bachelor of science and master of science. The total enrollment in all departments in the university in 1914–15 was 1097; of these, 387 were women and 710 were men. The faculty numbered 73. The library contains about 20,000 volumes. The president in 1916 was Elwood C. Perisho.

SOUTH DITHMARSCHEN. See DITHMARSCHEN.

SOUTHDOWN. An English breed of sheep, bred for their superior mutton. See SHEEP.

SOUTH DOWNS. A ridge of hills in England. See under DOWNS.

SOUTH′END′-ON-SEA′. A municipal borough and seaside resort in Essex, Eng., at the mouth of the Thames, 42 miles east of London (Map: England, G 5). It is a popular holiday and residential resort of Londoners. The town owns fine municipal buildings, promenade piers, a concert pavilion, electric street railways, pleasure grounds, and a cemetery, and maintains technical schools, a sanatorium, and an isolation hospital. Southend was bombarded by the Germans in 1915. See WAR IN EUROPE. Pop., 1901, 28,850; 1911, 62,713.

SOUTHERLAND, sŭth′ẽr-land, WILLIAM HENRY HUDSON (1852–). An American naval officer. He was born in New York City, and graduated from the United States Naval Academy in 1872. Before his appointment to Annapolis he had served as a naval apprentice. During the Spanish-American War he commanded the *Eagle* on the Cuban coast. He was a member of the Board of Inspection and Survey in 1906–07, and of the Naval Examining and Retiring Board in 1910. Promoted to rear admiral in the latter year he commanded the second division of the Pacific fleet in 1911–12, and was commander in chief of that fleet in 1912–13. In 1912 he had charge of an expeditionary landing force in Nicaragua, and in 1913–14 was a member of the General Board. In the latter year Southerland was retired by operation of law.

SOUTHERN ARMY WORM. See GRASS WORM.

SOUTHERN BAPTISTS. The name commonly applied to that part of the regular Baptist denomination found in the southern half of the United States. It includes considerably more than half the total number of communicants in the denomination. There were in 1914 2,592,217 communicants, 14,701 clergymen, and 24,360 churches. The various activities of the body are under the supervision of the Southern Baptist Convention, organized May 8, 1845. It includes mission boards, Sunday-school boards, and young peoples' societies. The total number of missionaries under the control of the Convention in 1914 was 1387.

SOUTHERN BAPTIST THEOLOGICAL SEMINARY. A theological seminary founded by the Baptist denomination in 1859 at Louisville, Ky. Both men and women receive instruction in the seminary. The men are nearly all ministerial students, while the women are prepared for missionary work of various kinds. The women students do not matriculate in the seminary, nor do they graduate as do the men. Most of the women matriculate at the W. M. U. Training School, for which the seminary does a large part of the teaching. The seminary in 1915 purchased a new site containing 44 acres in the suburbs of Louisville. The endowment of the seminary in 1915 amounted to $1,160,000, the grounds, buildings, and other property were valued at about $500,000, and the annual income was between $50,000 and $60,000. The library contains about 23,000 volumes. The president in 1916 was E. Y. Mullins, D.D., LL.D.

SOUTHERN CALIFORNIA, UNIVERSITY OF. A coeducational institution for higher education founded in 1879 at Los Angeles. It is under the control of the Southern California Conference of the Methodist Episcopal church. The university includes the colleges of liberal arts, physicians and surgeons, dentistry, law, theology, pharmacy, music, oratory, fine arts, a Marine Biological Station, and the university high school. The College of Liberal Arts includes both graduate and undergraduate departments. In the undergraduate departments the courses lead to degrees of A.B. and B.S. In the graduate departments the degree M.A. is given. The campus is about 3½ miles southwest of the business section of Los Angeles. The total enrollment in all departments of the university in the autumn of 1915 was 2773, with a faculty of 281. The university holds a summer session, in which there were enrolled in 1914–15 247 students. The value of the grounds and buildings is about $600,000. The library contains about 26,000 volumes. The president in 1916 was G. F. Bovard, LL.D., D.D.

SOUTHERN CROSS. See CRUX.

SOUTHERN CROSS, ORDER OF THE. The highest Brazilian order, founded by Dom Pedro I in 1822, in commemoration of his accession to the throne. The order has four classes, and until 1899 the members received pensions. The decoration is a white enameled cross of five arms, with a wreath of coffee and tobacco leaves. The effigy of Dom Pedro on the medallion is surrounded by the inscription *Petrus I, Brasiliæ Imperator.* On the reverse is a cross composed of 19 stars, with the words *Bene Merentium Præmium.* The decoration is suspended from a crown and is worn on a blue ribbon.

SOUTHERN DVINA. See DÜNA.

SOUTHERNE, sŭth′ẽrn, THOMAS (1660–1746). An English playwright. He was born in Ireland and was educated at Trinity College, Dublin. Entered at the Middle Temple in London, he abandoned law to write for the stage, his first play being *The Persian Prince or the Loyal Brother* (1682). His two best known pieces are the tragedies of *The Fatal Marriage* (1694), which was afterward revised by Garrick, and *Oroonoko, or the Royal Slave* (1696), founded on a novel of the time and remarkable as including one of the earliest English condemnations of the slave trade. Consult *Plays written by Thomas Southerne,* with an account of the life and writings of the author.

SOUTHERN MINNESOTA, UNIVERSITY OF.

A coeducational nonsectarian institution for higher education founded in Austin, Minn., in 1896. There were, in 1914–15, in all departments, 1034 students and the faculty numbered 34. The value of the grounds and buildings was $250,000, and the income from all sources $98,000. There were in the library 11,000 volumes. The president in 1916 was William W. Meiners, Ph.D., LL.D.

SOUTHERN RHODESIA. See Rhodesia, Southern.

SOUTHEY, south'ĭ *or* sŭth'ĭ, Caroline Anne (1786–1854). An English poet, daughter of Capt. Charles Bowles, born at Lymington, Hampshire. After the death of her mother (1816) and the loss of her property, she turned to literature. She sent the manuscript of a narrative poem, *Ellen Fitzarthur* (published 1820), to Robert Southey, who approved of it. A correspondence followed which led to marriage (1839). In the meantime Miss Bowles wrote: *Tales of the Factories* (1823), in verse; *Solitary Hours* (1826), in verse and prose; *Chapters on Churchyards* (1829), a group of tales which gained for her wide attention; and *The Birthday* (1836), a poem recalling Cowper. She also collaborated with Southey on a poem entitled *Robin Hood* (never completed). Soon after her marriage, Southey's mind completely broke down, and she passed three miserable years. After his death (1843), she lived in retirement. Consult the interesting *Correspondence of Robert Southey with Caroline Bowles,* edited by Edward Dowden (Dublin, 1881).

SOUTHEY, Robert (1774–1843). An English poet and miscellaneous writer, born Aug. 12, 1774, at Bristol. Southey passed his boyhood with an aunt at Bath, reading Spenser, Sidney, Shakespeare, and other writers, and essayed a drama. In 1788 he was sent to Westminster School, from which he was expelled four years later, on account of an essay against flogging. Aided by an uncle living at Lisbon, he entered Balliol College, Oxford (1792), where he remained for only two years. He met Coleridge in 1794; and in conjunction with another friend, Robert Lovell, they formed a socialistic scheme, which they called "pantisocracy." They were to take wives and emigrate to the banks of the Susquehanna. The three married sisters, but the scheme went no further. After secretly marrying Edith Fricker, at Bristol in 1795, Southey left to visit his uncle at Lisbon. On returning (1797) he studied law at Gray's Inn, but soon abandoned it. He settled with his wife first at Westbury, between Bath and Salisbury, and then at Burton, in Hampshire; later he joined Coleridge at Keswick in the Lake district (1803). Here at Greta Hall he passed the rest of his life amid his books. Besides the income from his pen, which became large, he received, between 1796 and 1806, an annuity of £160 from a school friend named Wynn. Its place was soon filled by a government pension of the same amount, to which was added, in 1835, another pension of £300. In 1813, then as strongly Conservative as he had once been Republican, he was appointed poet laureate. In this capacity he wrote *The Vision of Judgment* (1821), an apotheosis of George III in hexameter verse. The incident is made memorable by Byron's brilliant parody under the same title. Southey's wife died—her mind had failed years before—in 1837, and two years later he married Caroline Anne Bowles. His own mind was giving way and soon became a blank. He died at Keswick, March 21, 1843, and was buried in the Crosthwaite churchyard. A recumbent statue was placed in the church. Southey early formed the plan of a series of narrative poems on the mythologies of the world. Under the inspiration of this idea, subsequently modified, he wrote a number of poems of an epic cast, comprising *Joan of Arc* (1796); *Thalaba, the Destroyer* (1801), an Oriental tale; *Madoc* (1805); *The Curse of Kehama* (1810), his chef-d'œuvre, founded on Hindu legend; and *Roderick, the Last of the Goths* (1814). Though they contain many noble passages, they are in the main only rhetorical. His prose is well represented by *Letters from England by Don Manual Alvarez Espriella* (1807), a view of England from the assumed standpoint of a Spanish gentleman; *The Doctor* (1834–37), a wonderful commonplace book; the lives of Wesley (1820), of Nelson (1813), an incomparable brief biography, and of Cowper (with an edition of Cowper, 1833–37); and his delightful letters. Of his other miscellaneous work may be cited *History of Brazil* (1810–19), part of a contemplated history of Portugal; *History of the Peninsular War* (1823–32); *Colloquies on Society* (1829), unnecessarily ridiculed by Macaulay; *Naval History* (1833–40); and a revolutionary drama, *Wat Tyler* (written in 1794, and surreptitiously published in 1817). In literary industry he was one of the most notable figures of his time; and he was the master of a lucid, masculine, sinewy, and melodious prose style, which gives his works a value even when, as in some cases, they have been superseded in regard to substance.

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SOUTH FORE'LAND. See Foreland, North and South.

SOUTH GEORGIA, jôr'jȧ. An island in the south Atlantic Ocean belonging to Great Britain, and situated in lat. 54° 30′ S., long. 37° W., 800 miles east by south of the Falkland Islands, to which it administratively belongs (Map: World, Western Hemisphere, P 17). Area, about 1000 square miles. The island consists of mountains of Archean formation from 6000 to 8000 feet high. Several permanent glaciers exist in the deep gorges on the mountain slopes. The island is uninhabited, except by a transient group of whalers. It was discovered in 1675 by Laroche.

SOUTH HAD'LEY. A town in Hampshire Co., Mass., 3 miles northeast of Holyoke, on the Connecticut River (Map: Massachusetts, B 3). It is the seat of Mount Holyoke College (q.v.), and has two libraries. There are manufactures of writing paper, brick, cotton goods, and lumber products. Pop., 1900, 4526; 1910, 4894.

SOUTH HAVEN. A city in Van Buren Co., Mich., 40 miles west of Kalamazoo, on Lake Michigan and on the Michigan Central and the Kalamazoo, Lake Shore, and Chicago railroads (Map: Michigan, C 6). It has a good harbor, from which plies a regular line of lake boats. Pianos, pipe organs, and fruit-baskets are manufactured, and fruit is canned. Considerable shipments of fruit are made. The city is a popular summer resort, having a fine beach, lake and river drives, and a golf course. There is also a Carnegie library. Pop., 1900, 4009; 1910, 3577.

SOUTH HOL′LAND. A province of the Netherlands (Map: Netherlands, C 3). Area, 1166 square miles. Pop., 1909, 1,390,044; in 1913, according to communal lists, 1,502,105. The capital and largest city is Rotterdam. The Hague also is in this province.

SOUTHINGTON, sŭth′ĭng-tŏn. A town, containing a borough of the same name, in Hartford Co., Conn., 18 miles south of Hartford, on the New York, New Haven, and Hartford Railroad (Map: Connecticut, D 3). It is engaged principally in manufacturing drop forgings, general and carriage hardware, carriage bolts, tools, and wood screws. Pop. (town), 1900, 5890; 1910, 6516. Southington became a separate parish in 1724. It was incorporated as a town in 1779.

SOUTH KEN′SINGTON, National Art Schools of. The schools of South Kensington (London) were founded in 1852 for the application of art to industry when the nucleus of an art industrial museum was also formed. (See South Kensington Museum.) The central school for the systematic training of art teachers and students in all departments of design was afterwards established at South Kensington. Aid is furnished in the teaching of art in the elementary schools, in night classes for artisans, and in regular schools of art. The same body controls the provincial schools connected with South Kensington, which have grown extensively in number since their first establishment. Many national, local, and free scholarships are also open to British subjects.

SOUTH KENSINGTON MUSEUM. Officially known since 1899 as the Victoria and Albert Museum. An important museum of decorative and applied art under the control of the national Board of Education, located in London. It was opened in 1857 at South Kensington (London) in the temporary structure which now houses the Bethnal Green Museum, with funds derived from the International Exhibition of 1851. The present extensive buildings were begun in 1899 and opened in 1909. South Kensington's collections of applied and decorative art, derived largely from private gifts and legacies, are among the finest in the world. They are arranged in eight general departments, among the most important of which are ceramics, including glass and enamels; a representative collection of mediæval ivories and enamels; and a very comprehensive collection of mediæval and modern furniture. The museum contains also a collection of paintings, including Raphael's world-famous cartoons for the tapestries of the Sistine Chapel, an historical collection of British water colors, and many modern British and French paintings. Besides these collections it possesses an Art Library of about 120,000 volumes and 200,000 photographs; an important art school, known as the Royal College of Art; and the collections of the former India Museum. The museum has issued a series of important catalogues of its collections, many of them of high critical and scholastic value.

SOUTH KINGSTOWN, kingz′tŏn. A town, including West Kingston, the county seat, and several other villages, in Washington Co., R. I., 23 miles south of Providence, on the New York, New Haven, and Hartford, and the Narragansett Pier railroads. The Rhode Island College of Agriculture and Mechanic Arts is in the village of Kingston, also a public library. Other noteworthy features include the Hazard Memorial Library at Peacedale, the museum at West Kingston, and the Robert Beverly Hale Memorial Library at Matunuck. South Kingstown is a rich farming district and also has fishing interests. The leading manufactured products are woolens and worsteds. The first power loom in the United States was established at Peacedale in 1814. Pop., 1900, 4972; 1910, 5176.

SOUTH McAL′ESTER. See McAlester.

SOUTH MILWAU′KEE. A city in Milwaukee Co., Wis., 10 miles by rail south of Milwaukee, on the Chicago and Northwestern Railroad. It has a Carnegie library and a fine high-school building. There is a large manufactory of steam shovels and dredges. Malleable iron castings, glue, baskets, veneers, mineral wool, and electrical appliances are also manufactured. Pop., 1900, 3392; 1910, 6092.

SOUTH MOUNTAIN, Battle of. A battle fought Sept. 14, 1862, during the Civil War, at Turner's Gap, in the South Mountain Range near Sharpsburg, Md., between a small Confederate force under D. H. Hill, reënforced late in the afternoon by Longstreet's division and the right wing of the Federal army under Burnside. On the same day a battle was also fought at Crampton's Gap, 8 miles further south, in the same range, between Franklin and McLaws, the latter being outnumbered. Both of these hotly contested actions form part of the operations leading to the battle of Antietam (q.v.), and in both the Union forces were successful, winning the passes. At Turner's Gap were killed Reno on the Union, Garland on the Confederate side.

SOUTH NOR′WALK. Formerly a city in the town of Norwalk, Fairfield Co., Conn., consolidated in 1913 with Norwalk, the new city now having a government coextensive with the town (Map: Connecticut, B 5). It is situated at the mouth of the Norwalk River, on rising ground overlooking Long Island Sound. There are two libraries—the Public, and the Roth and Goldschmidt. There is a good harbor, and a large coastwise trade is carried on. The city is the centre of a large oyster trade. Its manufactures include air compressors, lace, corsets, underwear, shoes, hats, locks, and various iron products. Pop., 1900, 6591; 1910, 8968.

SOUTH OMAHA, ō′mȧ-hạ. Formerly a city in Douglas Co., Neb., incorporated in the city of Omaha (q.v.) in 1915. Here are large meat-packing and slaughter houses, and various other industrial establishments. South Omaha was settled in 1882, and grew rapidly after the establishment of the Union Stock Yards in 1884. The population just before its incorporation was about 27,000.

SOUTH ORANGE. A village in Essex Co., N. J., 4 miles west of Newark; on the Delaware, Lackawanna, and Western Railroad (Map: New Jersey, D 2). The main portion is picturesquely situated on a gentle eminence facing Orange Mountain. It is a residential suburb of Newark and New York. Seton Hall College (q.v.), a Roman Catholic institution, was opened here in 1856. The village has a public library and a town hall. Pop., 1900, 4608; 1910, 6014. South Orange was settled about 1670. Consult Whittemore, *Founders and Builders of the Oranges* (Newark, 1896).

SOUTH ORKNEYS. A group of sub-Antarctic islands, having an area of about 800 square miles, situated between 60 and 61 degrees S. latitude, and 43 to 47 degrees W. longitude (Map: World, Western Hemisphere, Q 16). Discovered by George Powell in 1821, they were originally named and charted as the Powell Group. On Laurie Island, second in size to Coronation Island, the Scottish National Antarctic Expedition maintained (1902–04) a magnetic and meteorological station, which has since been permanently occupied by the government of Argentina. Consult R. N. Rudmose-Brown and others, *Voyage of the Scotia* (London, 1906), and E. S. Balch, *Antarctica* (Philadelphia, 1902).

SOUTH PASADENA. A city in Los Angeles Co., Cal., nine miles northeast of Los Angeles, on the Atchison, Topeka, and Santa Fe Coast Line, the Salt Lake Route, and the Pacific Electric and Southern Pacific railroads. It has large ostrich farms and is engaged in fruit growing. Pop., 1900, 1001; 1910, 4649.

SOUTHPORT. A municipal borough and watering place in Lancashire, England, at the mouth of the Ribble Estuary, 15 miles southwest of Preston (Map: England, C 3). It is a handsome town, with fine public buildings and institutions. Owing to extreme recession of the sea at low tide there are artificial lakes and marine parks for bathing and model-yacht sailing. Southport owns the gas and electric-lighting works, markets, and cemeteries, and maintains a free library, art gallery, and technical schools. Pop., 1911, 51,650. Consult Stephenson, *Southport* (Southport, 1898).

SOUTH PORTLAND. A city in Cumberland Co., Me., on Fore River, opposite Portland, with which it is connected by ferry and four bridges (Map: Maine, B 5). It is the seat of the State School for Boys. Noteworthy are the government fortifications, the town hall, Masonic Building, and the Soldiers' Monument and grounds. The city has ironworks, acid works, ship, railway, and machine shops, etc. South Portland was a part of Cape Elizabeth until 1895. Pop., 1900, 6287; 1910, 7471.

SOUTH RIVER. A borough in Middlesex Co., N. J., 25 miles by rail from New York City, on the South River, and on the Raritan River Railroad (Map: New Jersey, D 3). The manufacture of bricks, clay products, and other fireproofing materials is the chief industry. Pop., 1900, 2792; 1910, 4772.

SOUTH SAINT PAUL. A city in Dakota Co., Minn., 5 miles from St. Paul, on the Mississippi River, and on the Chicago Great Western, the Chicago, Rock Island and Pacific, and several other railroads which are connected with the city by the St. Paul Bridge and Terminal Railway (Map: Minnesota, D 6). It is important as a live-stock market, and has large meat-packing establishments, a foundry, car shops, and tanneries. Pop., 1900, 2322; 1910, 4510.

SOUTH SEA. A name formerly applied to the Pacific Ocean and the China Sea (q.v.).

SOUTH SEA CHESTNUT. See INOCARPUS.

SOUTH SEA COMPANY, THE. An English commercial company incorporated 1711, a financial scheme organized by the Lord Treasurer Harley for the purpose of extinguishing the national debt, then amounting to £10,000,000. The company assumed the debt on condition of receiving from the government an annual payment of £600,000 for a certain number of years and a monopoly of trade to the South Seas. On the strength of purely prospective profits the value of the stock increased enormously. In the spring of 1720 the company proposed to assume the entire national debt, at that time over thirty millions, on being guaranteed five per cent per annum for seven and a half years. At the end of this time the debt might be redeemed, if the government chose, and the interest reduced to four per cent. The directors used every means to increase the value of the stocks, until in August, 1720, the shares were quoted at 1000, when the chairman and some of the principal directors sold out. This flagrant conduct and the failure of Law's Mississippi Scheme in France opened the eyes of the public, and late in 1720 the crash came. Thousands of innocent stockholders were ruined. Parliamentary investigation revealed a scandalous complicity by some of the cabinet. About one-third of the original capital was saved for the stockholders. Consult William Coxe, *Memoirs of Sir Robert Walpole* (London, 1802), and Charles Mackay, *Memoirs of Extraordinary Popular Delusions* (ib., 1852).

SOUTH SEA TEA. See YAPON.

SOUTH SHETLAND ISLANDS. An Antarctic archipelago lying about 600 miles south of Cape Horn, between 61° and 63° 20′ south latitude, and 54° and 63° west longitude, and separated from (Palmer) Graham's Land and Louis Philippe Land by the Bransfield Strait (Map: World, Western Hemisphere, Q 15). The islands are twelve in number, the chief of which are George Livingston, Smith, Deception, Elephant, and Clarence. The total area is about 880 square miles. Discovered by William Smith (1819), extended by Bransfield, explored and charted by George Powell (1821–22), the South Shetland group became at once the centre of the fishing activities of American sealers (see PALMER, N. B.). Overexploited, the fishery soon ceased, but in late years has been renewed with such success as to involve millions of dollars annually. The islands are now a British possession by proclamation of 1908. Consult Balch, *Antarctica* (Philadelphia, 1902). See POLAR RESEARCH, *American Quadrant*.

SOUTH SHIELDS. A seaport of England. See SHIELDS, SOUTH AND NORTH.

SOUTH STOCKTON. See THORNABY ON TEES.

SOUTH UIST. See UIST.

SOUTH VICTORIA LAND, or VICTORIA LAND. The eastern portion of the Victoria quadrant of the Antarctic land extending between the 160th and 170th meridan E. from about lat. 70° to beyond lat. 83° S. (Map: Antarctic Regions, F 6). It is a mountainous country, falling in steep snow-crowned cliffs to the sea, and rising to the height of 15,000 feet. It also contains the volcanoes of Erebus and Terror. Near the north end is the Magnetic South Pole. Victoria Land was discovered by Ross in 1841, explored and mapped by Borchgrevink in 1899, and was the base used by Nordenskjöld (1902–04), by Scott (1902–04), by Shackleton (1909), and by Scott (1912).

SOUTHWARK, sŭᴛʜ′ẽrk. A Parliamentary borough in London (q.v.), on the southern side of the Thames.

SOUTH′WELL. A cathedral city of the Newark Parliamentary division of Nottinghamshire, England, 27 miles by rail southwest of Lincoln (Map: England, F 3). The magnificent mediæval cathedral or minster of St. Mary, founded on the site of a church said to have been erected by the first Archbishop of York in 630, still retains its three towers; it became the cathedral of a new diocese in 1884. The building is cruciform, the towers, nave, and transept are twelfth-century Norman, and the choir is a beautiful example of the English Gothic. It was renovated in 1882. Pop., 1901, 3160; 1911, 3452; but the rural district of which it is the centre contains 19,573 inhabitants.

SOUTHWELL, Robert (c.1561–95). An English poet and martyr, son of Richard Southwell, of Horsham Saint Faith's, in Norfolk. Having studied at Douai and at Paris, he went to Rome, and was enrolled amongst the children destined for the Order of the Jesuits (1578), and ordained priest (1584). He was immediately sent to England as a missionary, where he became chaplain to the Countess of Arundel (1589). As a native-born subject ordained to the Roman Catholic priesthood, he was guilty of treason. He was not molested, however, till 1592, when he was arrested. After three years' imprisonment, with frequent tortures, he was tried, condemned, and executed (Feb. 21, 1595). During his residence in England Southwell wrote and circulated, usually in manuscript, several Catholic tracts, and a considerable body of choice verse (published after his death). His most ambitious poem is the long popular *Saint Peter's Complaint* (1595) in 132 six-line stanzas; his best is perhaps the brief *Burning Babe*, highly praised by Ben Jonson. Consult his *Poetical Works*, ed. by Turnbull (London, 1856); *Complete Poems*, ed. by Grosart ("Fuller's Worthies Library," ib., 1872); and *A Four-fould Meditation* (not in Grosart), ed. with bibliography by Edmonds (ib., 1895).

SOUTHWEST AFRICA, German. See German Southwest Africa.

SOUTHWESTERN COLLEGE. A coeducational institution for higher education founded at Winfield, Kans., in 1885, under the control of the Methodist Episcopal church. It includes a college of Liberal Arts, Academy, Business School, and department of Music and Oratory. The total enrollment in all departments in 1915 was 388, and the faculty numbered 30. The college had an endowment in that year of $130,000, the grounds and buildings were valued at $166,000, and the annual income was about $43,000. In the library were 6000 volumes. During 1915–16 a campaign to raise $300,000 additional endowment was carried on. The president in 1916 was F. E. Mossman, A.M., D.D.

SOUTHWESTERN UNIVERSITY. A coeducational institution for higher education founded in 1873 by the consolidation of the chartered rights of Ruterville College, founded in 1840, McKenzie College, chartered in 1848, Wesleyan College, founded in 1844, and Soule University, chartered in 1856. The university was established largely through the efforts of Rev. Francis Asbury Mood, who was its first regent. It was under the patronage and control of the Methodist Episcopal Church, South. The grounds of the university comprise altogether about 50 acres within the corporate limits of Georgetown, Texas. These grounds are in two separate tracts, on which are situated the buildings of the university and its fitting school. The degrees conferred are Bachelor of Arts, Bachelor of Science, Bachelor of Science and Education, Bachelor of Music, Master of Arts, and Master of Science. The total enrollment in the autumn of 1915 was 1022; of this, 486 were in the college department, 122 in the Fine Arts Department, 89 in the Fitting School, and the remainder in the Summer Schools. The faculty numbered 48. The university has an endowment of about $292,000, and an annual income of about $120,000. The college grounds and buildings are valued at $476,536. The library contains about 30,000 volumes. The president in 1916 was Charles McTyeire Bishop, A.M., D.D.

SOUTH′WICK. A town in Durham, England, 1 mile northwest of Sunderland. It has shipbuilding industries, glass works, and potteries. Pop., 1901, 12,640; 1911, 13,784.

SOUTH′WORTH, Mrs. Emma Dorothy Eliza [Nevitte] (1819–99). An American novelist, born at Washington, D. C. Her first novel was *Retribution* (1849), and she became eventually the author of nearly 60 popular novels. They dealt principally with Southern life and were highly emotional. A uniform edition of her works was brought out in 1872 at Philadelphia.

SOUVESTRE, sōō′vĕs′tr', Emile (1806–54). A French novelist and dramatist, born at Morlaix. He was early engaged in library work, in contributing to reviews, and as editor, at Brest, of *Le Finistère*. Soon after he settled in Paris in 1835 his first romances dealing with his native Brittany became popular. These include *Les derniers Bretons* (1835–37) and *Le foyer Breton* (1844), which perhaps represent him at his best. More noted is the sentimentally cheerful *Philosophe sous les toits* (1851). Lectures delivered by Souvestre at the Ecole d'Administration appeared as *Causeries historiques et littéraires* (1854).

SOUZA, Martin Affonzo. See Sousa, M. A.

SOV′EREIGN. An English gold coin of the value of a pound sterling, the standard weight of which is 123.374 grains troy. The sovereign is worth approximately in United States money $4.8665.

SOV′EREIGNTY (OF. *sovrainte*, Fr. *souveraineté*, from ML. *superanus*, principal, supreme, Lat. *super*, above, over). Several uses of the term "sovereignty" must be distinguished. Of these the principal are internal sovereignty and external sovereignty. Internal sovereignty touches the relation between a state and its citizens or subjects; external sovereignty relates to the position of a state among other states.

Internal Sovereignty. Under the head of internal sovereignty distinction is made between "legal" sovereignty and "political" sovereignty. Political sovereignty is the ultimate controlling power resident in any political society. Legal sovereignty is the organized power which at any given time must be regarded as legally supreme. Political sovereignty arises out of the nature of the state as an organization for the purposes of social control. A supreme power enabling the state to preserve a form of public order, protect the community, and otherwise promote the general welfare is necessary to organized society. Political sovereignty, then, is that power in the state the will of which is ultimately obeyed. At any given time this supreme will may or may not be accurately expressed by the existing legal or governmental authority.

Legal sovereignty refers to the supreme power of the state as embodied in some legal or governmental organ or agency. Thus the King in Parliament is termed a sovereign body in England; a Constituent Convention is so called in France; or a king in some cases is called the sovereign. This legal sovereign may not, although it generally does, represent the actual sovereignty in the state, but it is none the less supreme from the legal or governmental point of view. For example, the political sovereignty may actually belong to the mass of the people while the legal sovereignty may be vested in an aristocracy or a monarch; and, on the other hand, the actual power may be vested in a few while the government is democratic in form. Again, the legal sovereign, e.g., the Parliament in Great Britain, may pass a law opposed by the majority of the people, but the enactment is none the less law and legally enforceable until repealed, or until the government is overthrown by a revolution.

The origin of sovereignty has been explained in various ways by different schools of political philosophy. It has been asserted that the ruling authority holds by divine appointment or sanction; that the right to rule is a property right descending as other property in regular line of succession; that the sovereignty is created by a voluntary contract either between ruler and ruled or between independent individuals, as in the social contract (q.v.); that sovereignty is the prerogative of superior force and belongs to the strongest claimant. In modern times it is generally believed that sovereignty is a product of political necessity arising out of the essential nature of political association, and the tenure of the particular holders of the political sovereignty is a result of historical evolution. This process has thrown the supreme power in most civilized states into the hands of the mass of the people.

Characteristics of Sovereignty. In the narrower sense, sovereignty is generally regarded as absolute. Legally speaking, all governments, whether monarchical, aristocratic, or democratic in form, are absolute. There are physical and moral limitations upon it, but, so far as the legal organization is concerned, there is no other organization or association within the limits of the state which can resist in any legal way the commands of the sovereign. In the broader sense of the term, political sovereignty is not absolute, since the ruling element in the state, however powerful, is never strong enough to be absolute in all things. It is also pointed out by some authorities that there may be and actually are legal limitations on the sovereign power. Thus in the United States there is no legal way of depriving the states of their equal suffrage in the Senate without their consent (Const., Art. v), and in Germany the special rights of the states are likewise protected (Art. lxxvii). It has also been strongly urged that the self-limitation of a state through its own constitution gives rise to inviolable rights against the supreme power, and that therefore, although limited only by its own act, the sovereignty of a state should be regarded as legally limited, and hence not absolute in character.

Furthermore, sovereignty in the narrower sense of the term is indivisible. There cannot be two sovereign powers acting on the same territory in an organized state. The king cannot be half sovereign and the people half sovereign, nor in a federal system can the various members of the union be partly sovereign and the central authority also partly sovereign. What seems like the division of sovereignty in a "federal state" is, on closer analysis, found to be either the actual sovereignty of the political society as a whole, as in the United States, or the complete sovereignty of a number of independent states, associated for certain common purposes, as in the Confederate States.

The location of sovereignty has been a vexed question, especially in connection with the rise of modern constitutionalism. The sovereignty of the king and that of people have been stoutly and ingeniously defended by the partisans of court and commonalty. In general the theory of popular sovereignty has triumphed, although in Germany the doctrine of state sovereignty has been accepted as a compromise. There the state, including both king and people, is declared to be the repository of supreme power by most publicists. The location of sovereignty has also been a subject of discussion as well as actual warfare in Germany and the United States, and in both instances decision has been against the individual states. See STATE RIGHTS.

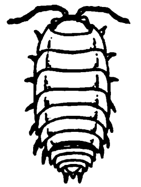
External Sovereignty. States possessing certain powers, such as that of negotiating treaties, declaring war, and regulating their internal administration, are called sovereign powers and are the parties to international law, entitled to its rights and privileges and liable to its duties and responsibilities. In international law sovereignty is not regarded as absolute, since no state is wholly independent of the other members of the family of nations. Some states frequently receive commands from and are practically in subjection to other nations, but are nevertheless treated as sovereign powers for the purposes of international law. Such are Morocco and Egypt. Moreover, in international law, sovereignty is generally looked upon as divisible in nature. Certain states are termed half sovereign or semisovereign. A state may yield up its right to negotiate with other powers, or the right to make war, or may surrender the control of a large part of its internal administration, and yet remain in the eyes of international law at least a semisovereign state. In fact, the territorial expansion of the Great Powers has given rise to a variety of complicated relations between strong and weak states, such as the protectorate, suzerainty, and the "sphere of influence," which make exceedingly difficult the logical application of the conventional idea of sovereignty, and, indeed, can be explained only by reference to the category of international law.

Consult: C. E. Merriam, *History of the Theory of Sovereignty since Rousseau* (New York, 1900); Bryce, "Nature of Sovereignty," in *Studies in History and Jurisprudence*, vol. ii (Oxford, 1901); E. Pujol, *Essai critique sur* *l'idée de la délégation de la souveraineté* (Toulouse, 1911), containing a bibliography; A. V. Dicey, *Introduction to the Study of the Law of the Constitution* (8th ed., London, 1915).

SOVEREIGNTY, POPULAR OR SQUATTER. See POPULAR SOVEREIGNTY.

SOW BREAD. See CYCLAMEN.

SOW BUG. A small carnivorous crustacean of the family Oniscidæ, the species of which live under logs in the woods and in similar places. It is an isopod. See CRUSTACEA; ISOPODA; and compare GRIBBLE.



SOW BUG.

SOWER, sour (or **SAUR**), CHRISTOPHER (1693–1758). An early American printer and publisher, born at Laasphe, near Marburg, Germany. After receiving a university education, and studying medicine at Halle, he emigrated to Pennsylvania in 1724, and in 1731 settled at Germantown. There in 1738 he set up a printing press and began the publication of an almanac in German, which was continued by his descendants for sixty years. In 1739 he issued the first number of *Der Hoch-Deutsch Pennsylvanische Geschichte-Schreiber*, a quarterly magazine, the first of the sort published in Pennsylvania. In 1743 he published a quarto edition of Luther's translation of the Bible in German—except Eliot's Indian Bible, the first published in America. He continued to publish both English and German works, and established a type foundry, the first in America, a paper mill, and an ink factory. He is credited with the invention of cast-iron stoves.

SOWERBY (sou'ẽr-bĭ) **BRIDGE.** A manufacturing town in the West Riding of Yorkshire, England, 3 miles southwest of Halifax. Its chief buildings are Christ Church, dating from 1526 and rebuilt in 1819, the town hall, and municipal offices. The town owns the gas works, slaughterhouses, and baths. Woolens are manufactured. Pop., 1901, 11,500; 1911, 11,350.

SOW THISTLE (AS. *sugu, istel, sugu,* sow + *istel,* thistle), *Sonchus.* A genus of about 30 species of Old World plants of the family Compositæ. Several species have been introduced in the United States. The common sow thistle (*Sonchus oleraceus*) is a somewhat branching annual weed 2 to 3 feet tall, with small yellow flowers, common in richly cultivated soils. The tops and leaves are used in northern Europe as greens. The field sow thistle (*Sonchus arvensis*) is a perennial with large yellow flowers. The spiny-leaved sow thistle (*Sonchus asper*) has also been introduced into the United States from Europe. The Alpine blue sow thistle (*Lactuca alpina*) is a native of the mountainous parts of Europe.

SOXHLET, zōks'lĕt, FRANZ KNIGHT VON (1848–). A German agricultural chemist, born at Brünn, Austria, and educated at Leipzig. In 1879 he was appointed professor of agricultural chemistry at the Polytechnic Institute in Munich and superintendent of the principal Bavarian agricultural experiment station, working on the chemistry of milk and its action. He devised a method of extracting fats by means of ether. His investigations, embracing the difference between human and bovine milk, sterilization of milk, the determination of percentages of fat contained therein, the varieties of sugars, and the formation of fats from carbohydrates, are valuable.

SOY BEAN (Jap. *si-yan,* Chin. *shi-yu,* soy), *Glycine hispida.* An upright, bushy, annual leguminous plant 2½ to 4 feet tall, a native of Asia, where it has long been cultivated, especially in China and Japan, whence it has been introduced into Europe and America. The name "soy" is from the Japanese *shoyu,* a food prepared from the seeds. The varieties in cultivation vary principally in the color, shape, and size of the seed and the length of the growing period. Besides its use as forage this crop is also frequently grown as a soil improver on soils deficient in nitrogen. It thrives best under conditions favorable to corn culture and on soils of medium texture well supplied with potash, phosphoric acid, and lime, although it also gives good returns on light poor soils. If planted for hay or fodder the seed is sown broadcast or closely in drills in the spring when the soil is thoroughly warmed; if for the beans, in drills about 3 feet apart and cultivated like corn. When used for hay, ensilage, or green fodder the crop is cut when the plants are in bloom; when harvested for seed, before the pods become ripe enough to burst and scatter the seeds. From eight to ten tons of green forage are obtained from an acre. From 25 to 40 bushels of seed per acre is considered a satisfactory yield, but sometimes from 75 to 100 bushels are obtained. Insect enemies and plant diseases do not seem to be troublesome.

Soy-bean hay cut in season and well cured has a high feeding value, but since the stems become woody and the leaves fall off, the crop is put into the silo either alone or mixed with corn ensilage. The seed, being a concentrated feed, is usually ground and mixed with other fodder. Fed alone or with other materials the meal is quite thoroughly digested; experiments with sheep showed that 91 per cent of the protein and 84 per cent of the total organic matter was assimilated. Similar values of the seed were 87 and 85 per cent. The seed is also an important source of oil and the seed cake, a by-product in making oil, is a valuable feeding stuff. Feeding the seed or seed cake to cows is said to produce injurious effects at times.

Though the soy bean is eaten more extensively in China and Japan than in any other countries, so far as known it is never eaten there as a vegetable, but in the complex food products, natto, tofu, miso, yuba, and shoyu, commonly made in Japan, and similar products in China. Tofu or bean cheese, a food product prepared from soy beans in Japan, is made from the thoroughly soaked and crushed beans by boiling with water, filtering, and curdling the filtrate, which has somewhat the appearance of milk, with the mother liquor obtained in making salt from sea water. The precipitate is separated by filtering and formed into cakes, which are eaten either fresh or frozen. The composition of these foods is given in the table on the following page.

Most of these soy-bean products, popular from ancient times, are fermented. The cell walls and other carbohydrate materials are broken down, the cell contents rendered more readily digestible, and peculiar and pleasant flavors developed.

The statement is frequently made that the Orientals live almost exclusively upon rice, eating little meat. It is not, however, generally known that deficiency of protein is made up by the consumption of large quantities of these soy-bean products, which take the place in the Japanese dietary of meat and other costly nitrogenous foods. They are eaten in some form by rich and poor at almost every meal. The beans are sometimes used for breadmaking, and when roasted as a substitute for coffee. Consult United States Department of Agriculture, *Farmer's Bulletin, Nos. 58, 372, 509* (Washington, 1897–1914), and C. V. Piper, *Forage Crops and their Culture* (New York, 1914).

PERCENTAGE OF COMPOSITION OF FOOD PRODUCTS FROM SOY BEANS

FOOD PRODUCT	Water	Protein	Fat	Nitrogen free extract	Fibre	Ash
Fresh tofu....	89.00	5.00	3.40	2.10	....	0.50
Frozen tofu...	18.70	48.50	28.50	2.60	....	1.70
Natto........	15.32	41.42	23.65	15.05	1.48	3.08
Yuba........	21.85	42.60	24.62	7.65	....	2.82
White miso...	50.70	5.70	24.40		12.60	6.60
Red miso	50.40	10.08	18.77		8.25	12.50
Shoyu (soy sauce)	63.29	8.31	5.10		....	19.45

SOYER, swä'yȧ', Alexis Benoît (1809–58). A French cook and writer on cookery, born at Meaux-en-Brie. After the Revolution of 1830 he went to England, where he became chief cook to the Duke of Cambridge. In 1837 he became chef at the Reform Club. In 1847 on a government appointment he proceeded to Ireland, where a famine prevailed, and there erected and conducted a large number of kitchens serving food at half the regular price. In 1855 he went to the Crimea, where, with Florence Nightingale, he directed reforms in the dietaries of the military hospitals. This he continued after the war, on his return to England, with the result that a radical dietary reform both in hospital and in barrack rations was effected. He wrote extensively on cookery. Consult Volant and Warren, *Memoirs of Alexis Soyer* (London, 1858).

SOYESHIMA, sō-yĕsh'ĭ-mȧ, Tanéomi. A Japanese statesman and scholar, born at Saga, in the Province of Hizen, in Kiushu, and educated in the local school for samurai. In 1866 at Nagasaki he came under the influence of Guido F. Verbeck (q.v.), an American missionary, by whom he was taught, particularly in the New Testament and the Constitution of the United States. Giving his special attention to the study of law, he was in 1868 made a commissioner by the new government for framing laws and later an Imperial councilor. In 1871 the Mikado sent him to Russian Siberia to settle the boundary question concerning the island of Sakhalin, and in the following year he was an ambassador to the Emperor of China regarding Luchu. As Minister of Foreign Affairs he was instrumental in releasing the Chinese coolies from a Peruvian vessel at Yokohama and thus ending the coolie traffic. (See Macao.) On his return to Japan he resigned his office because of differences on the Korean War question, but in private life continued to be influential in agitation for constitutional government, and later was invited to reënter the cabinet. He revisited China in 1876, was welcomed and lauded by the mandarins for his scholarship, and became a trusted private adviser of the Emperor, especially in his library.

SO'YOTS. A people residing on the headwaters of the Yenesei River in Asia. They are regarded as the original stock from which diverged the Samoyeds (q.v.) and the Finns (q.v.).

SO'ZINS. See Immunity.

SOZ'OMEN (Gk. Σωζομενός, *Sŏzomenos*), Hermias Salaminius (c.400–443). A church historian. He came of a wealthy family of Palestine and spent at least a part of his life as a lawyer at Constantinople. He wrote a history of the Church, covering the period from 323 to 439. The latter portion, dealing with the years from 423, is lost. He follows the church historian Socrates (q.v.) but has some independent material, especially upon monastic matters. The work was edited by Hussey (Oxford, 1860), and there in an English translation by Hartranft in the *Nicene and Post-Nicene Fathers*, 2d series, vol. ii (New York, 1891).

SPA, spä. A famous watering place in the Province of Liége, Belgium, 20 miles southeast of the city of Liége (Map: Belgium, D 4). It is attractively situated in a hilly region. The waters of the Pouhon spring are largely exported. It is in an inclosure erected to commemorate the visit of Peter the Great in 1717. The *Etablissement des Bains*, a handsome modern structure, is in the Place Royale adjacent to the Casino. There are noted manufactures of woodenware, which is stained brown by being steeped in the mineral waters. Pop., 1900, 8192; 1910, 8357. Spa's greatest popularity was in the eighteenth century, when it was the favorite resort of the European nobility. It declined after the French Revolution, but is regaining its former prestige. About 15,000 people visit the place annually. "Spa" as applied to mineral springs originated in the name of this town.

SPACE (OF., Fr. *espace*, from Lat. *spatium*, space). The nature of space is a problem that has been discussed almost from the beginning of metaphysical speculation. The naïve unreflective view is that space is a kind of vessel or medium, having independent existence, and that objects are contained in it. If these objects were to be annihilated, space would continue to exist; just as, in the creationist view, there is a tendency to suppose that space existed before creation and was filled with objects by the creative act. Now if the term real is applied exclusively to concrete objects having definite sensible characters, pure space, i.e., a vacuum, is unreal; there is nothing in it. This seems to be the view taken of space by many Greek philosophers, e.g., Parmenides and Plato, who spoke of it as that-which-is-not, while some, e.g., Leucippus, also said that both that-which-is-not and that-which-is actually are. An intelligible meaning can be given to the position of Leucippus by supposing that he used the term "being" in two senses, definite being with sensible qualities and being without any sensible qualities. In the former sense space is not, and is non-being; and yet this non-being *is*, in the sense that the absence of sensible objects in space would, according to this naïve conception, not imply the non-existence of space. Some Greek philosophers, however, went further than this; Parmenides denied the existence of empty space altogether; and Plato denied the ultimate reality of space. The fundamental realities of his system were "ideas," which were not created, and hence did not need a preëxistent space for their occupancy; while the world of sensible reality in space is of subordinate metaphysical value. Aristotle regarded space not as an independently existing entity, and yet not as unreal; but as "the first unmoved limit" of bodies. This is an anticipation of the modern empirical view, to be treated later in this article. Until modern times no thoroughgoing development of these different positions was undertaken.

Descartes considered space (= extension) as the essential characterizing feature of material substances, and as contrasting with thought, the attribute of spiritual substances. Spinoza followed Descartes in making space the fundamental differentia of matter, although he acknowledged only one substance; thus making extension one of the infinite number of attributes of substance, of which only two, viz., extension and thought, are known to us. Leibnitz denied any fundamental character to space; space is merely phenomenal; it is a confused perception of what intrinsically is not spatial but logical. The only realities are monads (q.v.), which are distinct from each other by their logical differences; these logical differences appear in confused thinking as spatial separations. To the perceived mutual spatial externalities of material bodies there correspond real logical differences between monads; hence matter in space is a "well founded phenomenon," "a regulated and exact phenomenon, which does not deceive him who is careful to observe the abstract rules of reason." Newton had meanwhile given definite expression to the old view of Leucippus: "Absolute space, in its own nature, without relation to anything external, remains always similar and immovable." "For the primary places of things to be moved is absurd. These therefore are absolute places; and transitions only out of these are absolute motions. But, because the parts of space cannot be seen, or distinguished from one another by our senses, therefore in their stead we use sensible measures . . . but in philosophical disquisitions, we must abstract from the senses." All these views have their difficulties, which led Kant to propound his now famous theory that space is an a priori form of perception. Real things (Dinge an sich) are not in space; but we cannot know such things; our knowledge is concerned only with phenomena, which are sensational in character; sensations as they are produced in the mind are arranged by the mind in forms supplied by the mind; among these forms is space. Space is thus merely subjective; only what is experienced is extended and it is so extended because the perceiving mind extends it, or supplies the form of extension to it. The same holds good of time. The form of space, subjective in origin, is not, according to the more consistent passages of Kant's writings, a ready-made mental framework into which sensations are placed; it is rather a principle of arrangement, which is applied according to need; hence space is neither infinite nor finite; but indefinitely extensible.

Recent empiricism declines to accept the Newtonian doctrine of absolute and absolutely independent space and also Kant's doctrine that space is an a priori form; extensity is regarded rather as a fundamental character of experienced objects, neither existing apart from such objects nor supplied by a mind to such objects. This extensity is not mathematical space, but by abstraction from it mathematical space is derived. Real space, i.e., the extensity of objects of experience, is not homogeneous and does not submit to geometrical laws, but geometrical laws hold good of an ideal space, obtained by the ignoring of the heterogeneities of experienced space. This view agrees in part with the Kantian view that mathematical space is a creation of the mind, but it declines to accept the a priori character of such space. Homogeneous space is an empirical abstraction. Neo-realism tends to revert to the Newtonian conception, but with thoroughgoing modifications. Into the details of none of these theories is it possible to go. A very interesting speculation on the nature and origin of space is given by Bergson in his *Creative Evolution;* space is an order, but not the original order of reality. Time is the only reality, i.e., concrete time in the sense of experiential change; when this order is arrested or reversed, space arises. But Bergson does not explain why time should undergo arrest or reversal.

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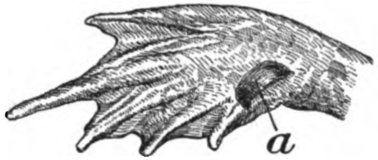
SPACE PERCEPTION. See Vision.

SPACH, späG, Ludwig Adolf (1800–79). An Alsatian historian, born and educated at Strassburg. In early life he was a tutor and traveled extensively. He was librarian of the Department of Bas-Rhin, Alsace, and head of the prefect's cabinet (1840), and in 1872 became honorary professor at Strassburg. His writings include: *Moderne Kulturzustände im Elsass* (1873–74); *Dramatische Bilder aus Strassburgs Vergangenheit* (1876); *Zur Geschichte der modernen französischen Litteratur, Essays* (1877). Spach, under the pseudonym Louis Lavater, also wrote the novels *Henri Farel* (1834), *Le nouveau Candide* (1835), and *Roger de Manesse* (1849). Consult F. X. Kraus, *Ludwig Spach* (Strassburg, 1880).

SPADEFISH. See Paddlefish.

SPADEFOOT. A toad of the family Pelobatidæ, prominently characterized by the inner bone of the ankle (tarsus) being covered with a hard, sharp-edged horny sheath, which forms an effective tool for digging. Three species belong to western Europe and the Mediterranean region, of which the best known is *Pelobates fuscus*, which makes deep holes in the sand, hiding during the day, hunting at night. The numerous eggs are laid in strings in water, and the tadpoles are very large, shrinking greatly when they change into young toads.



FOOT OF A SPADEFOOT.
Undersurface of a left foot, showing the spade, *a*.

American representatives of the family are several species of the genus *Scaphiophus*, one of which (*Scaphiophus solitarius*, or *holbrookeii*), common from New Jersey southward in lowlands, is renowned for the loud noise it makes when calling in the spring. Other species are found in Mexico. Consult Hans Gadow, "Amphibia and Reptiles," in *Cambridge Natural History*, vol. viii (London, 1901), and M. C. Dickerson, *The Frog Book* (new ed., New York, 1914).

SPAGNA, spä′nyȧ, Lo, properly Giovanni di Pietro (active 1500–28). An Umbrian painter, born in Spain. He was a pupil of Perugino and Pinturicchio and imitated them and his fellow pupil Raphael in a conscientious and often pleasing manner. He lacked, however, invention, feeling for space, and knowledge of the management of drapery. His work has frequently been confused with that of the three masters mentioned, the most notable example being the famous "Sposalizio" at Caen, long attributed to Perugino. His other paintings include his masterpiece, the "Coronation of the Virgin" (1511; at Todi), "Nativity" (Vatican), "Madonna" (Louvre), the "Nine Muses" (Capitol, Rome), and frescoes and altarpieces at Assisi and in and near Spoleto, where most of his life was passed.

SPAGNOLETTO, spä′nyȯ-lĕt′tȯ, Lo. See Ribera, Jusepe de.

SPAHIS, spä′hēz (Fr. *spahi*, from Hind., Pers. *sipāhi*, soldier, horseman, from Pers, *sipāh*, *supāh*, army). Native Algerian cavalry, originally formed from the Turkish spahis serving in the country when it was conquered by the French.

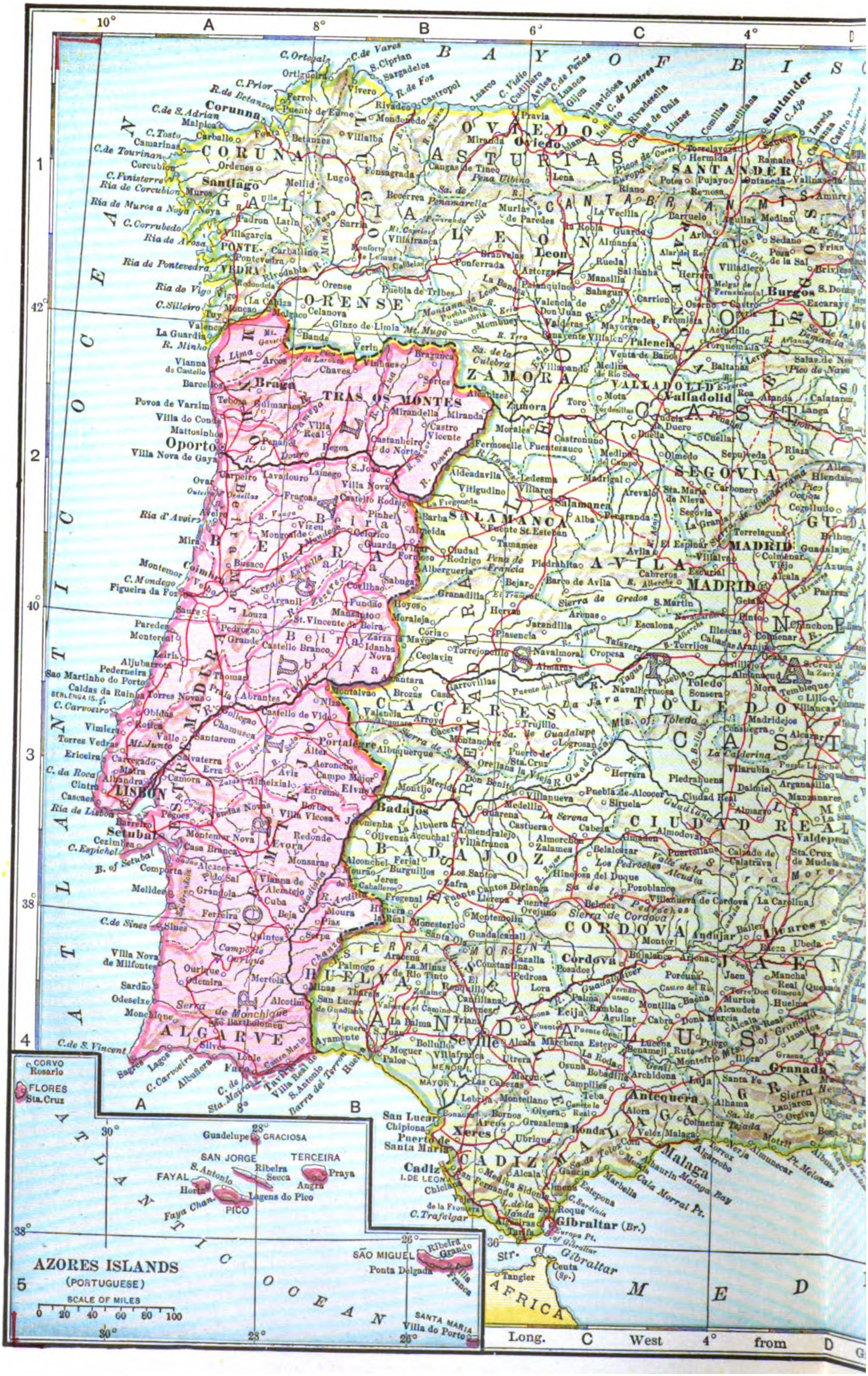
SPAHR, spär, Charles Barzillai (1860–1904). An American author and journalist, born at Columbus, Ohio. He was educated at Amherst, at Leipzig, and at Columbia. He was an associate editor of the *Outlook* from 1886 to 1904, when he became editor and part proprietor of *Current Literature*. His publications include *Essay on the Present Distribution of Wealth in the United States* (1896), in the Library of Economics and Politics, and *America's Working People* (1900). Consult Lyman Abbott, *One Who Loved his Fellowmen* (New York, 1905).

SPAIN (Sp. *España*, from Lat. *Hispania*). A kingdom occupying about six-sevenths of the area of the Iberian Peninsula. Lying between lat. 36° and 44° N. and long. 9° 15′ W. and 3° 20′ E., it is bounded by France, the Atlantic (in the north the Bay of Biscay), Portugal, and the Mediterranean. At the extreme south the narrow Strait of Gibraltar separates it from Morocco. Its continental area is 190,050 square miles. Including the Canary and Balearic islands and the small possessions on the north and west coast of Africa, its total area is 194,783 square miles. Natural features, the gorges of the Miño (Minho in Portuguese), the Guadiana River, and the cañons of the Duero (Douro) and Tagus (Tajo in Spanish), constitute a little less than one-half the boundary between Spain and Portugal.

Topography. The predominating natural feature of Spain is the great Iberian table-land (the meseta) which occupies three-quarters of the peninsula, nowhere reaching the sea—a compact, lofty, and mainly treeless plateau sloping as a whole to the west. The surface of the table-land rises from 1000 to 3000 feet above the sea, and its highest part is the Iberian Border Range, which separates the plateau of Castile from the Ebro basin and attains elevations of 3500 to 5000 feet. This lofty plateau is crossed by many mountain ridges called sierras, the most important of which are the Castilian Mountains in the centre of the Kingdom (Sierra de Guadarrama and Sierra de Gredos), which divide the extensive high plains of Old Castile from those of New Castile. The northern limits of the table-land are the Cantabrian Mountains, the western continuation of the Pyrenees, and the southern limits are the Sierra Morena, which is nothing more than the steep edge of the plateau separating Castile from Andalusia. The highest mountains of the table-land are those of the central region, such as the Plaza Almanzor (8730 feet) in the Sierra de Gredos and the Pico de Peñalara (7890 feet) in the Sierra de Guadarrama, but these summits rise scarcely 5000 feet above the general level of the plateau. Some of the depressions between the mountain ranges are narrow valleys drained by many rapid rivers, and communication across the sierras is difficult.

The long unbroken chain of the Pyrenees forms a mighty barrier between France and Spain, and as yet they are crossed by railroads only at their ends. The highest peak of the Pyrenees (which is situated on the Spanish side of the boundary) is the Pico de Aneto (Pic d'Anethou), whose summit is about 11,160 feet above the sea. The Sierra Nevada, in the extreme south, close to the coast, attains an elevation of 11,664 feet in Mulhacén, exceeded in Europe only by peaks in the Alps and the Caucasus.

The alternation of mountain and river valley in Spain is very conspicuous—first the Cantabrian Mountains and the Duero River in the north, then in succession the Guadarrama Mountains and the Tagus, the Toledo Mountains and the Guadiana, the Sierra Morena and the Guadalquivir, with the Nevada Mountains, in the south. Although the sea surrounds seven-eighths of its periphery, it has all the features of a continental mass, with restricted access to the ocean, as the coast is bordered by mountains, and there are almost no well-marked inlets on the coast and few navigable rivers. Barcelona has the only really first-class harbor. Spain contains two great low plains—one the plain of Aragon in the northeast, through which flows the Ebro, which drains most of northeastern Spain and extends between the Pyrenees and the Iberian Mountains, walled in from the Mediter-


10°
A
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BAY OF BIS
ATLANTIC OCEAN
CORUNA
GALICIA
ORENSE
ASTURIAS
OVIEDO
LEON
SANTANDER
ZAMORA
VALLADOLID
SEGOVIA
SALAMANCA
AVILA
MADRID
TOLEDO
CACERES
BADAJOZ
CIUDAD REAL
CORDOVA
JAEN
HUELVA
SEVILLE
CADIZ
MALAGA
GRANADA
ANDALUSIA
ESTREMADURA
OLD CASTILE
NEW CASTILE
PORTUGAL
MINHO
TRAS OS MONTES
BEIRA
ESTREMADURA
ALEMTEJO
ALGARVE
Lisbon
Oporto
Coimbra
Braga
Setubal
Evora
Faro
Madrid
Seville
Cordova
Granada
Malaga
Cadiz
Gibraltar (Br.)
Str. of Gibraltar
Tangier
Ceuta (Sp.)
AFRICA
MED
Long.
C
West
4°
from
D
AZORES ISLANDS
(PORTUGUESE)
SCALE OF MILES
0 20 40 60 80 100
CORVO
Rosario
FLORES
Sta. Cruz
GRACIOSA
Guadelupe
SAN JORGE
Ribeira Secca
TERCEIRA
Angra
Praya
FAYAL
Horta
S. Antonio
PICO
Lagens do Pico
Faya Chan.
SÃO MIGUEL
Ribeira Grande
Ponta Delgada
Villa Franca
SANTA MARIA
Villa do Porto
ATLANTIC OCEAN
30°
28°
26°
23°
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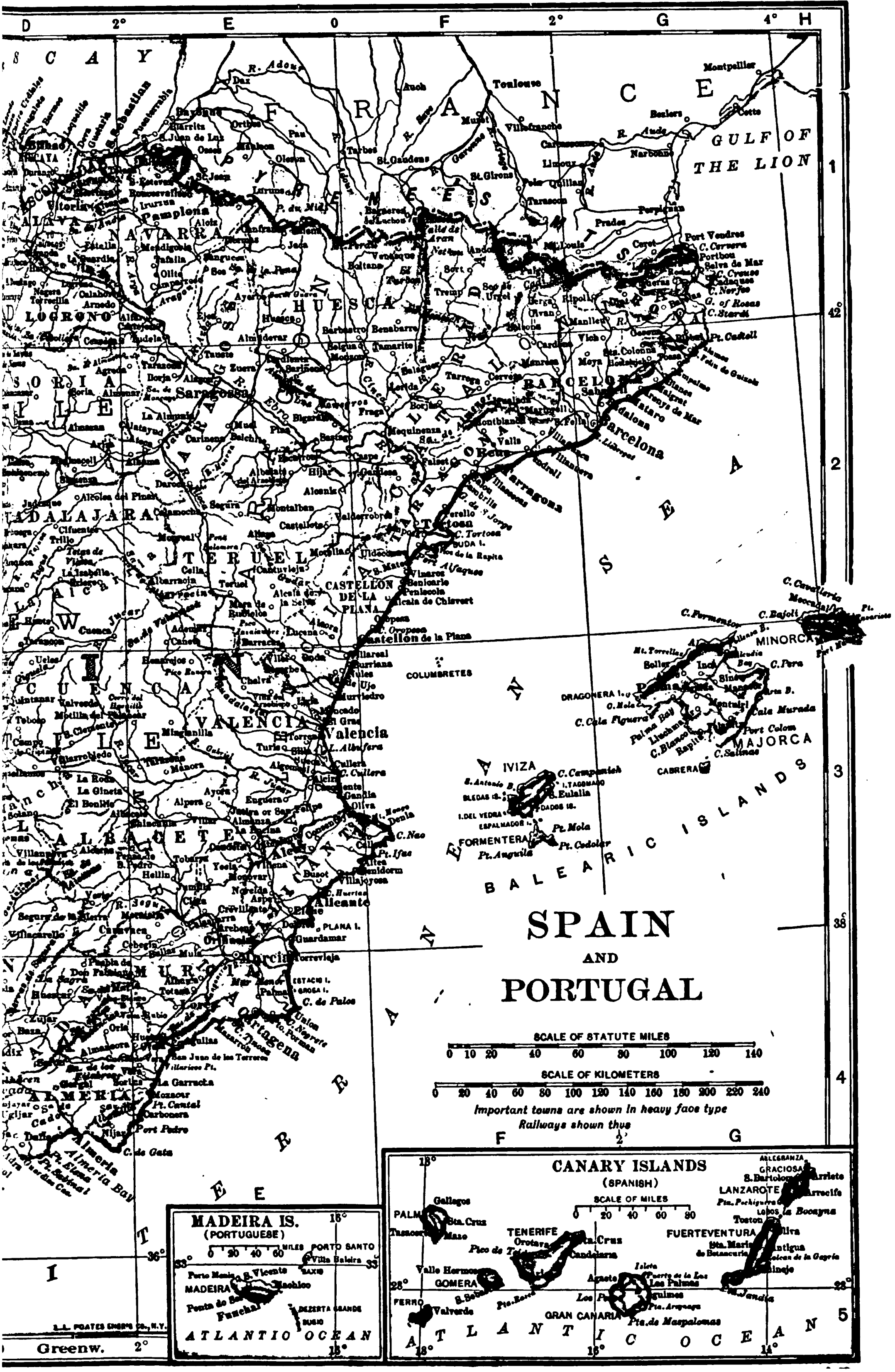
SPAIN
AND
PORTUGAL
SCALE OF STATUTE MILES
0 10 20 40 60 80 100 120 140
SCALE OF KILOMETERS
0 20 40 60 80 100 120 140 160 180 200 220 240
Important towns are shown in heavy face type
Railways shown thus
F R A N C E
GULF OF THE LION
BALEARIC ISLANDS
MINORCA
MAJORCA
IVIZA
FORMENTERA
CABRERA
DRAGONERA
COLUMBRETES
Barcelona
Tarragona
Tortosa
Castellon de la Plana
Valencia
Alicante
Murcia
Cartagena
Almeria
Saragossa
Pamplona
Huesca
Teruel
Cuenca
Albacete
Toulouse
Montpellier
Perpignan
Bayonne
MADEIRA IS.
(PORTUGUESE)
PORTO SANTO
MADEIRA
Funchal
DEZERTA GRANDE
ATLANTIC OCEAN
CANARY ISLANDS
(SPANISH)
SCALE OF MILES
LANZAROTE
FUERTEVENTURA
TENERIFE
GRAN CANARIA
GOMERA
PALMA
FERRO
ATLANTIC OCEAN
Greenw.
S. A. FOATES ENGR'G CO., N.Y.

ranean by the Catalonian Mountains; the other the Andalusian plain in the southwest, traversed by the Guadalquivir River and extending between the Sierra Morena and the Sierra Nevada. These plains, like the narrow and comparatively short coastal plains, are among the most fertile regions of Europe.

Hydrography. All the long rivers, excepting the Ebro, empty into the Atlantic, as the main water parting is nearer the Mediterranean than the ocean. Most of the rivers are for the greater part of the year very deficient in water and not navigable, and therefore of small value for shipping. They lie too far below the general level to be of use even for irrigation. The Miño, Duero, Guadiana, and Tagus are not navigable in Spain, though they are useful for commerce to some extent in Portugal. Of the 800 miles of waterways in Spain only 300 miles are available the year round. The Guadalquivir, which flows through a part of the Andalusian plain, is the deepest river in Spain; vessels of 1100 tons ascend it as far as Seville, and small boats reach Cordova. Its volume is fairly constant, being maintained by the snow of the high mountains of Andalusia. The Miño and Duero flow across the plateau of Old Castile; the Tagus, the longest of the rivers, courses through New Castile. These rivers with the Guadiana flow in deep rocky valleys. The only navigable river on the Mediterranean side is the Ebro, which allows small craft to ascend as high as Rogoño and seagoing vessels to Tortosa. In its lower course it is entered by the Amposta Canal. There are no important lakes, the small lake of Albufera, near Valencia, being the largest.

Climate and Soil. The climate of Spain, like the physical features, is somewhat unfavorable to density of population. The country has almost a continental climate, notwithstanding the length of its coast line. The range of temperature between summer and winter is large, and the diurnal variations are great and rapid. The summers of the table-land are so hot that nearly all the rivers become dry, and the earth so parched and unproductive that whole villages are sometimes compelled to migrate. On the other hand the height of the table-land causes the winter temperature to be low. At Madrid, centrally located, there is often skating in winter, though in summer the temperature may rise to 107° F., making its climate the most extreme in western Europe. On the southern coast, by contrast, the mean temperature in January is 55° F., and frost and snow are extremely rare. The mean temperature at Malaga (south coast) is in summer 77° F. and in winter 57° F., at Barcelona (northeast), on the Mediterranean, the summer and winter means are respectively 77° F. and 50° F., and at Madrid (central), 75° F. and 44.6° F. The total rainfall of the year in by far the greater part of Spain is less than 20 inches, a higher rainfall being for the most part confined to the north and west coast. The evil of deficient precipitation is increased by the fact that the largest rainfall is in the winter months after the growing season. Irrigation is, therefore, the basis of agriculture. The soils need only moisture to make them very fertile. The hot south wind of Andalusia, known as the solano, and the cold north wind, called the gallego, are peculiar to Spain.

Flora. The vegetation is that of central Europe. With such climatic conditions it is natural that both plants and animals should be limited. Herbs and shrubs predominate on the plateau, but a variety of plants is found in ascending to the mountain summits. Woods are met with only on the slopes of the mountains, especially in the north, where a heavy rainfall prevails, where chestnut trees and various oaks occupy the lower zone and conifers extend to the tree limit. The elm is found in many valleys and is planted in some cities. The poplar is one of the cultivated trees, and the beech forms large forests on some of the mountain slopes. The vine flourishes on stony soil, and the olive tree is important. The cork tree, from which the bark may be stripped every 10 years, is found in Granada and southwest of the Pyrenees and also in various other districts. Esparto, or alfa, and rushes, largely used for baskets and mats, are grown on the coast and in the interior; sugar cane is cultivated in Andalusia and Valencia; European and Mediterranean fruits and nuts, such as apples, pears, oranges, lemons, almonds, chestnuts, and figs, grow in abundance; the southern provinces also raise maize and rice; and Spain is the chief saffron-producing country in the world.

Fauna. The forests still harbor wolves, lynxes, wild cats, foxes, and even wild goats. The bear is now rare. Deer, hares, and other game abound, and wild boars of great size and strength are hunted in the oak forests.

Geology and Mineral Resources. The tableland is a very ancient and much altered block of the earth's crust, chiefly composed of Archean and Paleozoic rocks, for the most part of Cambrian, Silurian, and Devonian formation. On the north and south margins of the table-land two younger land masses were upheaved into lofty bordering ranges, the Pyrenean-Cantabrian on the north and the Andalusian on the south. The Pyrenees are an example of a young folded mountain system built up of parallel belts usually in a northwest and southeast direction. The crust folds of the Andalusian system have a low outer zone of folded Mesozoic and Tertiary strata and a lofty inner girdle, in which the Archean and Paleozoic rocks rise high above the Mediterranean. Spain, till the discovery of America, was the richest metal-producing country in the world. It is the most metalliferous land of Europe, not excepting the Ural mining district. The development of mining has been impeded by insufficient fuel and defective means of communication, but the chief reason for the inferior condition of the mining industries is found in the lack of enterprise and skill among the Spaniards. Foreign capital and energy have brought about most of the development in recent years, and the greater part of the ore is exported to foreign countries in its raw state. The rich iron ore and the copper ore go to England and Germany, and Spanish gold and silver ores are melted at Freiberg in Saxony. The great iron fields of Spain yielded in 1911 over 8,700,000 metric tons, which was exported mostly to Great Britain, chiefly through the port of Bilbao. The mines along the Bay of Biscay are nearly exhausted, but iron of excellent quality is found in considerable quantities in Andalusia, the Sierra Morena, and León. A further source of oxide of iron ore was discovered 85 miles from Malaga, and the product is now exported.

Nearly every province contains coal, the resources of the country being estimated at 13,000,000,000 tons. Coal is worked chiefly in Asturias, León, and Lérida, but the amount mined is comparatively small, and there have necessarily been large imports with the increasing demands of the railroads and manufacturing industries. The quicksilver mines of Almadén are very rich, being second only to those of the United States in quantity produced. Spain produces more lead than any other country of Europe, most of the mineral being obtained from the mines of the Alpujarras (q.v.) and those of Linares in Jaén. Copper is found in inexhaustible quantities on the Río Tinto in south Spain, where mines have been worked by British and German capital since 1873. The ore is also mined in Murcia, Oviedo, Jaén, and Zamora. Salt is chiefly obtained by evaporation of sea water at Cadiz, Valencia, and the Balearic Islands, though Catalonia and New Castile abound in rock salt. Among the other important minerals found are sulphur, soda, saltpetre, alum, graphite, and potter's clay. Mineral springs are numerous, the best known being the thermal sulphur springs of Mombuy in Catalonia. In 1912 there were in Spain about 2500 productive mines employing 128,700 men, 2606 women, and 18,506 boys and girls. The output of raw minerals in the same year was valued at 255,643,000 pesetas. The quantities and values of the more important minerals produced in 1912 (the peseta being valued at about 18 cents) were as follows.

CRUDE MINERALS	Metric tons	1,000 pesetas
Iron	9,139,007	56,979
Coal	3,625,666	59,979
Copper	3,364,000	53,116
Lead	190,162	44,236
Quicksilver	21,889	3,562
Zinc	175,311	7,671
Salt	23,292	439,867

Agriculture, Live Stock, and Fisheries. Over half the people live by farming, which supplies about two-thirds of the exports. Farm methods and implements, however, are primitive, and the special disadvantages are that much of the land is owned in large holdings, the taxes are high, and communications poor. About 90 per cent of the area is classed as productive; 35 per cent of this area is devoted to general agriculture and gardening, 2.5 to vineyards, 2.9 to olive growing, 25 to natural grasses, and 22 to fruit. Sheep and goat raising form an important industry, the plains of the comparatively dry table-land supplying a sufficient growth to sustain large flocks in summer, while in winter they are driven to the lower districts. Although about 280,000 of the holdings are in large estates, the subdivision of the soil has been rapidly advancing, and the number of small holdings is very great. Irrigation, as stated above, is necessary during the rainless months. Artificial watering in a wide belt along the Mediterranean coast transformed a great area into a fertile region. All available fertilizers, including street sweepings, are used, with the result that no land in the world is more productive than this section. Southern fruits, vegetables, sugar cane, maize, and other crops requiring abundant moisture are produced. About 9 per cent of the country is artificially irrigated. In the last two decades the government has attempted to enlarge the agricultural area by the construction of reservoirs and irrigation canals. The plans adopted for the irrigation system cannot fully be carried out for many years. Lands now irrigated in the valleys of the Ebro and Tagus yield many times as much fruit as the dry lands.

In Valencia, which is the most profusely watered and the best cultivated region, three or four crops are harvested annually, and the level parts of Catalonia, Murcia, and Andalusia are also very fertile. The dry lands of the interior are chiefly untilled, though, where subterranean waters are near the surface, wheat and other cereals are grown. The northern provinces export small quantities of cereals, though the wheat crop does not usually meet the home demand. Rice is grown on the swampy lands bordering the Gulf of Valencia; rye is the chief breadstuff grown in the part of Spain fronting on the Atlantic; and barley is grown for cattle food.

The areas in acres devoted to the cereal crops in the year 1914 were as follows: wheat, 9,676,879; barley, 3,402,553; rye, 1,886,206; oats, 1,303,314; maize, 1,136,736; rice, 96,824.

The cultivation of the vine receives much attention, and wine at times forms as much as a third of the total exports. The wine crop of 1913 was 432,617,000 gallons, being exceeded only by France and Italy. Most of the wines are poorly made. In the south are produced the famous wines of Malaga, Alicante, and Jérez (sherry), highly valued both for medicinal and table purposes. Valencia, Malaga, and Alicante also export great quantities of raisins and grapes. The grape production of 1913 was 2,952,258 tons. The most profitable crop of the huertas is fruits. Oranges and lemons thrive best along the Gulf of Valencia and in the Balearic Islands, and quantities of the peel of the bigarade or bitter orange are sent to Holland to be used in the manufacture of the liqueur curaçao. Olives and olive oil are large products, though somewhat less important than oranges in the export trade. The olive crop of 1913 was 1,486,874 tons, and the olive oil produced 265,422 tons. Spain is one of the principal producers of olive oil, and most of the product is consumed at home. The industry is chiefly developed in the southern provinces, Seville supplying the greater part of the olives for table use, while the oil comes from Cordova. Esparto, used for the manufacture of twines and a coarse cloth, grows in the southeast and is sent in large quantities to England. Tobacco is cultivated, but much is also imported; the tobacco industry, which is a government monopoly, is an important source of revenue. Hemp and flax are grown chiefly in the northern provinces.

Sheep raising is an important industry, but of less importance than formerly, the number grown having been reduced from about 20,000,000 to 14,500,000 in 1913, while the famous fine-wool merinos have been largely replaced by coarse-wool breeds. Goats are reared for their milk, flesh, and skins, the total number being, in 1913, 3,394,000. The best horses, originally of Arab stock, are raised in Andalusia and Asturias, but horse breeding is much neglected in favor of the mule, the Kingdom containing only about 540,000 horses. On the other hand there were, in 1913, 975,000 mules and 849,000 asses, which are bred with great care in most parts of Spain. The number of cattle amounts to 2,878,000 head. They are most numerous on the pastures of the northwest, where the rain from the Atlantic is abundant. The wild cattle specially raised for bullfighting are obtained from the Sierra Guadarrama and the Sierra Morena. Hogs, about 2,750,000 in number, are reared chiefly in the mountainous parts of the Kingdom, especially in the north and in Estremadura. Silkworm culture is only one-tenth as large as it was in the middle of the last century and is chiefly confined to the regions around the Gulf of Valencia. The yield of cocoons amounts to about 2,000,000 pounds annually. Most of the raw silk is sold to France, and large quantities of silk goods are imported. The sea fisheries are important, but the home industry does not begin to supply the demand, and much fish is imported from Norway. The total number of boats engaged in the industry is about 15,500; fishermen, 89,000. The chief catches are sardines, tunny, and cod.

Manufactures. Active efforts have been made to improve the manufacturing industries, which do not supply the home requirements, but the lack of fuel and raw materials renders this difficult. Catalonia has always been the home of the greater part of Spanish manufactures. Next in order come those districts of Galicia, Asturias, and Vizcaya in which water power abounds, and also a few towns in the interior, such as Madrid, Seville, and Toledo. Barcelona in Catalonia is the leading manufacturing town and the chief seat of the textile, metal, paper, and leather industries and lace making. The silk industry of Valencia, Murcia, and Andalusia and the woolen industry of Barcelona, Alicante, and Burgos also fail to supply the local consumption. The tobacco industry brings to the Treasury a large revenue and is carried on in the royal factories of Madrid, Valencia, Seville, and other towns. Paper making is steadily growing in importance. Iron ore is abundant in the north, and there is a large exportation, that to Great Britain being about $18,000,000 annually. The imports of manufactures of metals are about $20,000,000 annually, and those of machinery about $40,000,000. Gold and silver wares are produced in large quantities in Madrid, Toledo, Seville, and Barcelona, and Gijón, Seville, and Madrid are noted for their glass and porcelain. In the manufacture of cotton goods 2,600,000 spindles and 68,000 looms were employed in 1910, the latest census year; the woolen manufactures used 660,000 spindles and 8800 looms; about 150 paper mills make printing, packing, writing, and cigarette paper; 50 mills produce beet and 20 cane sugar. The production of the sugar beet is growing. More than 30 factories make glass; about 50,000 tons of cork are manufactured every year; and there are over 60 mills for expressing olive oil. The pickling of green olives is an important branch of industry; in addition to the large home consumption, some 6000 to 7500 tons are annually exported. There are about 600 factories engaged in sardine canning and fish preserving, employing 32,000 workmen.

Commerce. The trade consists chiefly in the export of raw produce and the import of the large part of the manufactures consumed. Minerals, fruits, and wine form the larger part of the exports. The imports are chiefly confined to cotton, coal, foodstuffs, textiles, lumber, and machinery. The domestic trade is seriously hampered by natural and artificial obstacles. Spain's commerce with foreign lands is chiefly maritime, and England and France are the most important factors. Imports and exports, exclusive of gold and silver bars, were, in 1900, $124,127,370 and $104,634,021 respectively and, in 1914, $203,871,000 and $172,611,000 respectively. The principal exports were, in 1914, metals and their manufacture, $22,937,000; cotton manufactures, $7,737,000; timber and manufactures thereof, $12,792,000; alimentary substances, including grain, sugar, and wine, $78,892,000. The principal imports were cotton and its manufactures, $25,017,000; alimentary substances, $50,124,000; timber and its manufactures, $10,809,000. The trade is chiefly with Great Britain, France, Germany, the United States, and Cuba. The imports into the United States from Spain in 1896, the year before the war with that country, were $4,131,184 and, in 1914, $24,658,857; the exports to Spain, in 1896, $11,492,428 and, in 1914, $30,587,539.

The following table shows the distribution of the more important foreign trade in two years (value of peseta, 1900, 14.28 cents; in 1913, 19.3 cents).

COUNTRY	Imports from		Exports to	
	1900	1913	1900	1913
	Pesetas	*Pesetas*	*Pesetas*	*Pesetas*
France	137,386,661	204,268,000	187,750,220	327,744,000
Great Britain	246,107,975	244,669,000	247,801,514	231,571,000
United States	105,834,020	167,486,000	17,415,050	72,195,000
Germany	77,792,154	185,370,000	31,804,682	74,419,000
Cuba	5,335,477	2,478,000	56,796,054	64,539,000
Philippine Islands	15,849,846	21,400,000	22,374,782	7,050,000
Porto Rico	3,227,480	7,855,000	12,607,616	2,503,000

Raw cotton, petroleum, staves, coal, and lumber are the chief imports from the United States. The United States sales of raw cotton to the mills in the Barcelona manufacturing district averaged 43,000 bales in the years 1912 and 1913. Wine, fruits, and cork wood are the chief exports from Spain to the United States.

Transportation and Communications. Much of the domestic trade is carried by coasting vessels, as Spain possesses more than 100 harbors large and small on its two seas. The home merchant marine is inferior and most of the shipping is under the British and French flags. The merchant marine in 1914 comprised 628 steamers of 844,322 tons net and 236 sailing vessels of 32,000 tons net; vessel entrances, in 1914, 18,774 vessels, with a tonnage of 21,596,000 tons. There is excellent communication with the chief Atlantic and Mediterranean ports of Europe and with the Philippine Islands and Cuba, and regular steamer service between New

York and Barcelona and the north and south coast ports of Spain. The most important Spanish ports are Barcelona, Cadiz, Malaga, Bilbao, Santander, Alicante, and Valencia. The railroad system connects all the chief towns with one another and unites Spain with France by two routes around the ends of the Pyrenees. Madrid is the centre of the Spanish broad-gauge railroad system. In 1914 the length of the railroads open for traffic was 9310 miles.

Banking. The chief financial institution is the Bank of Spain. Its note issue up to 1,200,000,000 pesetas is guaranteed by a metallic reserve of one-third the amount of the issue, half of which must be in gold. If the note issue exceeds this amount it must, up to 1,500,000,000 pesetas, be guaranteed by metallic reserves of at least 40 per cent in gold and 60 per cent of the remainder in silver. For issues exceeding 1,500,000,000 and up to 2,000,000,000 pesetas 50 per cent must be guaranteed in gold and 70 per cent of the remainder in silver. At the end of 1914 the notes in circulation amounted to 1,985,847,000 pesetas; capital and reserve, 172,000,000; deposits and accounts current, 640,605,000; property, 13,560,000; portfolio, 1,106,940,000; cash in hand, 1,300,313,000.

Finance. The revenue in 1914 amounted to 1,343,000,000 pesetas and the expenditure to 1,430,000,000. Revenue is raised by direct taxes on land, trade, mines, government salaries, etc.; indirect taxes are derived from imports, articles of consumption, tolls, and bridge and ferry dues; other sources of revenue are the tobacco monopoly, the lottery, mint, and receipts from the sales and rentals of national property. The detailed estimates of revenue and expenditure for 1915 were as follows.

REVENUE

	Pesetas
Direct taxes on land, trade, mines, government salaries, registration, etc.	490,108,000
Indirect taxes, customs, excise, etc.	421,300,000
Tobacco monopoly, lottery, mint, and minor sundries	313,370,000
National property	23,987,000
From the public treasury	31,770,000
Total	1,280,536,000

EXPENDITURE

	Pesetas
Civil list	8,828,000
Cortes	2,486,000
Public debt	422,520,000
Pensions	79,585,000
Presidents of Council	927,000
Ministry of Foreign Affairs	6,614,000
" Justice	19,864,000
" Worship	41,689,000
" War	164,640,000
" Marine	68,783,000
" Interior	94,152,000
" Instruction, etc.	74,356,000
" Public Works, etc	184,321,000
" Finance	18,584,000
Tax-collecting	150,990,000
Colonial	125,700,000
Total	1,465,044,000

In 1915 the outstanding debt amounted to 9,410,885,000 pesetas, mostly bearing interest at 4 and 5 per cent. Details of the principal items of the outstanding debt on Jan. 1, 1915, are as follows.

	Pesetas
External 3 and 4 per cent	1,028,070,000
Perpetual internal 4 per cent	6,559,043,000
Redeemable internal 5 per cent	1,559,220,000

Government. The present constitution of Spain was proclaimed June 30, 1876. It declares the government to be a constitutional monarchy with the executive power vested in the King. The sovereign is declared to be inviolable and irresponsible. He is aided by ministers who countersign all his official acts and who thereby assume the responsibility for them. Since the abolition of the Colonial Department in 1899 the ministry has been organized as follows: President of the Council; Minister of Foreign Affairs; Minister of Justice and Worship; Minister of Finance; Minister of the Interior; Minister of War; Minister of Marine; Minister of Agriculture, Commerce, and Public Works; Minister of Education. The ministers have seats in the national legislature and are permitted to take part in the debates.

The legislative power is vested in the King and a Cortes composed of a Senate and a Chamber of Deputies, the two Houses having substantial equality of powers in legislation. The Senate is composed of three classes of Senators: first, those entitled to seats in their own right (*senadores de derecho propio*); secondly, life Senators nominated by the crown from certain designated classes; and thirdly, 180 Senators elected by communal and municipal delegates and by the provincial estates, the church, the universities, learned societies, etc., and by the largest taxpayers. The first two groups must not exceed 180 members. Senators by right include the adult sons of the King and those of the immediate heir to the throne; Spanish grandees who have an annual income of at least $12,000; captain generals of the army, admirals of the navy, the patriarch of the Indies and the archbishops, and the presidents of the councils of state, of war, of the navy, of the Supreme Court, and of the tribunal of accounts. One-half the elective Senators retire every five years, and all retire whenever the King dissolves the Senate. The Chamber of Deputies is composed of 404 members chosen for a term of five years by popular election. Eighty-eight Deputies are elected by general ticket in 26 districts, provision being made for minority representation. The members are apportioned on the basis of one to every 50,000 of the inhabitants. They must be 25 years of age. By a law of 1890 all male Spaniards 25 years of age who are in the full enjoyment of their civil rights and who have been citizens of a municipality for at least two years are qualified voters. The Deputies receive no compensation for their services and are disqualified from holding office while serving in the Parliament. Annual sessions of the Parliament are held; it is summoned by the King and may be prorogued or dissolved by him, subject to the limitation that the new Cortes must be summoned within three months after the dissolution of the old. Both Senators and Deputies are responsible only to their respective Chambers for any words spoken in debate or votes cast. They are also privileged from arrest except in case of flagrant crime. The seat of government is Madrid.

For purposes of local government Spain is divided into provinces and communes, each with its own elected assembly. The Ayuntamiento or elected assembly of the commune consists of from 5 to 39 Regidores and is presided over by an Alcalde chosen from the body of the Ayuntamiento, except in some of the large towns, where he is appointed by the King. The term of the members of the Ayuntamiento is four years, one-half the membership being renewed biennially. The provincial Diputación meets once a year and is represented between sessions by a permanent committee. These two local assemblies have entire control of the local government in their respective jurisdictions and are free from interference of the central government except when they exceed their powers to the detriment of the general interest.

The judiciary consists of a Supreme Court of Cassation, which sits at Madrid, a number of district courts or audiencias immediately under the jurisdiction of the Supreme Court, tribunals de partidos below the audiencias, justices of the peace, and municipal courts. The audiencias serve as courts of appeal in civil matters and as courts of first and last resort for crimes and certain misdemeanors. The tribunals de partidos have jurisdiction in first instance of civil causes and in first and last resort of misdemeanors. They also have appellate jurisdiction in cases decided by the inferior courts. The partido is divided into circumscriptions, usually two, in each of which is a *juez de instrucción*, with civil and criminal jurisdiction in cases assigned to them by the higher courts. The circumscriptions are subdivided into communes, in each of which is a municipal judge with jurisdiction of petty offenses.

Colonies. The colonial possessions of Spain are confined to Africa and are represented in the following table.

POSSESSIONS	Area sq. miles	Population
Río de Oro	73,400	12,000
Spanish Guinea	12,000	200,000
Fernando Po, Annobon, Corisco, Elobey Chico, Elobey Grande	814	23,844
Total	86,214	235,844

Río de Oro, stretching along the Sahara coast, is administered by the Governor of the Canary Islands. Spanish Guinea is on the Gulf of Guinea, between French Coryo and German Kamerun. The national expenditure on account of the colonies far exceeds the revenues derived from them. About $400,000 has to be provided by the Spanish government to supply the deficiency. For an account of the colonies, see the respective headings.

Weights, Measures, and Money. Spain maintains the double gold and silver standard. The unit of coinage is the peseta, nominally worth 19.3 cents or 1 franc, but actually varying in value between 15 and 18 cents. The value of the money coined in Spain from 1868 to 1913 was, approximately: gold, 925,000,000 pesetas; silver, 1,335,000,000 pesetas. Metric weights and measures were introduced in 1859, but in addition to these the old Spanish weights and measures are still largely used.

Army. Service, theoretically, is compulsory with a total liability of 18 years. At the beginning of the European War in 1914 the government undertook measures to secure universal application of the principle. Periods of service are as follows: recruit class, one year; standing or active army, three years with the colors, five years with the reserve; second reserve, six years; third or territorial reserve, three years.

The field army in peace amounts to about 130,000 officers and men; in war this establishment, with the addition of constabulary and military police, is expanded to about 300,000. Recruits are drawn for the divisions from territorial districts, of which there are 8, the total number of divisions being 14. The division is composed of 2 infantry brigades of 2 regiments of 3 battalions, a regiment of cavalry, a regiment of field artillery of 6 batteries of 4 guns each. There are in addition 6 regiments of engineers, 1 of telegraphy, 1 of railways, 3 independent brigades of light infantry each of 6 battalions, 4 regiments (16 batteries) of mountain artillery, 1 regiment (6 batteries) of horse artillery, 1 cavalry division of 2 brigades, 3 independent cavalry brigades.

For the second reserve there is provided a skeleton organization for 7 divisions, which mobilized in war should add between 90,000 and 100,000 men to the field army. For the third or territorial reserve no organization has yet been provided.

The constabulary (Guardia Civil) and the military police (Caranbineros) provide an additional force of about 35,000 men, of whom 2500 are mounted. Colonial forces are maintained, on the coast of Morocco, at Melilla, Ceuta, and Larash, Africa. In the Balearic Islands there are 4 regiments of infantry, 1 battalion of chasseurs, 2 artillery companies, 2 engineer companies, 2 squadrons of cavalry. In the Canary Islands there are 4 regiments of infantry, 4 battalions of chasseurs, 2 artillery companies, 2 squadrons, 2 companies of engineers. Including constabulary and military police, the peace strength of Spain's army is about 13,500 officers and 152,000 men; war strength, including second reserve, about 400,000 combatants. The infantry is armed with the Mauser rifle, calibre .275 inch, the cavalry with the Mauser carbine, the field artillery with the Schneider-Canet 2.95-inch quick fire.

Navy. See NAVIES.

Population. The population of Spain proper by the census of 1910 was 19,950,817, with a density of 100.5 inhabitants to the square mile. Emigration from Spain is chiefly to Brazil, Uruguay, and Argentina. The cities with a population of over 90,000 each are: Madrid, the capital, 599,887; Barcelona, 587,411; Valencia, 233,348; Seville, 158,827; Malaga, 136,365; Murcia, 125,957; Cartagena, 102,519; Saragossa, 111,704. The table on page 338 gives the area and population of each of the 49 provinces according to the census of 1910.

Religion. The national church is the Roman Catholic, and in few countries has it so powerful an influence. The whole population adheres to that faith excepting about 30,000 Protestants, Jews, and others. The constitution requires the nation to support the clergy and religious buildings and institutions, the state expending for these purposes annually about 41,000,000 pesetas. Only restricted liberty of worship is permitted to Protestants. (See below, *History*.) The religious orders are numerous and influential, and many of them have schools and teach industries of all kinds. The total number of religious communities is 3115, with 51,000 members, over 40,000 being women and nearly 11,000 men; number of monks 12,801, of nuns 43,287.

Education. Until recently the Spanish educational system has not been as a whole what it should be; it lacked in the number and quality of its schools of primary and grammar grades and also to a certain extent of the secondary grades. In 1901 the statistics showed 66 per cent of the population unable to read or write. But the authorities are awake to the situation, and for some years past several very important reforms have been brought about and others initiated. They have begun at the bottom, with measures concerning the primary instruction: more schools (so as to make possible the fulfillment of the compulsory-attendance law), more and better teachers, and higher salaries. Some years ago the entire primary-school problem was placed in the hands of a recognized expert, and his position was made nonpolitical. The effect of this is being felt in the secondary schools because a better grade of pupils is being sent up. Commercial and technical schools have also been established. Since 1902 there has been regular governmental inspection, unaccompanied by clerical interference. The secondary schools, of which there must be one in every province, prepare for the 10 universities, which are also showing renewed life. The largest university is that of Madrid, with 5675 students. Recently there was established a Junta para Ampliación de Estudios é Investigaciones Científicas, which has in hand, through its several committees, all the various research work, carried on by the different faculties, and which has established a Summer Session for Foreigners (since 1912) at Madrid and, beginning with the course for 1915–16, three courses of three months each, also at Madrid and for foreigners. The government also supports special schools for engineering, agriculture, fine arts, and music. The budget for 1914 was 62,584,378 pesetas.

PROVINCE	Area sq. miles	Population
Alava	1,175	97,181
Albacete	5,737	264,698
Alicante	2,185	497,616
Almería	3,360	380,388
Avila	3,042	208,706
Badajos	8,451	593,206
Baleáres (Balearic Islands)	1,935	326,023
Barcelona	2,968	1,141,733
Burgos	5,480	346,694
Cáceres	7,667	397,785
Cadiz and Cueta	2,834	470,092
Canarias (Canary Islands)	2,807	444,016
Castellón	2,495	322,213
Ciudad-Real	7,620	379,674
Córdoba (Cordova)	5,299	498,782
Coruña	3,051	676,708
Cuenca	6,636	269,634
Gerona	2,264	319,679
Granada	4,928	522,605
Guadalajara	4,676	209,352
Guipúzcoa	728	226,684
Huelva	3,913	309,888
Huesca	5,848	248,257
Jaén	5,203	526,718
León	5,936	395,430
Lérida	4,690	284,971
Logroño	1,946	188,235
Lugo	3,814	479,965
Madrid	3,084	878,641
Malaga	2,812	523,412
Murica	4,453	615,105
Navarra (Navarre)	4,055	312,235
Orense	2,694	411,560
Oviedo	4,205	685,131
Palencia	3,256	196,031
Pontevedra	1,695	495,356
Salamanca	4,829	334,377
Santander	2,408	302,956
Segovia	2,635	167,747
Sevilla (Seville)	5,428	597,031
Sória	3,983	156,354
Tarragona	2,505	338,485
Teruel	5,720	255,491
Toledo	5,919	413,217
Valencia	4,150	884,298
Valladolid	2,922	284,473
Vizcaya (Biscay)	836	349,923
Zamora	4,097	272,976
Zaragoza (Saragossa)	6,726	448,995
Total	194,800	19,950,817

Ethnology. The perspective of Spanish ethnology extends back to the Paleolithic period. (See Europe, Peoples of.) In historic times all the great divisions of the Caucasian race have mingled their blood in Spain in greater or less proportion—Hamite, Semite, Teuton, Celt, and Mediterranean. The fundamental type bears the name of Celtiberian and is a result of a mixture of the earliest long-headed Mediterraneans and the later-coming brachycephalic Celts, producing a cranial index of 76–79. Keane and Ripley call attention to the uniformity of this index in Spain and in Britain, associated with tall stature and blondness in the latter, with dark color and low stature in the former. Spain has been invaded in historic times by Phœnicians, Carthaginians, Romans, Visigoths, Vandals, Arabs, and Moors. It is generally believed that these conquerors modified the original type but little, simply because many of them were already short of stature, dark in skin, hair, and eyes, as well as dolichocephalic.

History. Spain, the Iberia of the Greeks and the Hispania (q.v.) of the Romans, is supposed to have been inhabited originally by a distinct race called Iberians, upon whom, however, a host of Celts appear to have descended from the Pyrenees. (For the Iberians, see Italy, *Ethnology*.) In the earliest times of which we have any record these two races had already coalesced and formed the mixed nation of the Celtiberians, who were massed chiefly in the centre of the peninsula, in the western districts, and on the north coasts. (See Celtiberi.) In the Pyrenees and along the east coast were to be found pure Iberian tribes, while unmixed Celtic tribes occupied the northwest. On the south and east coasts were Phœnician, Carthaginian, Rhodian, and other colonies. In the second half of the third century B.C. a large territory was brought under subjection to Carthage by Hamilcar Barca (q.v.), who, according to Roman tradition, founded the city of Barcelona (228 B.C.). After the death of Hamilcar (q.v.) the power of Carthage in Spain was strengthened by Hasdrubal (died 220 B.C.), son-in-law of Hamilcar, who founded Cartago Nova (the modern Cartagena, q.v.) and concluded a treaty with the Romans whereby it was stipulated that he should not advance his standards north of the Iberus (Ebro). Hannibal (q.v.), son of Hamilcar, after the death of Hasdrubal attacked and destroyed Saguntum (q.v.) in 219 B.C. and thus brought on the Second Punic War. (See Carthage; Hannibal; Rome.) After the Romans had driven the Carthaginians from the peninsula (206 B.C.) the country was made into two Roman provinces (197 B.C.), Hispania Citerior, including the eastern and northern districts, and Hispania Ulterior, including the southern and western districts. The conquest of the native tribes proved an arduous task for the Romans. (See Lusitania; Numantia.) It was not till 19 B.C. that the Cantabri and the Astures in the extreme north of the country laid down their arms to Augustus. Under Augustus the peninsula was divided into the three provinces of Hispania Tarraconensis, Bætica, and Lusitania. (See

HISPANIA.) From the time of the establishment of the complete supremacy of the Romans till the death of Constantine the condition of Spain was eminently prosperous. Its fertile fields formed for a considerable time the granary of Rome, and from its metal-veined sierras an immense amount of treasure in gold and silver flowed into the Roman coffers.

In 409 A.D. hordes of barbarians, Alans, Vandals, and Suevi crossed the Pyrenees and swept over and desolated the peninsula. In 412 the Visigoths invaded the country, and their King, Athaulf, who acknowledged a nominal dependence on the Roman Emperor, established the Gothic monarchy in Catalonia. (See GOTHS.) The best known of the kings were Wallia (415–419), who greatly extended the Gothic monarchy, making himself master of a great part of Aquitania (where a century later the Visigoths were overcome by Clovis); Euric (466–485), who, besides increasing his territory, introduced and enforced a body of laws and did much for the advancement of civilization in Spain; Leovigild (567–586), who effected the subjugation of the Suevi; Wamba (672–680), who built a fleet for the protection of the coasts; and Roderic (q.v.), who was killed in July, 711, in battle with the Arabs (Saracens). This battle gave the Arabs almost undisputed mastery of nearly the whole of Spain, as well as (later) of Septimania (Languedoc) in France. The remnant of the Goths betook themselves to the highlands of Asturias, Burgos, and Biscay, where they maintained their independence.

The Arabs held Spain for the first few years of their rule as a dependency of the Province of North Africa, but after the downfall of Musa (q.v.) the country was governed (717) by emirs appointed by the Caliph of Damascus. These emirs were intent upon the extension of their conquests into Gaul, to the neglect of the rising power of the Goths in Asturias. Their northward progress was arrested in the battle of Poitiers by Charles Martel (q.v.) in 732. The walis, or local governors of districts and province, frequently rebelled against the emir and drew swords against each other. Within a period of 40 years no fewer than 20 emirs had been called to the direction of affairs, but a revolution at Damascus, which unseated the Ommiads and placed the Abbasides in possession of the caliphate, put an end to this state of misrule in Spain. The last of the emirs, Yusuf, was in favor of the Abbasides, but the walis and alcaydes, being chiefly of the Ommiad faction, invited one of this family, Abd er Rahman, who was in concealment among the Zeneta Arabs in Barbary, to become an independent caliph in Spain. (See OMMIADS.) Thus was founded (758) the Emirate of Cordova. By 778 the Franks had wrested from the Arabs all their possessions north of the Pyrenees and northeastern Spain to the Ebro. The latter acquisition, subsequently denominated the Spanish March, was for a time alternately in the hands of the Moslems and dependent upon France.

During the early period of Arab-Moorish domination the small independent Kingdom of Asturias, founded by Pelayo (q.v.), grew in power and extent. Alfonso the Catholic, son-in-law of Pelayo, conquered nearly all of Galicia and recaptured León, together with Salamanca and other cities. Alfonso the Great (866–910) by his victories greatly extended the Asturian dominions, which soon after his reign figure as the Kingdom of León. In the course of the ninth century Navarre struggled into existence as a separate state. The Kingdom of León was for a long time distracted by bitter and bloody strife among the members of the royal line and with its neighbor, Navarre, would have fallen an easy prey to the powerful Ommiads had not the latter directed their chief attention to the subjugation of Morocco. During this relaxation of the constant warfare between Moors and Christians another independent state, Castile, an offshoot from León, came into existence, at first under the rule of the famous Count Fernán González. About 1026 it was erected into a kingdom. Castile, from its central position and consequently greater facilities for expansion, soon became the most powerful of the Spanish states. A considerable part of Aragon was wrested from the Moors by Sancho the Great of Navarre (1000–35), and at his death this part of his dominions passed as a separate kingdom to his son Ramiro, who added to it the districts of Sobrarbe and Ribagorza and a considerable extent of country which he conquered from the Moors. By 1131 the territory of the counts of Barcelona (Catalonia) was united with Aragon. The last Christian kingdom to be founded in the Iberian Peninsula was Portugal (q.v.).

The Ommiads ruled Mohammedan Spain for about 275 years. The greatest of this dynasty was Abd er Rahman III, who ruled from 912 to 961 and who in 929 assumed the title of Caliph. His capital, Cordova (q.v.), was the greatest city in Europe except Constantinople and was unrivaled in the splendor of its edifices. The civilization of Spain during the Moorish supremacy was far in advance of that of the rest of Europe. At the great Mohammedan universities medicine and mathematics were cultivated, and Aristotle was studied there long before he was well known to Christian Europe. An extensive literature was developed, the caliphs themselves often being poets and authors of note. Commerce and agriculture were fostered, and the stranger marveled at the splendid system of irrigation, which made the country like a garden. The Moorish fleets controlled the Mediterranean and carried on an extensive trade. For the art which was developed in Spain by the Moors, see MOHAMMEDAN ART.

The Ommiad dynasty came to an end in 1031, and a number of independent Moorish kingdoms were formed—Cordova, Seville, Toledo, Lisbon, Saragossa, Tortosa, Valencia, Murcia, Badajoz, and others of less note. The kings of Castile and Aragon did not fail to benefit by this disruption of the Mohammedan realm, for by well-directed and unremitting attacks they subdued some states and rendered others tributary. A few years more might perhaps have destroyed the Moorish domination in Spain had not the rulers, hard pressed by Alfonso VI of León and Castile, who in 1084 conquered the Kingdom of Toledo (New Castile), applied for aid to the ruler of the sect of the Almoravides (q.v.) in Morocco. The Almoravides crossed over to Spain, but after defeating the Christians they turned their arms against the Spanish Moors, and by the beginning of the twelfth century the Almoravide sovereign was acknowledged the ruler of Mohammedan Spain. The power of the Almoravides was extinguished by the Almohades (q.v.), a fanatical sect who passed over from Morocco just before the middle of the twelfth century and conquered the territories of the Mohammedans. In a great battle fought on the plains of Tolosa (*las navas de Tolosa*) in 1212 the kings of Castile, Navarre, and Aragon broke the Almohade power in Spain. Soon nothing was left out of the wreck of the Almohade realm but the Kingdom of Granada, which was forced to acknowledge the overlordship of Castile. This last Moorish kingdom rose to great splendor.

Prominent among the late Castilian monarchs were Ferdinand III, who extended the dominions of Castile far into Andalusia, conquering Cordova in 1236 and Seville in 1248; Alfonso X the Wise, famous as a legislator, writer, and patron of learning; Alfonso XI; Peter the Cruel; and Isabella, whose marriage with Ferdinand the Catholic (1469) brought about the union of Castile and Aragon in 1479. Among the sovereigns who raised Aragon to the position of an important power and extended its dominion beyond the bounds of the Iberian Peninsula were James I (1213–76), who conquered Valencia and the Balearic Islands; Pedro III (1276–85), who obtained Sicily (1282); James II (1291–1327), who resigned his rights in Sicily to his brother Frederic, founder of the Aragon line of kings of Sicily; Alfonso V (1416–58), who conquered Naples; and Ferdinand II, the Catholic (1479–1516), who became the ruler of the whole of Spain. The mediæval history of Castile and Aragon is marked by a vigorous development of constitutionalism as embodied in the assertion of their power by the estates of the realm. (See CORTES.) In both kingdoms the cities enjoyed great political freedom, of which they were gradually deprived after the consolidation of Spain into a single monarchy.

The union of Castile, León, and Aragon enabled the Christians in Spain, both sovereigns and people, to undertake several plans that would otherwise have been impossible in such turbulent times. The balance of power in Castile had shifted from sovereign to nobles, from nobles to the middle class as represented in the Cortes, and back to the nobles. The highways were infested with bandits, many of whom were great nobles. The sovereigns reëstablished the Holy Brotherhood, which made short work of the bandits by razing their castles and driving them into exile. In 1480 Isabella held the great Cortes of Toledo, one of the most important in the history of Spain. The laws were recodified, the system of judicial procedure was reformed, and five councils were established to handle foreign relations, petitions to the sovereigns, Aragonese questions, police, and finance. The Inquisition was reëstablished in Castile and reorganized in Aragon in an effort to complete the unification in religious and political affairs and finish the reconquest of the peninsula. In the Cortes of Toledo a set of very oppressive laws was adopted against Jews. In 1481 the Inquisition was formally established in Seville, and from the beginning it was aimed particularly at those of Jewish or Moorish descent. In this same year the war on the Kingdom of Granada, the last Moorish foothold in Spain, was begun. Political unification of the peninsula was attained in 1492, with the fall of Granada. Ferdinand thereupon felt free to insist that Aragonese interests in France and Italy should receive attention. In order to get money to accomplish this the Jews were expelled and their property confiscated. The money thus obtained enabled Ferdinand to recoup his losses in Italy and avenge himself upon the French. Under the "Great Captain" Gonsalvo de Córdoba the French were easily expelled from Naples, and Spanish infantry gained the reputation (enjoyed for 140 years) of being the finest infantry in Europe. Although the Moors had been promised religious and civil liberty, the Church authorities were not pleased and soon began a system of enforced conversion and petty persecution that became intolerable. (See XIMEŃEZ DE CISNEROS.) In 1512 Ferdinand was able to conquer that part of Navarre that lay south of the Pyrenees, thereby completing the unification of Spain. The discovery of the New World by Columbus (1492) and its exploration and conquest by his followers opened up new vistas of wealth and power for the Spanish people at the time when their rulers were about to entangle them in the obligations and wars of the Empire and of all Europe. Isabella had died in 1504, and Ferdinand had at once renounced his title as King of Castile and León in favor of their daughter and her consort the Archduke of Austria, Philip the Beautiful. (With the marriage of Ferdinand and Isabella there went no actual and immediate union of the kingdoms. Each continued to be sole ruler in his or her own realms, with only courtesy title in the realms of the other.) Ferdinand announced that Juana wished him to act as Regent. Philip would consent to no such arrangement, but none the less craftily agreed with his father-in-law in proclaiming Juana's madness, so that in the end he was recognized as King of Castile and León and authorized to reign in her stead. He promptly put a stop to the terrible work of the Inquisition in Granada and in Cordova by suspending Deza and Lucero from their functions. In 1506 he suddenly died, possibly from poisoning. If Juana was not mad before, she became so after the death of Philip, and Ferdinand hurried back from Naples to assume the regency for his grandson Charles, son of Juana and Philip. In 1516 Ferdinand died, and the crowns of all the Spains at last became united in the person of Juana. But Charles I, who was now 16 years of age, rejected the regency of Cardinal Cisneros and ordered the Cardinal to proclaim him King, despite the fact that his mother was still alive. In 1519 he was elected to the throne of the Holy Roman Empire as Charles V. The Spains and Naples he inherited from his mother Juana; the Netherlands he inherited from his father Philip I (the Beautiful); he acquired the Duchy of Milan (embracing most of Lombardy) and in the New World came into possession of Mexico and Peru, whose gold and silver mines poured forth a ceaseless stream of treasure. Charles V was the most powerful Christian monarch of his time. His reign was taken up with endless wars with the French and attempts to suppress Protestantism throughout Europe and make war upon the Turks. (See CHARLES V, HOLY ROMAN EMPEROR.) For two years (1541–43) Charles was in Spain and devoted a part of each day to instructing Philip in the system of government, whose principles he was to continue, and Charles was so impressed with Philip's aptitude in the matters of statesmanship that when in 1543 he was obliged to return to Germany he decided to leave in Philip's hands the regency of Spain during his absence. Upon his departure Charles left for Philip's guidance two letters that are of the utmost importance as giving the key to all of Philip's subsequent political action. The one dealt with politics and religion, domestic and foreign, and with the statesmen whom Philip must use. The other contained still more secret instructions concerning his social conduct and his private life. Philip was to play off the rival factions against each other and thus concentrate all real power in his own hands. Philip was eminently successful as Regent and fulfilled the Emperor's fondest hopes. From 1554 to 1558, as husband of Mary Tudor (see MARY I), Philip was King of England. Upon Philip's marriage to Mary Tudor, Charles conferred upon him the kingdoms of Naples and Sicily and confirmed to him the Duchy of Milan. In 1555 Charles handed the Netherlands over to Philip, and in 1556 the crown of Spain, which he had hitherto administered only as Regent, was formally transferred to him. The outstanding facts of the reign of Philip II (q.v.) (1556–98) are as follows: in pursuit of the policy he had inherited from his father he developed the Inquisition. His attempt to root out Protestantism in the Netherlands, to introduce there the Spanish system of taxation, and to rule that country as a province of Spain, without regard for his oath to defend the rights of the several states, brought on an uprising that ultimately caused Spain the loss of the Netherlands. The years 1568–70 saw the rebellion and expulsion of the Moriscos from the Kingdom of Granada. His wars against the Turks culminated in the brilliant victory of Lepanto (1571), which placed the Spanish naval power on a pinnacle of glory from which wars with England were destined to dethrone it, with the destruction of the Armada (1588). (See ARMADA; DRAKE.) Meanwhile in 1571 Legazpi conquered the Philippines, and in 1580 Philip conquered Portugal in defense of his unsound hereditary claims. The last period of Philip II's reign saw the war with Henry IV of France (q.v.), the treachery of Antonio Pérez (q.v.), the revolt of the Aragonese (1591), and the sack of Cadiz by the English (1596) as punishment for Philip's aid of the rebellion of Tyrone in Ireland. Philip's fiscal system could hardly have been worse in principle, and his concentration of all power in his own hands reduced all the councils and representative bodies, including the Cortes of the various kingdoms, to mere figureheads. The alcavala was a 10 per cent tax on the price of every article that changed hands by sale; the sisas or millones were a heavy tax on six of the leading necessities of life—wine, vinegar, oil, meat, soap, and tallow candles; and the great number of other taxes were made the more burdensome by being farmed out years ahead at ruinous rates of interest. In the succeeding reigns the alcavala was gradually forced up to 14 per cent and the millones were not only advanced to an eighth of the value of the six articles previously mentioned, but were extended to many other prime necessities. Under Philip III (q.v.) (1598–1621) the financial schemes of Lerma (q.v.) practically ruined the country. Furthermore the work of the Inquisition, politically and otherwise, looking towards the unification of faith, by successive edicts (the first great ban against the Moriscos was published in 1609) brought it to pass that by 1614 the country was entirely purged of infidels and also of its most expert and thrifty subjects. Under Philip IV (q.v.) (1621–65) internal and external affairs went from bad to worse. By the middle of the seventeenth century at least 17 formerly prosperous industries had been driven out of Spain, especially those related to metal working, cordage, and shipbuilding, and the really national industries, silk weaving, fine fabrics, linens, and gloves, were reduced to a mere shadow. To combat the natural rise in prices Olivares issued an edict diminishing by half the value of copper money. Previous to this he had attempted to administer Portugal as a province of Castile and impose upon it the 5 per cent Castilian tax on all property, movable and immovable. This caused a rebellion whereby Portugal in 1640 was lost to Spain. In a subsequent war with France the Spanish infantry, which had for more than a century been reputed the finest in Europe, received the deathblow at the battle of Rocroi (1643). The Thirty Years' War (q.v.) left all Europe exhausted; the Treaty of Münster (1648) brought it to a close, securing from Spain the recognition of the independence of the Netherlands. With the reign of Charles II (q.v.) (1665–1700) the male line of the Hapsburgs in Spain became extinct. Under the previous reign the Inquisition had been less aggressive, but as in this reign no one was really in authority, the Inquisitors saw a chance, and took it, of reasserting their awful political influence, and in 1680 the greatest auto-da-fé ever held took place at Madrid. Under Charles II the disintegration of the Spanish Empire went on apace; the Treaty of Nimeguen (1678) gave Franche-Comté to France, and by the Treaty of Ratisbon (1684) Spain ceded Luxemburg to France, which again restored it to Spain by the Treaty of Ryswick (1697). It was finally ceded to Austria by the Treaty of Rastadt (1714). Upon the death of Charles II the conflicting claims to the throne of Spain produced the War of the Spanish Succession (see SUCCESSION WARS), in which England and Holland were allied with Austria, Prussia, the German Empire, and Savoy against Louis XIV to prevent the aggrandizement of France by the acquisition of Spain as an appanage of the house of Bourbon. When the rival Austrian claimant became Emperor and head of the Austrian dominions as Charles VI in 1711, a similar objection existed to his obtaining the throne of Spain, and the allies conceded the succession to Philip of Anjou, who had been proclaimed King of Spain as Philip V in 1700 and was confirmed by the Peace of Utrecht in 1713. This was the beginning of the Bourbon dynasty in Spain. Spain emerged from the War of Succession stripped of the Belgian Netherlands, Naples, Sicily, Sardinia, and her Lombard territories. She had to cede Gibraltar to the English, who had captured it in 1704.

A few years later Spain, whose policy was at this time directed by Alberoni, made an effort to recover some of her lost possessions, but her aggressions were promptly met by the Quadruple Alliance of 1718 between Great Britain, France, Austria, and Holland, and the schemes of the able Prime Minister came to naught. In the War of the Polish Succession, however, Don Carlos, son of Philip V, wrested the Two Sicilies from Austria and established the Bourbon dynasty there.

Philip was succeeded by his son, Ferdinand VI (q.v.) (1746–59), in whose reign numerous reforms were introduced in the administration. Ferdinand was succeeded by his half brother Charles III (q.v.) (1759–88), who, on ascending the Spanish throne, relinquished the Two Sicilies to his son, Ferdinand IV. Charles brought into Spain from his Italian domains a new spirit and initiated reforms in the internal administration, foreign policy, and economics of the state. As a result of the Seven Years' War, in which Spain joined France, Florida was ceded to Great Britain and Louisiana acquired from France (1763). In 1767 the Jesuits were expelled from the Spanish dominions. In 1779 Spain became the ally of France in the war against England, and in 1783 she recovered Florida, which in 1819 was ceded to the United States. Charles IV (q.v.) (1799–1808) was incapable of continuing his father's vigorous policy. He was under the control of the notorious Godoy (q.v.), the Queen's favorite, who played into the hands of Napoleon for his own profit. In March, 1808, the King abdicated in favor of his son Ferdinand, and the latter was compelled to renounce his claims to the crown in favor of his father, who then handed his right over to Napoleon. The latter then conferred the Spanish crown upon his brother Joseph Bonaparte. Deserted by their rulers, the Spanish people organized resistance, declared for Ferdinand VII, and refused to recognize the Bonapartes. A supreme junta of leading Spaniards was established at Seville, and subordinate juntas were formed in each of the provinces.

It was the obstinate resistance of Spain and the efficient work of the supporting English armies in the Peninsular War that first checked Napoleon and showed Europe that he was not invincible. (See PENINSULAR WAR.) Meanwhile the Spanish colonies in America revolted, and after a fierce warfare of 16 years the Spanish dominion on the American mainland was completely extinguished (1826). After the expulsion of the French King, Ferdinand VII returned to Spain and entered Madrid, May 14, 1814. The liberal constitution of 1812 enacted by the Cortes was at once abrogated, the religious orders were restored to their earlier predominance, the Cortes were abolished, and the Inquisition was reëstablished. A popular reaction aided the King and his ministers in this course. A Liberal revolution in 1820 restored the constitution of 1812 and instituted a Cortes which was notable for its extreme liberalism. The Inquisition was abolished, and the privileges and exemptions of the Church were invaded. The clergy and the peasants opposed the revolution, but it was received with favor by the army and the educated classes. In 1822 the Holy Alliance (q.v.) took note of the Spanish situation, and France was commissioned to suppress the Liberal movement. A French army of nearly 100,000 men invaded the peninsula, and the Spanish forces were entirely unable to meet the attack. On May 24, 1823, the French entered Madrid, established a regency, drove the Cortes from Seville to Cadiz and out of the country, and restored Ferdinand, who had been declared of unsound mind by the Cortes. The King at once revoked all of the liberal measures except the abolition of the Inquisition. Repression and wholesale punishment followed. The French army remained in occupation until 1827. Bermúdez, the Prime Minister, adopted finally a moderate policy, but this satisfied neither Absolutists nor Liberals. The Clerical party, guided by the Apostolic Junta, rallied around Ferdinand's brother, Don Carlos, as the representative of extreme absolutism and clericalism, and a number of insurrections were started by the Junta in his interest. In 1831 Ferdinand, having no male heir, decreed the revival, on behalf of his daughter Isabella, of the old law admitting female succession. Ferdinand died in 1833, and Queen Maria Christina became Regent for her daughter Isabella II. The Carlists proclaimed their candidate as Charles V, and there was an immediate division of parties in the Kingdom into Carlists and Cristinos. The Queen Regent was compelled to turn to the Liberals for support. A royal charter, in lieu of a constitution, was promulgated in 1834, but it did not give real popular government, and the ministry and the chambers were both under the control of the crown. Civil war broke out, and the Carlists were at first successful. An alliance was concluded by the Regent with England, France, and Portugal for the purpose of maintaining the crowns of Spain and Portugal against the pretenders Carlos and Miguel (qq.v.). The death of Zumalacárregui (q.v.), the only Carlist leader of ability, and the accession to the command of the government forces of General Espartero (q.v.) turned the tide. Maroto, the Carlist commander, concluded the Convention of Vergara with the government in 1839 and returned to his allegiance with his army. By this treaty Navarra and the Basque Provinces, which had been the strongholds of Carlism, were confirmed in their ancient privileges. Espartero defeated the remnants of the Carlists in Catalonia, and Don Carlos went into exile, handing over his pretensions to his son.

In the meanwhile the struggle for a Liberal constitution was being waged in the Kingdom, and a revolutionary movement at the palace of La Granja in 1836 forced María Christina to swear to the constitution of 1812. In 1840 Espartero, the Liberal leader, was made the head of the ministry on his own terms. María Christina resigned the regency Oct. 12, 1840, and the Cortes made Espartero Regent and guardian of Isabella and her sister. The Regent's firm government made enemies, and in 1843 a revolutionary movement, headed by Narváez and Prim (qq.v.), drove him from power. In November, 1843, Isabella was declared of age and assumed the crown, with Narváez, the leader of the Moderates (Moderados), as Prime Minister. María Christina was recalled and the constitution modified on reactionary lines. Narváez exercised practically dictatorial powers until 1851. Parties gradually readjusted themselves, the old Absolutists, with whom the Moderates tended to assimilate, grouping themselves about Queen Isabella and her mother, and the Liberal elements joining the Progressists. In March, 1851, a concordat was arranged with the Pope by which all ecclesiastical affairs were to be canonically regulated, and all religions but Catholicism were forbidden in the Kingdom, the Church in return yielding its secular jurisdiction and recognizing the sale of Church lands. A cabinet of personal supporters was made up by the Queen mother. They attempted in 1852 a modification of the constitution in the direction of absolutism. This led in 1854 to a new outbreak. A coalition of the more liberal Moderates under Narváez and Progressists under O'Donnell (q.v.) was formed and was joined by Espartero, now again recognized as one of the Progressist leaders. María Christina left the country, and a government was formed with Espartero as President of the Council and O'Donnell as Minister of War. The latter was now at the head of a new party, the Liberal Union, which favored a liberal constitutional monarchy. In the coalition government the Progressists were at first the dominant factor, but before the new constitution of 1855 was promulgated they lost control. There were republican risings in the northeast and Carlist risings in the northwest, and the suspension of popular liberties by the government, while engaged in the suppression of these revolts, gave an opportunity to O'Donnell and his party. Their control was short-lived, and in 1856 Queen Isabella appointed a Moderate ministry under Narváez, which adopted a reactionary policy. In 1858 the Queen recalled O'Donnell, and he held office for five years. A war with Morocco (1859–60) had no result except to test the efficiency of the Spanish army. Spain joined France in the ill-advised Mexican expedition, but Prim, in command of the Spanish forces, signed a convention with Juárez and refused to support the French. Napoleon III was indignant with his ally, and in Spain there was bitter discussion of Prim's course. The Progressists made it a handle for a partisan attack on the government, and the Moderates also took a hostile attitude. The O'Donnell government, which had added vastly to the national debt, went down in 1863.

With the passing of the Liberal Union there was a gradual return to absolutism. The Miraflores government, which succeeded that of O'Donnell, attempted to govern constitutionally, but the Absolutist pressure in court circles was too strong, and this ministry gave way to successors more pliable. The government really fell into the hands of the camarilla, a group of personal favorites who had influence with the Queen. The Liberal groups were forced more and more into a hostile and revolutionary attitude. Castelar (q.v.), then a professor in the University of Madrid, raised his eloquent voice against the extravagance of the crown and was supported by the university. The government attempted to suppress such agitation. The Cortes was dissolved in 1866, and Marshal Serrano (q.v.), President of the Senate, was sent into exile. Narváez, who had represented all shades of political opinion at different times, was now called to the head of affairs and maintained a strong government, which was really a military dictatorship, until his death in 1868. An open revolt headed by Prim failed, but a little later Prim, Serrano, and Admiral Topete (q.v.) began a better organized and better supported revolutionary movement. The fleet at Cadiz under Topete declared for national sovereignty. Serrano marched towards the capital, defeated the government forces at Alcolea on Sept. 28, 1868, and on October 3 entered Madrid, already in a state of insurrection. Isabella in the meanwhile escaped into France, and the revolution was accomplished.

A provisional government was established by the revolutionists under the presidency of Serrano. A liberal monarchical constitution was put through by a combination of Republicans under Castelar and Progressists under Prim and was promulgated June 6, 1869. Serrano was made Regent, with Prim as Prime Minister. Carlists, Republicans, and Constitutional Monarchists all aspired to profit by the upheaval in the government. Several foreign princes were invited to take the crown—among them Prince Leopold of Hohenzollern, whose candidacy (July, 1870) gave rise to irritation between France and Germany and in a measure provoked the Franco-German War. At last in December, 1870, Amadeus, Duke of Aosta, son of King Victor Emmanuel, accepted the crown (see AMADEUS I), but before his arrival in Madrid Prim, the king maker, was assassinated. King Amadeus thus lost a strong support, and he abdicated Feb. 11, 1873, after a brief and uncomfortable reign, distracted at the end by a great rising in favor of the young Don Carlos (Charles VII) and disturbed by an insurrection in Cuba, which had broken out in 1868. A republic was then declared. Figueras was the first President of the Ministry, with Castelar as Minister of Foreign Affairs. A constituent Cortes was summoned in June and prepared a constitution making Spain a federal republic. Several ministries attempted vainly to cope with the situation, which, in addition to the Carlist insurrection in the north, was complicated by the risings of the Intransigentes (see INTRANSIGEANTS) and Internationals in the cities of Andalusia, Murcia, and Valencia. On September 7 Castelar was made President of the Executive with dictatorial powers, and the Cortes adjourned until January, 1874. The wise and positive course of Castelar in enforcing order and recognizing conservative interests displeased the extremists, and when the Cortes reassembled a vote of lack of confidence was passed. Castelar resigned, and Serrano became nominally President of the Executive, but in reality a military dictator. He carried on with vigor the war against the Carlists, but he had hardly secured recognition for his government from the European Powers when Gen. Martínez Campos (q.v.) proclaimed Alfonso XII, son of Isabella, King (December, 1874). The army declared for Alfonso. The Serrano government, of which Sagasta (q.v.) was then Prime Minister, gave way, and Cánovas del Castillo (q.v.) headed a provisional government. Alfonso, then 17 years of age, assumed the government on Jan. 14, 1875, guided by Cánovas del Castillo. The Carlist revolt was completely suppressed in 1876. Don Carlos went into permanent exile, and Navarra and the Basque Provinces were deprived of their ancient privileges and fueros (q.v.). A constitution of a decidedly illiberal character was adopted in 1876, and its provisions were enforced with severe literalness by the ministry of Cánovas del Castillo. By 1878 order had been reëstablished throughout most of Cuba. Martínez Campos, who was sent to the island to put down the insurrection, came back in 1879 an advocate of a reform policy towards Cuba and attempted to form a ministry on that issue, but failed and went into the opposition. Much of his programme, including abolition of slavery in the Antilles, was carried out by Cánovas del Castillo. In 1881 a more liberal régime was inaugurated under Sagasta.

The government under the restored monarchy was nominally in the hands of a ministry responsible to the majority in the Cortes, but personal factions and rivalries disintegrated parties to such an extent that this was not so in practice. There were two leading parties—

Conservatives, and Liberals or Constitutionalists, both upholding the constitutional monarchy. The remnant of the Carlists could do little but agitate. The Republicans lacked a leader, since Castelar had given up the republican programme as impracticable. Cánovas del Castillo returned to power in 1884, after having been out of office for three years. On Nov. 25, 1885, Alfonso XII died, and his widow, Christina, who was pregnant, became Regent of the Kingdom, the premiership being intrusted to Sagasta. On May 17, 1886, Christina gave birth to a son, who became King as Alfonso XIII. Sagasta governed with vigor, energetically repressing military uprisings, and brought about the enactment of a measure providing for universal suffrage. A Conservative ministry under Cánovas del Castillo was in office from July, 1890, to December, 1892. The succeeding Liberal ministry under Sagasta was unpopular because of its attempt to apply needed economies and its severe measures to repress anarchism, which had become rampant in Catalonia. In 1895, when a new revolt broke out in Cuba, the Conservatives returned to power under Cánovas del Castillo. The army officers were dissatisfied with the growth of the civil power and restive under the criticism of an increasingly independent press. Premier Cánovas del Castillo was assassinated in 1897, and Sagasta took his place at the helm, in time to face the problems of a war which was already imminent. The Cuban revolt produced complications which led in 1898 to a conflict with the United States. (See CUBA; SPANISH-AMERICAN WAR; UNITED STATES.) This unequal struggle was brought to a close by a treaty of peace negotiated at Paris, Dec. 10, 1898, by which Spain relinquished her sovereignty in Cuba, Porto Rico, and the Philippine Islands. Later the Caroline, Pelew, and Ladrone Islands were sold to Germany.

The military party under Weyler (q.v.) made the peace treaty an issue and forced Sagasta out of office. A Conservative ministry headed by Silvela came in, but resigned in October, 1900, and a reconstruction was effected under General Azcárraga on distinctly military lines. Anticlerical disturbances in 1901 pointed to a growing spirit of liberalism and independence. A new government was organized under Sagasta, March 6, 1901, and adopted a stern attitude towards the religious orders. King Alfonso XIII came of age May 17, 1902, and the regency was terminated. For several months Sagasta retained office with great reluctance, and on Dec. 6, 1902, the ministry retired, and an entirely new cabinet was constituted by Silvela. During the ensuing years there was a rapid alternation of ministries, as many as four cabinet changes occurring in 1905. Closer relations were established with France in 1904, the two nations agreeing on a common policy in Morocco. In 1906 a vigorous anticlerical campaign was begun by the government, aiming at the establishment of civil marriage and the regulation of religious associations. On May 31, 1906, King Alfonso XIII married Princess Ena of Battenberg, a granddaughter of Queen Victoria. On May 10, 1907, an heir to the throne was born and christened Alfonso. Under the stress of the anarchistic activities and the assassinations of the Portuguese King and Crown Prince the Terrorist Bill was voted in 1908, and Spain joined France in the handling of the Moroccan question. The year 1909 saw renewed anarchistic activities and an attempt at revolution in Barcelona, which led to the trial and execution of Ferrer. The speech from the throne (1910) announced that measures were to be adopted for putting the relations of Spain and the Vatican upon a more modern basis, for limiting the number of religious orders, and for obliging those orders that indulged in business to pay the regular taxes. A previous royal order granted to non-Catholic bodies the right to display the signs of their religion on their buildings and make public announcement of their services. These reforms, proposed in a much more gentle way than had been the similar reforms in France, were placed under the leadership of Canalejas, who secured the passage of the Padlock Law in 1910, and introduced his Associations Bill in 1911. This campaign he continued until his assassination in 1912, when his successor, Count Romanones, undertook it, although he pressed it with less vigor. It has not yet been passed, nor has the Decentralization Bill been passed, although introduced by Canalejas in 1912 and earnestly supported by Romanones and by his successor, Dato, who in 1913 secured the passage of a provisional decree giving effect to its vital principle. In the Great War which began in 1914 Spain announced a policy of strict neutrality. See WAR IN EUROPE; CAVALRY; GOTHIC ARCHITECTURE; POLITICAL PARTIES; RENAISSANCE ART; ROMANESQUE ART; SOCIALISM; SPANISH LITERATURE.

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SPALATIN, spä′lȧ-tēn′, GEORG BURCKHARDT (1484–1545). A German reformer and friend of Luther. He was born at Spalt, near Nuremberg, and took his name Spalatin from his birthplace. He studied law and theology at Erfurt and Wittenberg. In 1508 he was ordained priest. He became one of the trusted advisers of the Elector Frederick the Wise of Saxony and was influential in winning his sympathy for the Lutheran movement. He continued to enjoy court favor after the death of Frederick and was made canon of Altenburg in 1525. He wrote biographies of the electors Frederick the Wise (ed. by Neudecker and Preller, Weimar, 1851) and John the Constant, *Christliche Religionshändel* or *Religionssachen* (extracts from which were published as *Annales Reformationis* by Cyprian, Leipzig, 1818), and a history of popes and emperors of the Reformation period. Consult Seelheim, *Georg Spalatin als sächsischer Historiograph* (Halle, 1876), and G. Berbig, *Spalatin und seine Verhaltnis zu Martin Luther* (ib., 1906).

SPALATO, spä′lȧ-tō. A seaport of Dalmatia, on a peninsula in the Adriatic Sea, 74 miles southeast of Zara (Map: Austria, E 5). High mountains are north and east, and Fort Grippi on the east. The harbor, protected by a long mole, is safe. In the remarkable palace of Diocletian, to which the town owes its name, the Emperor lived after abdicating. The remains are interesting—the loggia, with its red columns, and a ruined rotunda being noteworthy. The old town, with its narrow streets, is mostly inclosed within the palatial ruins. The new town, with wide thoroughfares, lies to the west. The cathedral is an octagonal structure of Roman origin. Spalato has a naval school, an episcopal seminary, a Serbo-Croatian national Realschule and Gymnasium, and a public garden. Spalato exports olive oil, fruit, and especially wine. There are manufactures of wool and silk. Pop., 1900, 27,198; 1910, 31,451, mostly Serbo-Croatians.

SPALDING, spạl′dĭng, ALBERT (1888–). An American violinist, born in Chicago. He began his studies with Jean Buitrago at New York, continuing with Chiti in Florence. After further study under Lefort in Paris he made his début in the French capital in 1906, where he met with a flattering reception. His tours of France, Germany, and England securely established his European reputation. It proved more difficult to arouse enthusiasm in the United States, where he appeared in 1909, but after a few seasons his countrymen acknowledged him among the violinists of the first rank. As a composer he attracted attention with a *Prelude and Fugue* for piano, a set of variations on *My Old Kentucky Home*, a *Concerto quasi fantasia* for violin and orchestra.

SPALDING, Albert Goodwill (1850–1915). An American merchant, born at Byron, Ill. In 1871 he joined the Boston Club of baseball players and pitched for them until 1875. After 1876 he was a member of the Chicago Club, serving successively as manager, secretary, and president of the club until 1891. In 1876 he established and became president of A. G. Spalding & Bros., dealers in sporting goods, and later organized also a manufacturing branch of the firm, known as the Spalding Manufacturing Company, of which he also became president. These enterprises were very successful. After 1900 Spalding lived at Point Loma, Cal., as a member of Mrs. Katherine Tingley's (q.v.) Raja Yoga Theosophical colony. In 1910, at the primaries, he won the Democratic nomination for United States Senator, but was not elected. He wrote *America's National Game* (1911).

SPALDING, John Franklin (1828–1902). An American Protestant Episcopal bishop. He was born at Belgrade, Me., and was educated at Bowdoin College and at the General Theological Seminary, New York. In 1873 he was consecrated Missionary Bishop of Colorado, with jurisdiction in Wyoming. His principal publications are: *The Threefold Ministry of the Church of Christ* (1864; 2d ed., 1887); *The Church and its Apostolic Ministry* (1887); *The Best Mode of Working a Parish* (1888); *Jesus Christ the Proof of Christianity* (1891).

SPALDING, John Lancaster (1840–). An American Roman Catholic archbishop. He was born at Lebanon, Ky., was educated at Mount St. Mary's College and at the University of Louvain, Belgium, was ordained priest in 1863, was appointed secretary and chancellor of the diocese of Louisville in 1869, and was consecrated Bishop of Peoria in 1877, resigning in 1908 on account of ailing health. In 1909 he was made titular Archbishop of Scythopolis. He took a prominent part in various social and educational movements and in 1902 was a member of the President's commission to investigate the coal strike. Among his writings are a *Life* of his uncle, Archbishop M. J. Spalding (q.v.) (1873); *Education and the Higher Life* (1890); *Things of the Mind* (1894); *Means and Ends of Education* (1895); *Thoughts and Theories of Life and Education* (1897); *Opportunity and Other Essays and Addresses* (1900); *Socialism and Labor* (1902); *Religion, Agnosticism, and Education* (1902); *Religion and Art and Other Essays* (1905).

SPALDING, Martin John (1810–72). An American Roman Catholic archbishop. He was born near Lebanon; was educated at St. Joseph's, Bardstown, Ky., and in Rome, where he was ordained priest in 1834; and became Coadjutor Bishop of Louisville in 1848 and Bishop in 1850. In 1864 he succeeded Dr. Kenrick as Archbishop of Baltimore. He published: *Early Catholic Missions in Kentucky* (1846); *Lectures on the General Evidences of Christianity* (1847; 4th ed., 1866); *Life of Right Rev. B. J. Flaget* (1852), his predecessor at Louisville; *History of the Protestant Reformation* (1860). Consult his *Life* by his nephew, John L. Spalding (q.v.) (Baltimore, 1873).

SPALDING, William (1809–59). A British author. He was born in Aberdeen, where he was educated at Marischal College. In 1833 he became an advocate. A deep and minute student of the Elizabethan drama, he published a notable "Letter on Shakespeare's Authorship of 'The Two Noble Kinsmen'" (1833; reprinted by New Shakespeare Society, 1876) and other important contributions, which appeared mostly in the *Edinburgh Review*. In 1840 he became professor of rhetoric and belles-lettres in Edinburgh University and in 1845 professor of logic, rhetoric, and metaphysics at St. Andrews. He was the author of *Italy and the Italian Islands* (3 vols., 1841), the fruit of his travels and studies, and of a useful, compendious *History of English Literature* (1853). Consult the Life, by J. H. Burton, prefixed to the "Letter" in the New Shakespeare Society edition above mentioned.

SPALLANZANI, spăl′lăn-tsä′nê, Lazzaro (1729–99). An Italian biologist, born at Scandiano and educated at Modena and Bologna. In 1754 he became professor at Reggio, in 1761 at Modena, and in 1768 professor of natural history at Pavia. He was distinguished in experimental physiology, where he disproved the doctrine of spontaneous generation of life and demonstrated the physiology of digestion and the true nature of the spermatic fluid and spermatozoa. His works are *Opuscoli di fisica animale e vegetabile* (1780) and *Expériences pour servir à l'histoire de la génération des animaux et des plantes* (1786).

SPALLART, Franz Xaver von Neumann. See Neumann-Spallart, F. X. von.

SPANDAU, spăn′dou. A town in the Province of Brandenburg, Prussia, situated at the confluence of the Havel and the Spree, 9 miles west-northwest of Berlin, of which it is now a suburb (Map: Germany, E 2). Through extensive improvements in its fortifications and the construction of numerous detached forts Spandau has been made a stronghold of the first rank for the protection of Berlin. In the citadel, which is also used as a government prison, is the Julius tower, in which was kept the Imperial military reserve fund of $30,000,000 in gold, of which the basis was the French indemnity of 1871. Spandau has an infantry rifle-practice school, an artillery construction bureau, and a Gymnasium. The state ammunition, rifle, and artillery works are located here. The city owns the gas works. Its manufactures include porcelain, woolens, and military tents. The town is the shipping centre for a large trade between Berlin and Hamburg. There are fisheries and important horse and lumber markets. Spandau received municipal privileges in 1232 and was strongly fortified in the fourteenth century. Pop., 1900, 65,014; 1910, 84,855.

SPAN′DREL. The flat wall space comprised between two adjoining half arches or between a half arch and any adjacent vertical member, such as a pier, column, or pilaster, and limited above by a horizontal line or band or entablature near to or touching the crowns of the arches. This space is approximately triangular and offers an admirable field for decoration. It may be adorned with figures in relief, as in Roman triumphal arches, or with medallions, as in the Ospedale degli Innocenti at Florence and many other Renaissance buildings; with surface enrichments in color or with incised or relief carving. In certain types of steel arched bridges the spandrels are formed by series of columns or other supports for the upper chord of the truss or the roadway. The term is also applied in the engineering of steel-skeleton buildings to the rectangular space between two columns from the head of a window to the sill of the window next above it.

SPANGENBERG, spăng'*en*-bĕrk, AUGUSTUS GOTTLIEB (1704–92). A bishop of the Moravian church. He was born at Klettenberg, Prussia, and educated at Jena, and while there, in 1728, came under the influence of Zinzindorf (q.v.). In 1732–33 he was a member of the theological faculty of the University of Halle. He then allied himself formally with the United Brethren and was sent to the West Indies and North America as a missionary, receiving in 1735 a grant of land near Savannah, Ga., and establishing a colony there. The Moravians made him Bishop in 1744, and for nearly 20 years he exercised his jurisdiction principally in America. In 1760 he was called to the supreme council of the sect, four years later was appointed supreme inspector in Upper Alsatia, and in 1789 was made president of the general directory. He died at Berthelsdorf, Saxony. His principal work is *Idea Fidei Fratrum, oder kurzer Begriff der christlichen Lehre in den evangelischen Brüdergemeinden* (1782), translated into English by Benjamin La Trobe (1784). Consult lives by K. F. Ledderhose (Heidelberg, 1846; Eng. trans., London, 1855), G. C. Knapp (ed. by Otto Frick, Halle, 1884), and G. Reichel (Tübingen, 1906).

SPANGLED COQUETTE. See HUMMING BIRD.

SPANIARD ROD. See OSIER.

SPAN'IEL (abbrev. of OF. *chien espagnol* (Fr. *épagneul*), Spanish dog, from Sp. *Español*, Spanish, from *España*, Spain). A short-legged, long-haired variety of the domestic dog. Two groups may be made: (1) hunting spaniels, (2) fancy or toy spaniels. The first contains the field spaniel, clumber, cocker, Norfolk, Sussex, and English and Irish water dogs; the second the King Charles, Prince Charles, Ruby, Blenheim, and Japanese spaniels. They are exceedingly close hunters on a ground scent; though for rapidity of action and range they have been supplanted by the pointer and setter, they are unsurpassable in rough, tangled country. They neither point nor set, but (except the clumber) give tongue when they scent the game. The difficulty is to keep their eagerness in control. They not only find game, but retrieve it, especially from water. The chief characteristics of all varieties are length of body and shortness of legs (in modern dogs greatly exaggerated), a great abundance of beautiful silky coat, and a placid disposition.

Field Spaniel and Cocker. Although of different origin, these may well be considered together. Both in form are long and low, with shapely, gracefully carried heads and straight strong front legs. The coat is straight, dense, and silky, heavily fringing the ears, the back of the legs, and the toes. The color most preferred is solid black. The cocker spaniel will usually weigh from 18 to 24 pounds, the field spaniel twice this.

The Clumber. This is a large dog weighing up to 65 pounds, with a predominance of white in color. It takes its name from the seat of the Duke of Newcastle, who introduced the breed into England from the kennels of the Duc de Noailles of France early in the eighteenth century. Unlike other spaniels these hunt in silence. They are handsome, grave-looking dogs, with massive heads and a furrow between the eyes. The nostrils are large, open, flesh-colored; the eyes large and deeply set, showing a haw. The coat is not long, except the profuse featherings, properly lemon and white with few markings. The tail is usually docked. The Sussex spaniel is a variety of clumber which must be a rich golden liver color. It is faster in the field and, although not mute, is less noisy than others. The Norfolk is another variety of this type which arose in the English county of that name as a pheasant dog. In the days of hawking this spaniel was the falconer's special assistant. See Plate of DOGS.

Irish Water Spaniel. This dog is of very ancient lineage and great value as a retriever. Its general appearance is that of a large spaniel, with a topknot of hair over the eyes. The tail tapers like that of a pointer; the face is long and the hair on it free from curling, though that on the body is closely curled, and the small, dark amber eyes are set flush, without eyebrows. The color is a rich dark liver and the weight from 50 to 60 pounds.

Toy Spaniels. The best known of the small pet or fancy spaniels is the King Charles—a black and tan, maintained pure-blooded for many generations with jealous care by the dukes of Norfolk. In early times they were broken to hunt. Now they are only pets. They are in the main simply miniature spaniels, weighing from 7 to 10 pounds, with eyes large, wide apart, and level, and ears long, drooping, and silky. The Blenheim resembles the King Charles, but its ears are shorter and it differs in color, being a pure pearly white, with bright chestnut or ruby-red markings, evenly distributed in large patches. Both the ears and cheeks are red, with a blaze of white between them, in the centre of which is one small red spot. The breed is named from the estate of the first Duke of Marlborough, by whose family it was bred. They were in those days trained for the hunt as well as highly prized in the house. The Prince Charles, Charles I spaniel, or tricolor, resembles the Blenheim, except that where the Blenheim is red he is black, and he has no blaze. The ruby is a King Charles spaniel, red, with a black nose. The Japanese spaniel is pure white, parti-colored with black or red or lemon, and very small. It may weigh 8 to 12 pounds or only 1 pound, as do some of the sleeve dogs, so called in Japan because they may be carried in the coat sleeve. The Japanese spaniels have a compact body, large, highly arched head, with dark eyes set high and wide apart. The nose is short and puglike, the legs are slender, and the tail is well feathered and carried in a tight curl over the back. They are alert and affectionate. A similar dog is highly esteemed in China, especially when solid fawn or silver in color.

Consult M. H. Spicer, *Toy Dogs* (New York, 1903); also references under Dog.

SPANISH-AMERICAN LITERATURE. The Colonial Period. Spanish-American literature owes almost nothing to the few fragments of Nahua and Inca literature that survived the destruction of hieroglyphs by the Spanish conquerors. The early literature centres largely around the city of Mexico. (See Mexican Literature.) As subsidiary literary centres Bogotá, Quito, Lima, and Guatemala became noted during the later colonial era.

The subject matter of intellectual colonial effort consists largely of the preparation of grammars and dictionaries of native languages (Menéndez y Pelayo, in *La ciencia española*, gives a list of 59 of the principal ones) and of catechisms and sermons in both Spanish and the native vernacular. This work is merely of philological interest. Another branch of literary activity was the writing of the history of the conquest and early settlement of America. During the later colonial period works on natural and political science began to appear. The remaining literary effort produced a few works of merit (so recognized by the mother country), of importance in the further literary development of America. These writers (largely ecclesiastics, though occasionally some conquistador handled the pen equally well with the sword) described the conflicts of the Spaniards with the natives, as did the Chilean epic poet Pedro de Oña (born 1560–70), in his *Arauco domado,* and the Peruvian poet Pedro de Peralta y Barnuevo, in his *Lima fundada;* or they depicted the beauties of natural scenery and the happenings of agricultural life, as did the Guatemalan Rafael Landívar (1731–93), in his bucolic Latin poem, *Rusticatio Mexicana;* or they collected the materials for history and wrote excellent accounts of the pacification and settlement of America, as did Juan de Velasco of Ecuador, in his *Historia del reino de Quito,* and the Jesuits Ovalle and Rosas in Chile. Fr. Juan de Barrenechea y Albis, of the latter country, in his *Restauración de la imperial* (1693), made a solitary attempt at novel writing. There appeared also some worthy attempts at devotional writing, both in prose and verse, such as the *Sentimientos espirituales* of the Colombian Sor Francisca Josefa de la Concepción (died at Tunja, 1742) and *La Cristiada* of Diego de Ojeda (who lived in Lima early in the seventeenth century). Juan de Castellanos (sixteenth century) of New Granada, in his *Elegías de varones ilustres de Indias,* not only celebrated in hendecasyllabic verse the deeds of the early explorers of America and of his native viceroyalty, but also achieved the doubtful distinction of writing the longest poem in the language. The crowning glory of New Granada, however, lies in the intellectual movement which, under the leadership of José Celestino Mutis (1732–1808), the "illustrious patriarch of botanists of the New World," and the many-sided José de Caldas (1741–1816), became memorable in the Spanish-American scientific literature of the latter half of the eighteenth century. During this same period the Ecuadorean Antonio de Alcedo (died 1812) produced his *Diccionario geográfico-histórico de las Indias occidentales* (1786–89), a translation of which, by G. A. Thompson, with numerous additions, was published in London (1812–15).

The Period of Independence. The revolutionary days of the early nineteenth century, which, in Spanish America, substituted the radical philosophy and sentiment of the progressive French for the unswerving loyalty and religious mysticism of the conservative Spaniard, did not wholly release American writers from dependence upon peninsular schools of thought. Through translation and imitation one may trace the influence of Byron, of Hugo, of Heine, and other great leaders of the Romantic school of literature; but in most cases these and other writers are introduced to Spanish America indirectly, and above all through the writings of the Spanish Romanticist Zorilla, who has exerted a most profound influence upon American authors. The one great bond that unites the separate republics and keeps them in touch with the thought of the mother country is the "sonorous Castilian language," which its best writers have preserved in all its grammatical and rhetorical purity of diction, but to which they have given a buoyancy and flexibility lacking in the original and a greater freedom of thought.

During the early decades of the nineteenth century themes suggested by the revolutionary conflict, in which many writers took part, naturally formed the greater portion of the literary output. The period which followed is marked by literature of a more contemplative tone. Within recent years there has arisen the new school of creolism, whose devotees show in the faithful portrayal of native customs, generally of a rustic character, many elements of rugged strength. During the century there has also occurred a shifting of literary centres in South America. Lima, Quito, and Bogotá have been relegated to a secondary rank, while Buenos Aires, early brought under the direct influence of the French Romantic school, and Carácas, influenced as profoundly by Zorilla and his followers, and Santiago, at present the centre of the most inspiring literary productions of the South American continent, far outstrip their rivals.

The chief literary figure of Latin America is that of Andrés Bello (q.v.), whose mastery of Castilian is illustrated in his many-sided career and whose reputation as a poet rests chiefly upon his georgic *La agricultura en la zona tórrida.* José Antonio Maitín (1792–c.1859), another native of Venezuela, was one of the first of the ardent followers of Zorilla. Rafael María Baralt (1810–60), in his *Historia antigua y moderna de Venezuela,* in style and method compares favorably with the best of modern Spanish historians and also ranks high as a linguist and poet. Among others who have shed lustre on the literary reputation of Venezuela are the members of the gifted Calcaño family, Julio and José Antonio; the Romantic poet José Heriberto García de Quevedo (1819–71); the lyricist Jacinto Gutiérrez Coll (1836–), made famous by his *A mi ángel guardián* and *Sueño de amor;* Francisco de Sales Pérez (1836–), whose *La vida del campo* is a faithful portrayal of the customs of his native llanos; and the present-day Díaz Rodríguez, whose artistic romance, *Sangre patricia,* recalls the Italian D' Annunzio. Colombia was the home of the lyric poet José Eusebio Caro, whose *Lara* (published in 1834) marked an important literary period in the history of his native land. His associate, Julio Arboleda (died 1862), essayed in *Gonzalo de Oyón* a notable attempt at epic writing, but achieved a greater success in his brilliant romance *Casimiro el Montañés*. The realistic poet José Joaquín Ortiz is favorably known because of his masterpiece, *Los colonos*. The most noted Spanish-American novel, *María*, is the work of the Colombian Jorge Isaacs, while the *Historia de la revolución de Nueva Granada* (1827) of José Manuel Restrepo is but one of the many historical works that have brought honor to the northern Republic. Her southern neighbor, Ecuador, boasts of the statesman poet José Joaquín de Olmedo (1782–1847), whose *Canto de Junín* is the most stirring of revolutionary poems, but whose work has been rivaled by the more recent verse of Juan León Mera, famous also as a critic and for his novel *Cumandá*, and Julio Zaldumbide, a poet of the Contemplative school. Mention should also be made of the lyric poet Numa Pompilio Llona (born 1832), who wrote *Odisea del alma* and *Cantos americanos* and whose *Noche de dolor en las montañas* is one of the best poems of recent Spanish-American literature; and also the poet and orator Gabriel García Moreno and the elegant prose writer Juan Montalvo. Lima in Peru was the home of the political satirist Felipe Pardo de Aliaga, famous also for his dramas *Frutos de la educación* and *Una huérfana en Chorillos*. From the middle of the century Peruvian writers have largely followed the Spanish school of Romantic literature, and one of the most inspiring of this class of writers is Fernando Velarde, whose collected poems, *Flores del desierto*, appeared in 1848. José Arnaldo Márquez (1825–81) is regarded as the leading lyric poet of modern Peru. In fiction *El Padre Orani* of Narciso Aréstegui occupies a prominent place, and the dramatists M. N. Corpancho (born 1830), C. A. Salaberry, and M. A. Segura take a high rank. But the most important author in modern Peruvian literature is beyond question Ricardo Palma (born 1833) (q.v.). As under the political régime of viceroyalty days, Bolivia has continued to be in a literary sense the appendage alternately of Peru and of Argentina, but the lyric poetry of Ricardo J. Bustamante (1821–84) and the *Ensayo sobre la historia de Bolivia* of Manuel José Cortés (1811–65) have received favorable notice, as has also the *Ultimos días coloniales en el Alto-Perú* (1896), written by Gabriel René-Moreno (born c.1835).

Chile, long the most backward of the South American republics, was greatly aroused by the long residence of Bello and by the coming of many exiled Argentines. Of the succeeding generation the publicist and poet Arteaga Alemparte (1835–80) achieved a poetic triumph in his hymn *Al amor*. Isaias Gamboa, in his *Poemas* (1902); the rare and strange Antonio Bórquez Solar, in his *Campo lírico* (1900); and Carlos Walker Martínez, in *Poesías* (1894) and *Romances americanos* (1899), exhibit an elevation of thought and a beauty of versification unequaled elsewhere in Spanish-America and hardly surpassed in Europe. Chilean writers of history and political science, among whom are reckoned Vicuña MacKenna, Barros, Arana, and the Amunáteguis, likewise enjoy an international reputation, while *Alberto el jugador*, a novel by Rosario Orrego de Uribe, *Contra la marea*, by Alberto del Solar, and the work of Salvador Sanfuentes, Eusebio Lillo, and Guillermo Blest Gana attest the worth of her writers of fiction, some of whom wrote dramas also.

With the dawn of independence the classic translations and imitations of Valera, Quintana, and Cienfuegos inaugurated the literary history of Argentina, a history which includes that of her neighbor, Uruguay. In Argentina Estéban Echeverría, one of the first American lyricists, known for his *La cautiva*, introduced romanticism directly from the French and liberated the thought of his own countrymen. His fellow citizen José Rivera Indarte produced the stirring poem *El festín de Baltasar*, and his pupil Juan María Gutiérrez the lyrics *Recuerdo* and *A mi caballo*. Following these came a host of littérateurs with centre at Buenos Aires or, in time of political proscription, at Montevideo, whose work in poetry and prose has greatly influenced the political thought and literature of their own and neighboring republics and has rendered famous the names of the historian and novelist Vicente Fidel López, the dramatist José Mármol (author also of the novel *Amalia*), and the poet José Hernández, whose *Martín Fierro* has been the most widely sold poem of the southern continent. The *Flores silvestres* of the dramatist Francisco Javier de Acha of Uruguay have also met with a favorable reception, and the *Libro extraño* of Francisco Sicardi is one of the best of recent novels. The *Historia argentina* (1894) of Mariano A. Pelliza is a monumental work of great merit. In the department of criticism the *revistas* of Buenos Aires have occupied a leading place, and one of their most famous contributors was Juan Bautista Alberdi, whose *Escritos completos* appeared in 1886. Bartolomé Mitre's *Historia del general Belgrano* is one of the most successful attempts at biographical history that the century has produced. Central America, in addition to a number of political writers, has contributed to the field of letters the satirist José de Batrés y Montúfar and the writers of fables García Goyena and Matías Córdoba of Guatemala.

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SPANISH-AMERICAN WAR. A war between the United States and Spain, which occurred in 1898. After a consideration of the conditions in Cuba, which had existed in the island for a century and had resulted in violations of the laws of humanity and in systematic disregard of the rights of American citizens, the United States determined to intervene. The Cuban uprising of 1895 had been suppressed with severity by Spain. Devastation, famine, and death were the lot of the natives, and lives and property of foreigners were not safeguarded. On April 6, 1896, Secretary of State Richard Olney offered in rather vague terms the friendly offices of the United States to save Cuba from "absolute impoverishment" and to ameliorate the condition of foreigners in that country. Spain declined, and President Cleveland, in his annual message to Congress in December, 1896, spoke of "higher obligations" than those due to Spain, which would devolve upon the United States if Spain should be unable to cope with conditions. In the early part of McKinley's administration Congress appropriated $50,000 for Cuban relief. Sagasta, the new Prime Minister of Spain, perceiving the trend of affairs, recalled the hated Captain General Weyler and sent out General Blanco in his stead. Spain promised to establish civil order in Cuba and to give it local autonomy when the American Minister to Spain, Stewart L. Woodford (q.v.), announced that his country could not view with indifference indefinite prolongation of existing conditions. In the meantime the United States government began to strengthen its naval forces. Relations became further strained when a letter written by the Spanish Minister criticizing President McKinley was stolen from the mails and published. His resignation followed the disavowal of any knowledge of the affair by the Spanish authorities. The critical point was reached when the United States battleship *Maine* was blown up on the evening of Feb. 15, 1898, in Havana harbor with a loss of 266 men. Boards of investigation were appointed by both countries. The American commission reported that the catastrophe was due to the explosion of a submarine mine. This was supported by a later investigation (1911). On March 8 Congress appropriated $50,000,000 for national defense, and on March 11 the War Department began mobilization of the regular army. President McKinley had again tendered the good offices of the United States, before the report of the investigating committee, but, not satisfied with Spain's reply, determined to lay the whole matter before Congress. In anticipation of war American citizens left Cuba, the Cuban Junta demanded recognition before interference, and Spain declared a general truce on April 10. In his message (April 11) President McKinley described the situation, declaring intervention necessary, advising against recognition of the Cuban government, and requesting Congress to take action. Eight days later Congress declared the people of Cuba free and independent, demanded the surrender of all Spanish authority over the island, and empowered and directed the President to enforce this resolution by the army and navy. The President signed this ultimatum on April 20 and gave Spain until the 23d to make satisfactory reply. The Spanish Minister almost immediately demanded his passports, and the American Minister was handed his at Madrid. Formal declarations of war were issued by Spain and the United States on April 24 and 25 respectively.

The first naval action occurred on April 27, when Capt. W. T. Sampson (in charge of the blockading squadron, Cuban north coast) bombarded Matanzas. Spain sent a fleet to Cuban waters and had another in Philippine waters. Com. George Dewey (q.v.), who was at Hongkong, was ordered (April 25) to "proceed to the Philippine Islands; commence operations at once against Spanish fleet; capture vessels or destroy." On April 30, under cover of the darkness, he entered Manila harbor with 9 vessels, 131 guns, and 1678 men. The next morning he attacked Admiral Montojo, whose 10 more or less helpless vessels (120 guns and 1796 men) lay at anchor in Cavite Bay. After a four-hour fight he destroyed the enemy's fleet and silenced the local fortifications with a loss of only six wounded. The whereabouts of the Spanish fleet in Cuban waters, under the command of Cervera, puzzled the Americans for some time until it was discovered in Santiago Bay. The harbor was rigorously blockaded by Admiral (then Captain) Sampson (q.v.), who had superseded Com. W. S. Schley (q.v.) on June 1. A daring attempt by Lieut. R. P. Hobson (q.v.) to close the harbor channel by the sinking of the collier *Merrimac* was unsuccessful. On Sunday morning, July 3, Cervera's ships emerged. The United States fleet immediately pursued and in four hours destroyed or drove ashore the six Spanish ships. The Spanish losses were about 350 killed and 1700 officers and men captured. The Americans lost one man and had ten wounded.

President McKinley had issued a call for 125,000 volunteers on April 23, 1898, and a second call for 75,000 more on May 25. Spain had about 197,000 men in Cuba, of whom 155,000 were regulars. On June 13 Gen. W. R. Shafter, U.S.V. (q.v.), left Tampa, Fla., with 815 officers and 16,072 men, composed almost entirely of regulars. His instructions were: "Go with your force to capture garrison at Santiago and assist in capturing harbor and fleet." He landed on June 20 at Daiguiri, the Spaniards withdrawing to their intrenchments near Santiago, protected by barbed-wire entanglements. Gen. Joseph Wheeler (q.v.) dislodged the Spanish troops at Las Guasimas after a sharp engagement in which he lost 68 men, killed and wounded (Spanish loss 28). On July 1 the United States troops, with the aid of Cubans under General García, began the general assault on the Spanish positions. Two really separate actions were fought, El Caney and San Juan; San Juan Hill was captured at 1.30 P.M.; El Caney carried by storm at 4.30. On July 3 General Shafter notified the Spanish commander, Toral, that unless he surrendered by the morning of the 4th the city would be shelled. The truce which followed was ended on the 10th and hostilities, under the form of a siege, resumed. On the 16th articles of capitulation were signed. All forces, material, and territory of the District of Santiago were to be surrendered and all Spanish soldiers to be transported to Spain. The Spanish losses are not accurately known; those of the Americans were 1156. On July 25 Gen. Nelson A. Miles, U.S.A. (q.v.), landed on the island of Porto Rico; his skillfully conducted campaign was terminated on August 13 by the news that an armistice had been concluded. On August 13 Admiral Dewey and Gen. Wesley Merritt made a combined attack on the city of Manila, which surrendered; final capitulation was concluded August 14. About 13,000 Spanish soldiers yielded to the Americans, who had lost only five killed and 43 wounded. For the subsequent organization of the Filipinos for gaining independence, see AGUINALDO; PHILIPPINE ISLANDS.

Spain sought peace through the French Ambassador late in July. On August 12 the peace protocol and preliminary arrangements were concluded. The treaty was signed on December 10 in Paris; by this Spain withdrew from Cuba and ceded Porto Rico, Guam, and the Philippines to the United States, which in return agreed to pay her $20,000,000 and to yield temporary commercial privileges in the Philippines. The political status of the inhabitants of the new possessions was to be determined by the new government. During the war a high death rate in camps brought out charges of maladministration against the War Department. See ALGER, RUSSELL A.; CUBA; PHILIPPINE ISLANDS; PORTO RICO; UNITED STATES.

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SPANISH-AMERICAN WAR, NAVAL AND MILITARY ORDER OF THE. A patriotic and hereditary society organized in New York City on Feb. 2, 1899. It admits to membership any man of good repute who served on the active list or performed active duty as a commissioned officer, regular, or volunteer in the United States army, navy, or marine corps during the war with Spain or in the subsequent insurrection in the Philippines, or who participated in the war or insurrection, prior to April 1, 1901, as a naval or military cadet or as an officer in the revenue-cutter service on any vessel assigned to duty under the control of the Navy Department.

SPANISH BARBER, THE. A comedy by George Colman, the elder, produced in 1777, based on Beaumarchais' famous comedy *Le Barbier de Séville*.

SPANISH BAYONET. See YUCCA.

SPANISH FEVER. See TEXAS FEVER.

SPANISH FLY. See BLISTER BEETLE.

SPANISH FOWL. The black Spanish fowls constitute one of the oldest varieties of domestic poultry and are renowned for fine laying qualities. The white face is a distinguishing feature and should be long, smooth, free from wrinkles, rising over the eyes in arched form, extending towards the back of the head and the base of the beak, covering the cheeks and joining wattles and ear lobes. The plumage is rich, glossy black; any gray is considered a defect. Shanks and toes are blue or dark leaden. The comb is single, bright red; wattles, bright red, except the inside of the upper part, which is white; ear lobes, pure white.

SPANISH FRIAR, THE. A drama by Dryden, produced in 1681, in part a satire on Roman Catholic priests. Two plots, one serious, the other comic, are combined in the story, connected by Dominick, the friar, a fat, amusing rascal.

SPANISH GYPSY, THE. 1. A romantic comedy by Middleton, assisted by Rowley, printed in 1653. Two stories are combined, one from Cervantes' *Fuerza de la Sangre* and the gypsy tale from his *La Gitanilla*. 2. A long dramatic poem by George Eliot (1868). A Spanish grandee is about to marry a beautiful girl, who discovers that she is the daughter of the gypsy chief Zarco. The call of race and duty finds itself in conflict with her love, and the outcome is a renunciation of her personal happiness.

SPANISH LANGUAGE. A Romanic language, i.e., Modern Latin, as spoken in Spain and carried by Spanish colonists to the Canaries, the Antilles, the Philippines, Mexico, portions of the United States, Central America, the greater part of South America, and a few places on the coast of Africa, and by the Jews into Turkey and other regions in which they settled after their expulsion from Spain in 1492. In the Iberian Peninsula the boundaries of the Spanish-speaking domain do not coincide exactly with those of the political division called Spain, since within the latter are contained in the northwest Galicia (whose inhabitants speak Gallegan, a language which, while closely akin to Portuguese, is recognized by many linguists as an entirely independent member of the Romanic family and has had an interesting literary renascence since about 1875), the Basque Provinces (q.v.) in the north, and along the east coast the Principality of Cataluña and the Kingdom of Valencia (wherein Catalan (q.v.) is spoken). The inhabitants of the Balearic Islands speak a Catalan dialect. Probably not far from 55,000,000 persons at present use Spanish as their native tongue, the majority being in the New World. Five principal dialects are distinguishable in the language as spoken in the mother country: Asturian, Leonese, Aragonese, Andalusian, and Castilian. Castilian has become the standard literary speech.

Castilian has the five simple vowels, *a, e, i, o, u*, a variety of diphthongs, and a few triphthongs produced by the union of a strong vowel (*a, e, o*) with two weak vowels (*i, u*). The diphthongs *ie* and *ue* are especially common as representatives of a Latin short *e* or *o*. Qualitative distinctions in vowels (open and close *e* and *o*) exist, but are not so marked as in certain other Romance languages. The consonant sounds are *p*; a bilabial spirant written both *b* and *v* (the usual sound of these letters); a bilabial stop written both *b* and *v* (the value of these characters where they follow an *m* of the same word or an *n* at the end of the preceding word, as in *también* and *en vida;* the sound is that of the usual English *b*, pronounced with less emission of breath, for the sound of the English *v* does not exist in Spanish); *f; w* (written *u* in hiatus); *m; t*, a voiceless lingua-dental explosive (articulated farther forward in the mouth than the corresponding English sound and with less emission of breath); a voiceless spirant that is interdental or nearly so (written *c* before *e* or *i*, and *z* at the end of a word, or before a consonant, or before any vowel, though rarely now before *e* or *i*, e.g., *celo*, zeal, *zapato*, shoe; the value is about that of *th* in the English *breath*); a voiced spirant, interdental or nearly so (written *d*, which has this sound especially between vowels, as in *lado*, side; or when preceded by a vowel and followed by *r*, as in *padre*, father; or at the end of a word, as in *abad*, abbot; the value is about that of *th* in the English *breathe*); *l;* a palatalized *l* (written *ll* and pronounced nearly like the *li* of *filial*); *n;* a palatalized *n* (written *ñ* and pronounced like the *ni* of *pinion*); a simple tongue-trilled *r* (never slurred); a reënforced form of the same sound (written *rr* between vowels and *r* at the beginning of a word or after *s*, *l*, or *n* within a word, e.g., *perro*, dog, *reo*, criminal, *israelita*, Israelite, *honra*, honor); a voiceless *s* (with the value of the English *ss*); *y* (written both *i* in hiatus and *y*); *k* (written *c* before *a*, *o*, and *u*, or before a consonant and in the final position, and *qu* before *e* and *i*, e.g., *carro*, car, *querer*, to like, *quién*, who); *g* (the so-called hard sound of English *g* in *game, get;* written *g* before *a*, *o*, *u*, and *gu* before *e*, *i*, e.g., *gato*, cat, *guerra*, war); a velar or guttural spirant (with approximately the value of *ch* in Scotch *loch* and German *nach;* written *j* in all positions and *g* frequently before *e*, *i*, e.g., *jamás*, never, *gente*, people; some observers find also a voiced form of this spirant, but it is usually voiceless); a velar *n* (with the value of English *ng* in *sing;* written *n* before a guttural or palatal, as in *banco*). It is the general rule that the Spanish written characters represent actual sounds, but *u* is frequently used before *e* or *i* as a sign that a preceding palatal consonant has the hard or stop value, as in *que* or *guerra; j* is silent in the singular noun *reloj;* and in a few words like *usted* a final *d* may not be pronounced. The simple *h* is generally not pronounced, though before the diphthong *ue* it may have a slight aspiration. In the conjunction *y* (= and) the sound is that of the vowel *i*. An aversion to the doubling of consonants is a distinguishing feature of Spanish spelling; *c* and *n* alone may be doubled, as in *acción*, action, *innoble*, ignoble, and these combinations must be pronounced as double sounds wherever they occur; *ll* and *rr* are properly not doubled consonants, and they figure as individual signs in the alphabet. Among the combinations of consonants may be mentioned *ch*, which stands in the Spanish alphabet as a single letter or character, with a value like *ch* in the English word *church*, e.g., *chico*, little. According to the Academy the written *x* is a double consonant equivalent to *ks*, but before a consonant there is a rather widespread tendency to pronounce it like a simple *s*. In older Spanish *x* was a much more common character than now and had the value of English *sh*. By a decree of the Spanish Academy issued in 1815, *x* with the value of *sh* has been displaced in favor of *j*, pronounced as described above. The matter of accentuation is governed by strict rules of the Academy. Words ending in a consonant not *n* or *s* regularly stress the last syllable, e.g., *verdad*, truth. Words ending in *n* or *s* or in a vowel regularly stress the syllable before the last, e.g., *aman*, they love, *hijos*, sons. Words infringing these rules and all words stressed on a syllable not the last or second last must bear a written acute accent on the stressed syllable, as *nación*, nation, *cortés*, courteous, *médico*, physician. If a diphthong or a triphthong occur in the stressed syllable, the stress will fall upon its strong element (*a*, *e*, or *o*), and where the diphthong consists of two weak elements (*i*, *u*) the second of the two will have the stress.

In its chief grammatical usages Spanish accords with French, Portuguese, Italian, and the other Romanic languages. A decided peculiarity is the use of the preposition *á* (to) before the direct object of a verb when that object represents a definite person, e.g., *veo á mi amigo*, I see my friend. An idiomatic usage that lends great flexibility to the sentence structure is that of the infinitive in dependent conditional clauses, and others, with a subject pronoun in the nominative case. Like Portuguese, Spanish has two verbs "to have" (*tener* and *haber*, the latter used to-day only as an auxiliary in conjugation) and two verbs "to be" (*estar* and *ser*), and in each case the functions of the verbs are distinct. With *estar* and the gerund of a principal verb there may be formed a very useful periphrastic conjugation corresponding to the English progressive form, thus, *Juan está estudiando*, John is studying. Instead of the four conjugations of Latin there are but three in Spanish; furthermore, regular verbs of the Spanish second conjugation and the Spanish third conjugation differ in only four forms, viz., the present infinitive, the first and second persons plural of the present indicative, and the second plural of the imperative. There are certain radical-changing verbs which, though perfectly regular as to their endings, change their root vowels *e* and *o* under the accent to the diphthongs *ie* and *ue* respectively, or, going a stage farther, to the simple vowels *i* and *u*. The subjunctive mood persists with much more vigor than in most modern languages; besides the usual present and imperfect tenses it has a second imperfect form (called also the conditional subjunctive), which is properly a descendant of the Latin pluperfect indicative and upon occasion may still be used as an indicative pluperfect or aorist in Spanish, and also a descendant of the Latin future perfect indicative, the so-called future, or hypothetical subjunctive. Spanish has also a real second person plural present imperative form in addition to its second person singular. For all other affirmative imperative purposes, and for all negative imperative purposes, the corresponding forms of the present subjunctive must be used. Auxiliaries are used to form the compound tenses, as in the sister Romanic tongues, but, contrary to the custom in French and Italian, it is "to have" (*haber*) and not "to be" that forms the perfect tenses of reflexive verbs; thus *se ha lisonjeado*, he has flattered himself. Spanish outdoes by far most of the other Romanic languages in its idiomatic use of reflexive verbs with special meanings. As in the other Romanic languages the Spanish future and conditional indicative are really compounds formed by adding to the entire infinitive (used as a stem) the present and imperfect indicative endings, respectively, of *haber*. The neuter gender survives in the case of the singular of the definite article *lo*, of the demonstrative words *esto, eso, aquello*, and of the objective pronoun of the third person *lo*. These neuter forms occur only in indefinite and general constructions, and when the neuter article, always accompanied by an adjective (or an adverb), forms abstract expressions, thus, *lo bueno*, the good = goodness.

Latin, of course, forms the basis of the Spanish vocabulary, but there is an admixture of words from other sources. There are doubtful traces of words from pre-Romanic languages, such as Iberian and Celtic and the speech of the Punic invaders and colonists. Despite trading relations, few permanent acquisitions seem to have been made from Greek until after the Roman conquest. The Visigothic invasion brought very few Germanic words, but that of the Arabs brought in a host of Oriental words, many of which are easily detected by the prefixed Arabic article *al*. In the eleventh century many lexical elements came from beyond the Pyrenees with the entrance of French soldiers, ecclesiastics, and colonists, and an infusion of Italian elements was occasioned by Aragonese domination in Italy and by the great vogue of Italian poetry in the Spanish Peninsula during the fifteenth and sixteenth centuries. Colonial relations have led to the introduction of a few terms from Indian and other sources, and learned influences have constantly increased the stock of borrowings from Latin, Greek, and French.

Traces of written Spanish are found in Latin deeds and grants as early as the eighth century, but the first really important Spanish document is one of the eleventh century, containing a series of glosses, and literature in Spanish does not begin until the twelfth century, in so far as the extant documents are concerned.

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SPANISH LAW. The most widely extended branch of the civil law (q.v.). Even if Portuguese law, which is an offshoot of mediæval Spanish law, be left out of the reckoning, Spanish law prevails to-day over a wider area and governs a larger population than any other system except the English. Spanish law, in its Castilian form, was introduced into all the Spanish colonies. In Mexico, in Central America, and in all of the South American states, except Brazil (which is governed by Portuguese law), the law of Castile still forms the historical basis of the legal order. Modern Spanish law, as codified in the later decades of the nineteenth century, obtains in Cuba, in Porto Rico, and in the Philippines.

History. 1. *Pre-Roman and Roman Periods.* In mediæval Spanish law, some legal historians find traces of Iberian, Celtic, and Phœnician customs, but for all practical purposes the history of Spanish law begins with the conquest and civilization of the peninsula by the Romans. Until the fifth century of the Christian era the rule of the Roman law was as complete in Spain as in any other province of the Roman Empire. The laws of Malaga and Salpensa, preserved in inscriptions dating from 82 or 83 A.D., are among the most valuable sources of our knowledge of Roman municipal law.

2. *Visigothic Period.*—A new and important element was introduced in the fifth century by the Germanic conquest of the peninsula. In the Visigothic Kingdom, which existed until 711, the conquered Roman population retained for nearly two centuries their own law in matters that concerned themselves only. A special compilation of Roman law, the so-called Breviary of Alaric (q.v.), was drawn up for their use 506 A.D. From the name of the royal official who attested the copies of this compilation it is generally described in Spanish legal literature as the Breviary of Anianus. The Visigothic conquerors, however, lived by their own customs and laws, and to these, in case of conflict, the Roman law gave way. Their law also was put in written form. The so-called Lex Antiqua Visigothorum (palimpsest in the Bibliothèque Nationale, Paris) is ascribed by some authorities to King Euric (466–c.485 A.D.), by others to King Leovigild or to King Reccared, a century later. The written law of the Visigoths was developed from reign to reign, with an increasing infusion of

Roman law, civil and ecclesiastical. The assemblies which approved these laws were practically Church councils; they consisted wholly or chiefly of prelates. About the middle of the seventh century the Breviary of Alaric was deprived of legal authority, and the Romanized Lex Visigothorum became the general law of the peninsula. The form in which this code has come down to us is practically that which it received in the reign of King Reccessuinth (649–672). In the eighth and following centuries the Visigothic code was frequently described as the Liber Judicum, or Forum Judicum, or (in the vernacular) Fuero Juzgo. To the Visigothic period belongs a Spanish collection of council decrees and papal decretals, the so-called Hispana, which was much used in western Europe and became one of the most important sources of the canon law (q.v.).

3. *Mediæval Period.*—The Moorish conquest and occupation of the peninsula (711–1492 A.D.) left few permanent traces upon Spanish law. The Christians who lived under Mohammedan rule retained not only their religion, but, in matters concerning themselves alone, their laws also. This was the case even with the so-called Mozarabs, who accepted the speech of the conquerors, as is shown by the existence of an Arabic translation of the Hispana and by Arabic notes on the Visigothic code. As the peninsula was gradually reconquered by the Christian states of northern Spain the Moors who remained enjoyed similar privileges, but the general expulsion of the Moriscos (1609–14 A.D.) left Catholic Christianity and Gothic-Roman law in complete dominion. In Christian Spain, however, as in other parts of Europe, the development of the law during the Middle Ages was particularistic. The Visigothic code remained, in theory, applicable, but its rules were superseded by local, provincial, and class customs and laws (fueros, q.v.). The Spanish cities obtained charters of self-government (cartas pueblas) and developed independent city laws earlier than in the cities in the rest of Europe. The earliest town law that has come down to us is that of León (1020). At the close of the fourteenth century there was scarcely a town of any consequence that had not its own fuero. In the open country the tenants and serfs of the crown, of the Church, and of the nobles lived by different manorial customs. The earliest fueros of provinces or kingdoms represented the legal customs of the nobles; one of the most interesting of these is the Fuero Viejo of Castile (1212). In the thirteenth century attempts were first made to combine the general rules of provincial and town law in general fueros of the various kingdoms, issued by the kings with the approval of the estates. Such were the Fuero Real (1255) and the Ordenamiento de Alcalá (1348) in Castile; the Fuero de Huesca (1247) and the Observancias (1437) in Aragon; and the Fueros Generales of Navarre (1237) and of Valencia (1239). The revival of the study of the law books of Justinian in the twelfth and following centuries resulted in Spain, as elsewhere, in more or less reception of Roman Imperial law. (See CIVIL LAW.) In Catalonia, Valencia, and Navarre the law books of Justinian, as interpreted by the Italian commentators and taught in the Italian and Spanish universities, were received as subsidiary common law. In Aragon and Castile they were not so received in bulk, but in Aragon the new jurisprudence influenced legislation, and in Castile it produced an essentially Roman code, the celebrated Siete Partidas. In its first form (so-called Spéculo or Setenario) this code dates from 1260, but it did not obtain legal force until 1348. It was to be applied only when the general laws of Castile and the special fueros still in force furnished no rule, but in practice, through the influence exercised upon the courts by the doctrines of the universities, the Partidas to some extent supplanted the purely Spanish sources.

4. *Modern Period.*—The union of Castile and Aragon (1479), the conquest of Granada (1492), and the annexation of Navarre (1512) established the modern Kingdom of Spain. In the new Spain, however, the provinces that had been separate kingdoms retained a considerable degree of autonomy. Each of them kept its separate parliament (Cortes), and in each of them the law was developed by provincial legislation. In each of them compilations of the laws were made from time to time. In Castile the most important legislative products were the Ordinanzas Reales (1485), the Leyes de Toro (1505), the Nueva Recopilación (1567), and the Novísima Recopilación (1805–07). After the parliaments had ceased to play an important part some of the new laws promulgated by the kings were made applicable to all Spain. One penal code was adopted in 1822, another in 1848, another, which is still in force, in 1870. The existing code of criminal procedure dates from 1882. A code of civil procedure was promulgated in 1855 and revised in 1881. In 1885 a commercial code was adopted. The attempts to unify the civil law encountered obstinate resistance because of the attachment of the provinces to their ancient fueros. The law of real property was transformed, early in the century, by the abolition of feudal tenures and of entails, and an important law requiring the registration of conveyances, mortgages, etc., was adopted in 1861 (revised in 1871). Civil marriage was introduced in 1870. In 1888 a general civil code was adopted (revised in 1889), but this code has not given Spain a common law; for, except as regards the law of marriage, it does not derogate from the laws previously in force in Navarre, Aragon, Catalonia, and the Balearic Isles, i.e., it has in these provinces only subsidiary force. In Catalonia the Roman law, civil and canon, is still subsidiary law. In the rest of the peninsula, however, the Code of 1888–89 has replaced the older laws.

Spanish Colonies. From the early part of the sixteenth century many laws were issued concerning the colonies. The earliest compilation of these laws was made in Mexico in 1563 by Vasco de Puga. In 1570 was published in Spain a collection of orders in council affecting the colonies, and a fuller collection was made early in the seventeenth century. In 1680 a code of colonial laws was published—Recopilación de las Leyes de las Indias. (This was repeatedly revised, the last edition dating from 1841.) This code dealt chiefly with administrative matters, to some extent with crimes and penalties, hardly at all with private law. In matters not covered by special colonial legislation the laws of Castile had been applied from the beginning, and this practice was expressly sanctioned in the Laws of the Indes, II, i, 2 and II, xv, 66. In the early part of the nineteenth century (1810–26) all the Spanish colonies of Central and South America achieved their independence. These republics have adopted codes of their own. The earliest Spanish American civil code was that of Bolivia

(1831). The most important is that of Chile, which has served as a model for several other Central and South American codes. All these codes, like the Spanish Code of 1888–89, show the influence of the Code Napoléon. (See CODE.) In Cuba, Porto Rico, and the Philippines the Spanish codes of the nineteenth century are still in force.

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SPANISH LITERATURE (called also Castilian literature, since the dialect of Castile is the dominant and literary speech of Spain). Literature in the Spanish tongue began only when the process of reconquest restored to the Christian Spaniards a considerable portion of their ancestral domain. This first literature was epic, reflecting the warlike spirit of an heroic age. Very little of the Old Spanish epic poetry has been preserved to us in anything like its original form. The only considerable remains are some poems on the Cid (of which one, the *Poema del Cid*, dating from 1140, is the oldest extant monument of Spanish literature), some fragments of a poem or of poems on the Infantes of Lara, and a learned poem on Fernán González. But allusions and records in the Chronicles and elsewhere lead us to believe that there once existed many epics now lost. According to the recent investigations of Menéndez Pidal, we must abandon the theory of Gaston Paris, that the Spanish epic is derived from the French, and accept in its stead a development parallel to that of the French. It was quite natural that the French tales dealing with Charlemagne's wars against the Spanish Arabs should impress the Spaniards, and it was equally natural that the Spanish *juglares* should seek to make native heroism play some part in the conflicts with the Moors. This they did by inventing the figure of Bernardo del Carpio to supplant the French hero Roland. The traditions concerning Bernardo are preserved for us only in the *romanceros* and in the prose accounts of the Chronicles, especially the *Crónica general* of Alfonso the Wise; but the Chronicles drew upon the poems of the *juglares* for the matter that they contain.

We come to a thoroughly domestic tradition in the story of Fernán González, Count of Castile (932–970), with whom began the actual though not the nominal independence of that region. An extended poetic account of his active life we owe to a monk of the monastery of San Pedro de Arlanza. This work was written in 1250 or shortly thereafter, but we now possess it only in a manuscript of the late fifteenth century, which is incomplete, and in a few short manuscript fragments. The *Crónica general*, however, affords us the substance of what must have been the second part of the poem. A purely Spanish tradition is found again in the tragic story of the seven Infantes of Lara (or Salas), done to death through the perfidy of their uncle and aunt and later avenged by their Moorish half brother, Mudarra. Here, also, the legend is preserved in various reworkings of the *Crónica general*, which has, in this case, absorbed many verses of the Old Spanish poems on the subject without wholly obliterating their assonance and metre. Careful and dextrous studies by Menéndez Pidal have reconstructed for us about 300 lines of the primitive epic, *Gesta de los Infantes de Lara*, which has a strange and naïve beauty and energy. By similar studies Puyol y Alonso has unearthed from the *Crónica del Cid* a *Cantar de gesta de Don Sancho II de Castilla*, whose primitive form may well belong to the eleventh century. By good fortune we still possess two of the Old Spanish poems dealing with the story of the doughtiest of all the native heroes, the Cid (q.v.), an historical personage of the eleventh century. The *Poema del Cid* has survived in but a single and incomplete manuscript of the fourteenth century, and besides its versification is in an exceedingly irregular state. There are three main divisions (or *cantares*): the first begins with Rodrigo's exile from Castile and ends with the capture of the Count of Barcelona (vs. 1–1086); the second carries the account (vs. 1087–2277) through the conquest of Valencia and the marriage of his two daughters to the historical Infantes of Carrión (who were long considered as fictitious characters); while in the third (*La afrenta de corpes*) the necessity of punishing the Infantes for their abuse and desertion of their spouses brings the Cid to the court of Castile and affords an opportunity for completely reconciling him and his liege lord. The poem ends with a second marriage of the Cid's daughters, who, now wedding the princes of Barcelona and Navarra, make the Cid an ancestor of the later royal house of Spain. Other works of importance in this anonymous age are the *Disputa del alma y el cuerpo*, *La vida de Santa María Egipciaqua*, *Libro de los tres reyes dorient*, *Libro* *de Apollonio*, and *Razon de amor con los denuestos del agua y vino*, all of the early thirteenth century. An imaginative account of the Cid's youth is found in the poem termed the *Crónica rimada* (which might better be called the *Cantar de Rodrigo*), a document of the fourteenth century which has survived only in a fifteenth-century reworking. It relates particularly Rodrigo's slaying of the Count of Gormaz and the marriage of the youthful slayer to the Count's daughter, Ximena.

Much greater than the bulk of the heroic poetry preserved is that of Old Spanish religious, didactic, and narrative verse. Of this the oldest monument that has come down to us is the liturgical drama *El auto de los reyes magos*. Some scholars claim that it appeared as early as 1120, and in any case it seems certain that it belongs not very late in the twelfth century and that consequently it is probably the oldest drama that has survived in any modern literature. The greater part of this early verse, however, is in the form of monorhymed quatrains called *cuaderna vía* and often mistaken for Alexandrines. There is no knowledge of the existence of this learned poetry before the thirteenth century, but in the first half of that period it is found fully developed in the works of the cleric Gonzalo de Berceo, who is the first Spanish poet that we know by name. He flourished in the first half of the thirteenth century. Most of his productions deal with religious subjects. There is now attributed to him furthermore a long poem dealing with profane matter, the *Libro de Alexandre*, which relates in some 2500 stanzas the life of Alexander the Great. The assignment to Berceo is, however, far from proven.

Spanish prose, at first clumsy and labored, earliest appeared in the *Diez mandamientos* (early thirteenth century) and in law codes (*Fuero Juzgo*, 1241, and *Siete Partidas*, 1256–63) and official documents. The first use of Spanish prose for chronicle purposes is seen in the two *Anales Toledanos* put together before 1250. Alfonso X the Wise (?1220–84) wrote, or had written under his direction, many works dealing with the science of the time. Great value attaches to the so-called *Crónica general*. As early as 1251 he had caused to be made the translation of the celebrated Arabic book *Kalila et Digna*. Thanks to this many-sided interest and encouragement from the King, moralizing works and collections of sententious sayings drawn from Arabic sources or written in imitation of them became rife both in Alfonso's time and in the ensuing period. One of the Arabic moral anthologies thus introduced into Spanish was the very popular *Bocados de oro*, which lived on in the poetical aphorisms of Sem Tob and Santillana.

Sancho IV (1284–95), the successor of Alfonso X, inherited his father's love for letters, and by his direction there were prepared translations from Latin, French, and Provençal, e.g., *Li livres du Tresor* of Brunetto Latini. The interesting translation, the *Gran conquista de ultramar*, dealing with the Crusades and preserving the substance of French literary monuments now lost, was long attributed to this reign. It now seems probable that it was begun at a later period. According to the researches of Foulché-Delbosc and Groussac it seems likely that we shall have to deny to Sancho IV the credit of having written the *Castigos e documentos*, which is an adaptation of a fourteenth-century Castilian translation of Egidio Colonna's *De Regimine Principum* (written c.1284). The translations that were made, however, show a broadening interest in foreign literature, further exemplified in an early fourteenth-century version of the prose *Tristan*. To the extreme end of the reign of Sancho IV we must probably credit the beginning of the first independent example of Spanish prose fiction, the *Caballero Cifar*, which gives us our first sketch of the knight-errant and of the *pícaro*, the chivalresque and picaresque types in which Spain was to excel. If indeed the original version of the celebrated *Amadis de Gaula* were Spanish (and the oldest version and the oldest references to it, that we know, are Spanish), it too must probably be assigned to the end of this reign.

Literature was not especially favored by Sancho's immediate successor, but a monarch of intellectual force appeared again in Alfonso XI (1312–50). The most important of the works which were prepared under his direction was a series of chronicles that should close the gap between his own time and the period with which the *Crónica general* of Alfonso X ended, a work which formed the basis of the *Poema de Alfonso XI*. Don Juan Manuel (1282–1348), a nephew of Alfonso X, played a more direct part in the development of letters at this time, being, like his uncle, one of the greatest prose writers in early Spanish literature. The great prose that had been developed for didactic and historical uses he turned to the service of creative didactic literature. The most interesting and important of his many treatises is the famous framework of tales called the *Conde Lucanor* or *Libro de Patronio*. The contents of the 51 tales comprise historical or pseudohistorical elements relating to Spain, matters of personal experience, Arabic traditions, besides elements drawn from Phædrus, the *Kalila et Digna*, the Barlaam story, and above all the general European stock of stories; and all are told in an original and unpretentious style.

The poetry of this reign includes a modest and successful imitation of the *cuaderna vía*—*Poema de Yuçuf* or *Poema de José*. (See JOSE, POEMA DE.) Poetry also gives us the most important literary personage of the reign, Juan Ruiz (q.v.), who in the *Cantares* recounts his erotic adventures, interspersing here and there fables, accounts of his disputes with Love and of a lesson given him by Venus, wife of Love, etc.

With the middle of the fourteenth century an artificial form of the lyric continuing the tradition of the troubadour poetry of Galicia and called court poetry—because it was mainly cultivated by versifiers attached to the royal court—began to take the place of importance formerly occupied by epic, religious, and didactic verse. There was a transition period of some duration, however, so that the greatest development of the Provençalized lyric did not come until the reign of John II (1405–54), and then there flourished by its side a humanistic literature bearing the impress of the Renaissance movement and an allegorical poetry that derived from the works of Dante and other Italian poets. Representative works of many of this brilliant galaxy are to be found in the *Cancionero de Baena*. The literary movement of the court of John II was continued outside of Spain by the poets who, in the suite of Alfonso V of Aragon (1385–1458), flocked to Naples. As time went on the Provençal Galician court poetry passed out of vogue, and the lyric measures of Italy became predominant everywhere throughout Spain. Spanish prose, already given considerable flexibility by Alfonso the Wise and Juan Manuel, becomes in the second half of the fourteenth century the medium of translation from the classics of antiquity and, even more than the verse of this time, teems with Latinisms. Much more attractive than the verse already mentioned is the epic ballad (*romance*), which was much cultivated from the beginning of the fifteenth century, and of which Spain has a richer literature than any other country except the British Isles. Here and there, too, may be found examples of a charming popular lyric.

Pedro López de Ayala (q.v.) (1332–1407), who held important offices at the courts of King Pedro the Cruel and of Henry of Trastamara, was one of the last writers of his time to make any large use of the *cuaderna vía*. This form prevails in his satirical and didactic *Rimado de palacio*, in which he assails the social, political, and other abuses of his time. In the second part of the poem he inserts, here and there, plaints, laments, and songs to the Virgin, which are lyric in their nature and are composed in various measures. During the reign of Pedro the Cruel the Rabbi Santo of Carrión (written also Santob and Sem Tob) prepared his *Proverbios morales*. This collection constitutes one of the most important Hebrew contributions to Spanish literature, and it introduces a genre which is later to be attempted by such writers as Santillana and Pérez de Guzmán. Seriousness of purpose, lacking in the court poetry, is present in the Dantesque allegory and vision introduced into Spain, soon after 1400, by Imperial, a native of Seville, but of Genoese origin.

The moralizing tendency is also visible in the *Doctrina* of Pedro de Veragua and especially in the noted *Danza de la muerte* (Dance of Death), which seems to be a work of the middle of the fifteenth century and is much more dramatic than the corresponding French work, the *Danse Macabre*. The highest point reached by culture in the reign of John II (q.v.) (1405–54) is seen in the literary works of Santillana, Fernán Pérez de Guzmán, Mena, and Rodríguez de la Cámara, or del Padrón. To Fernán Pérez we owe the *Claros varones de España* (a panegyric in verse), versified *Proverbios*, and allegorical and lyrical poems, besides historical works in prose, and especially his great *Generaciones y Semblanzas*. Rodríguez has left us ballads and a little verse in the conventional court manner, besides a prose tale, *El siervo libre de amor*. Iñigo López de Mendoza, Marquis of Santillana (q.v.) (1398–1458), is probably the most impressive literary figure of the fifteenth century. He was one of the first in Spain to imitate Horace, he imported the sonnet from Italy, and he furthered the influence of Dante by copying the latter's allegorical methods in his *Comedieta de Ponza*, his *Coronación de Mossén Jordi*, and his *Infierno de los enamorados*. In certain other poems he displays a didactic and a satirical bent, as in his *Proverbios*, his *Diálogo de Bías contra fortuna*, and his *Dotrinal de privados*. The most interesting and certainly the most entertaining element of his poetical work is that represented by his pastoral love songs, such as the *serranillas*. In prose he himself prepared a *Carta al Condestable de Portugal*, a work of extreme interest and value, in which he appears as the first true historian of Spanish literature. The influence of Dante, as well as that of Lucan, is obvious in the allegorical *Laberinto de fortuna* (also called the *Trecientas*, from the original number of its stanzas) of Juan de Mena (q.v.) (1411–56), and to him are due likewise a poetical eulogy of Santillana, entitled *La coronación*, and the moralizing *Coplas de los siete pecados mortales*.

During the reign of Henry IV (1454–74) there appeared no slight amount of political satire, among the chief instances being the *Coplas de Mingo Revulgo*. Of ballads (*romances*), as has already been said, Spain was exceedingly productive; in broadsheets or in collections (*romanceros*) there were published during the final years of the fifteenth century and during the sixteenth century a very large number dealing with subjects drawn from the real or legendary history of Spain and of France, etc., as well as with subjects chivalrous and erotic. Among the poets of this period Antón de Montoro (?1404–80) occupies a special place by reason of his origin and position (he was a converted Jew and a tailor) and his witty indecency and irony. Oddly enough one of his admirers was a knight of Madrid, Juan Alvarez Gato (?1430–96), who was himself a graceful versifier of the utmost circumspection. His love songs show a nobility of sentiment rare in his day. Pero Guillén de Segovia (1413–?74) is at present known only by his dignified *Salmos penitenciales*, since his other poems (of which there are scarcely 30) are only now being collected and edited. The greatest poets of the reign of Henry IV, however, are Gómez Manrique (?1415–?90) and Jorge Manrique (?1440–79). The former not only is a graceful lyric poet, but occupies an important position in the development of the early drama, since two of his pieces must be counted as among our earliest specimens of the religious drama, and two others take a similar position for the secular drama; the latter is remembered for his noble *Coplas* on the death of his father, which will assure him of renown as long as Castilian literature endures. They have been exquisitely done into English verse by Longfellow.

In Spanish prose of the fifteenth century the humanistic work already begun in Italy was zealously carried on. There was much translation of the classics of antiquity and of the modern Latin writings of Boccaccio and others. Ecclesiastical Latin authors also received some share of attention, and works were introduced from the French, Catalan, and Italian, those of Boccaccio being particularly popular for translation purposes. The influence of all these translations—and especially those from Plutarch, Livy, and Valerius Maximus—manifested itself in the development given to the writing of history. López de Ayala had already continued the official chronicle of the realm (*Crónicas de los reyes de Castilla*); Alvar García de Santa María (died 1460) and Diego de Valera (?1412–87) worked upon the *Crónica del rey Juan II*, and the latter worked on the *Crónica de España* (1482) and the *Memorial de Hazañas;* Diego Enríquez del Castillo (fl. 1467) wrote the *Crónica de Enrique IV;* and Hernando del Pulgar (?1436–?93) and Andrés Bernáldez (fl. 1488–1513) prepared accounts of the reign of Ferdinand and Isabella. There also appeared a multitude of chronicles dealing with the lives of individual personages. No little interest attaches to the *Crónica Sarrazina* (c.1443) of Pedro de Corral, which gives the whole legendary history of Roderick the Goth. We should remember too that Alonso de Palencia (1423–92), by writing his *Crónica de Enrique IV* in Latin, deprived himself of the position in Spanish prose to which his talents made him eligible.

In French stories of a pseudohistorical nature the Spaniards had very early begun to take a serious interest, and these stories, particularly those treating the *matière de Bretagne*, were to play an important part in connection with the development of prose fiction in Spain. The court poetry of the reign of John II (first half of the fifteenth century) is full of references to Arthur and his knights of the Round Table, to Merlin, and to the Quest of the Holy Grail. Charlemagne and Roland are still named along with the heroes of the Round Table, but they obviously have no longer the same living interest.

With the *Caballero Cifar*, of the last half of the thirteenth century, we saw the first independent work of fiction in Spain, and this was followed, probably only a little later, by one of the most famous of all modern romances, the *Amadis de Gaula*. (See AMADIS OF GAUL.) This important work, which is probably *not* Spanish in its original form (see VASCO DE LOBEIRA), may lay claim to no small amount of originality; it accepts the elements at the basis of the French courtly romance, but it develops them in its own way, for, though retaining the traditional service of woman and quest of adventure, it stresses the virtuous qualities of the hero no less than his courtliness, something that the French romances had not done. In the form in which we possess it the *Amadis* is due to Garcí Ordóñez de Montalvo (q.v.), who completed his redaction of it between 1492 and 1504 and published in 1508 the earliest version that we have. It consists of four books. The *Amadis* was the forerunner of many similar romances which enjoyed enormous vogue in the sixteenth century. For many years these chivalresque novels were thought to be wild exaggerations. As we become more familiar with the *Passo honroso de Suero de Quiñones* (which is the detailed account of an entire tourney, written by Pero Rodríguez de Lena, who was an eyewitness of the event, which occurred in 1434) we begin to realize that in most cases the chivalresque novels are only pale reflexes of what actually was the usual happening, and that in few respects do they go beyond the reality.

In imitation of Boccaccio's *Fiammetta*, which had been translated about the middle of the fifteenth century, the tale was now attempted in Spain; noteworthy instances are Rodríguez del Padrón's *Siervo libre de amor* and *El cárcel de amor* of Diego de San Pedro. Novelistic and didactic in its manner is the *Trabajos de Hércules* of Enrique de Villena (1384–1434). One of the most original and entertaining works of the whole period appeared in 1438; this is a satire on womankind by Alfonso Martínez de Toledo, chaplain to John II and archpriest of Talavera (?1398–?1470), entitled *De los vicios de las malas mujeres*, but also called the *Corbacho*. For the other side of the picture one should read the *Libro de las claras e virtuosas mugeres* (1446) of Alvaro de Luna (q.v.) (?1385–1453). Of decided interest for the study of folklore are the Hebrew-Spanish and the *aljamía* documents, in which the Jews and the Moors, writing in Spanish, but using respectively their Hebrew and Arabic characters, created a rather considerable literature of their own. Many of the documents in question belong to the fifteenth century, and especially the most important of them all, the previously mentioned *Poema de José*, which gives a Mohammedan version of the story of Joseph.

The sixteenth century ushers in the classic age of Spanish letters, that period which extends into the second half of the seventeenth century and is generally known as the golden age. The influence of Italy and the Renaissance, which had been so strong during the preceding century, persists, but, contrary to what happened in other European lands, it does not tend to bring about any dissolution of continuity as between the old and the new. The ancient Church remains unaffected, and the humanistic paganism of the Renaissance gets no foothold in Spain. In lyric verse Italian forms prevail, but the subject matter is only partially affected by influences from without. A realistic movement, marked by a strict application of keen powers of observation, guides the development of the novel, which is perfected by Cervantes in the reign of Philip II. The ballad continues to be a favorite form, and it contributes to the rise of the drama. The drama, giving fullest expression to the national and religious ideals of the Spaniard, constitutes the greatest glory of the golden age.

Already in the fifteenth century Santillana had imitated the structure of the Italian sonnet, but in this innovation he had had no followers; it remained for the Catalan Boscán (q.v.) (c.1490–1542) to establish Italian verse methods in Castilian. A better poet than Boscán is his friend and companion in the work of innovation, Garcí Laso de la Vega (q.v.) (1503–36). Petrarch is the chief model of the lyric poet, but so far as content is concerned, the love lyric of Petrarch did not differ very materially from that already cultivated by the Spaniard; the real innovation was a formal one. Moreover the older Castilian measures were not cast aside; even those who favored most warmly the use of the imported forms continued to employ the domestic forms. A third leading representative of the movement was Diego Hurtado de Mendoza (1503–75); elements of refinement still lacking in the art of the three poets mentioned were added by writers such as Fernando de Acuña (c.1500–c.1580), Gutierre de Cetina (?1518–57), and the Portuguese Gregorio Silvestre (1520–69). In the second half of the sixteenth century the followers of Garcí Laso formed two main groups, the school of Seville and the coterie at Salamanca; minor groups were those at Granada and in Valencia and Aragon. The head of the school at Seville was Fernando de Herrera (?1534–97), who is noted both for the purity of his style and the richness of his diction, best exhibited, perhaps, in his hymns on the battle of Lepanto and on the tragic fate of the Portuguese King, Dom Sebastian. The most important member of the Salmantine group was the charming poet Luís de León (?1528–91), whose religious and mystic strains have never ceased to please. Allied to him in spirit are the other mystic poets San Juan de la Cruz (1542–91) and Malón de Chaide (?1530–96). The religious lyric may be seen at its best in the *Romancero espiritual* of Valdivielso (died 1638) and in the *Rimas sacras* of Lope de Vega; its vogue began to decrease when that of the conceptism of Ledesma and his fellows began to grow. An overstressing of the importance of the formal side of things and an undue straining of the means necessary to the attainment of perfection of style led, in the early years of the seventeenth century, to the adoption of the kind of lyric mannerism which is known in Spain as *culteranismo*, and which is paralleled by the Marinism of Italy, by the euphuism of England, and by the préciosité of France. Luís de Góngora (1561-1627) was the founder of this artificial style, which is therefore often called Gongorism. Its characteristics of bombast, obscurity, and general extravagance are fully exhibited in the so-called *Soledades* of Góngora. Even contemporaries of so high an order of talent as Lope de Vega and Francisco Gómez de Quevedo (1580-1645), who at first opposed the Gongoristic movement, later adopted many of its methods. As a poet Quevedo was most successful in his satires, which are full of the spirit of Juvenal. The lyric poets of the seventeenth century were legion: Mira de Amescua (q.v.) (?1578-1644), Estéban Manuel de Villegas (1589-1669), Salvador Jacinto Polo de Medina (fl. 1636), Francisco de Borja, Príncipe de Esquilache (1581-1658), and the dramatist Calderón were but a few of them. With the facilities now provided by the printing press it became possible to make extensive collections of the ballads (*romances*), which, previous to the end of the fifteenth century, seem to have survived only through oral tradition.

There appeared during the *siglo de oro* more than 200 poems belonging to the category of the artificial epic. Of these the most important deal with subjects appertaining to the national history; many treat religious matters, and many others are of the class of the chivalrous epic. They are mainly written in octaves, only occasionally in blank verse (*versos sueltos*). Chief among the epics of an historical character is the *Araucana* of Alonso de Ercilla y Zúñiga (q.v.) (1533-94), written by a soldier who here gives the results of his experience in the wars of the Spaniards with the Araucanian Indians. The historical value is still of a high degree in the *Elegías de varones ilustres de las Indias* (first part printed 1589) of Juan de Castellanos (q.v.) (1522-?1607) and the *Argentina* of Barco Centenera. The imagination plays a larger part than the historical fact in the *Austríada* of Juan Rufo (1547-c.1600). In the period of greatest dramatic productivity the historical epic gradually wanes in importance; the *Nápoles recuperada* of Francisco de Borja (1651) is one of the last. A place apart is occupied by the *Amantes de Teruel* (1616) of Juan Yagüe de Salas, which the author pretended to be an historical account of the tragic fate of the famous lovers. The Vergilian epic was made known to many by the *Eneida* of Hernández de Velasco (1557); after the appearance of Boscán's *Fábula de Leandro y Hero* mythological episodes from classic antiquity were made the theme of poems by Hurtado de Mendoza, Lope de Vega, Montemayor, Góngora, etc. The Italian epic of the *Cinquecento* was transplanted to Spain and was made the subject, not only of verse translations, but also of amplifications and continuations, some of these latter dealing with Spanish history or legend. A religious epic deserving of note is Azevedo's *Creación del mundo* (1615), being remarkable in that, imitating the *Semaine* of Du Bartas, it shows a resumption of literary relations with France. The mock heroic of Greece and Italy finds an echo in Juan de la Cueva's *Batalla de ranas y ratones*, Villaviciosa's *Mosquea* (1615), and Lope de Vega's *Gatomaquía*.

The tendency to fill Spanish prose with Latinisms, so strong in the preceding period, now yields to a feeling which finds a native dignity in the mother tongue. Juan de Valdés, in his *Diálogo de la lengua* (c.1535), initiated the scientific study of the grammatical and stylistic peculiarities of Castilian. Comparative perfection of form is attained in Mariana's (q.v.) (?1535-1624) *Historia de España* (1601, etc.), the first thoroughly good account of Castilian history based on the study of documents. In his *Agudeza y arte de ingenio* Baltasar Gracián (1601-58) gave the law book of that system of literary mannerisms termed conceptism; he also got the attention of contemporaries and posterity by his aphoristic and sententious sayings of various kinds. Religious literature of a mystic and ascetic nature must occupy an important place in the annals of the time; it is best represented by the writings of Luís de León (q.v.) (?1528-91), San Juan de la Cruz (St. John of the Cross) (1542-91), Malón de Chaide (?1530-?1596), Luís de Granada (?1504-88), and Santa Teresa de Jesús (St. Theresa) (1505-82).

Preceding the period of activity of Cervantes we have the continuation of the chivalric novel, the pastoral novel, the narrative form as exhibited in the *Celestina*, and the earliest of the picaresque novels. Of the posterity of the *Amadís*, the unsurpassable type of the romance of chivalry, are a number of continuations dealing with the adventures of Florisando, Lisuarte of Greece, Perión of Wales, Amadis of Greece, and similar heroes. Hardly less a favorite than the *Amadís* was an imitation of it entitled *Palmerín de Oliva* (1511), which in its turn was made the subject of other continuations and imitations. The books of chivalry prepared the way for the pastoral romance, introduced into Spanish by Jorge de Montemayor (q.v.) (?1520-61), who founded his *Diana* on the *Arcadia* of the Italian Sannazaro. For contemporaries a good deal of the interest in the *Diana* and its kindred depended upon the personal allusions conveyed by the characters and in the dialogue. The *Tragicomedia de Calisto y Melibea* (later termed the *Celestina*) was published at Burgos in 1499 (the first edition we know, although probably not the first edition) and appeared in an amplified form at Salamanca in 1502. Although it is called a tragicomedy, it cannot in its present form have ever been capable of scenic representation, and it is certainly more a novel than a play. On account of its spirited action and of the development which the *Celestina* gave to the handling of dialogue and the delineation of character, it exerted an influence upon both later dramatists and novelists. It soon provoked continuations and imitations, and a connection may even be traced out between it and the *Dorotea* of Lope de Vega. The realistic tendencies evinced in the *Celestina* are equally pronounced in the first of the picaresque novels, the anonymous *Lazarillo de Tormes* (1554), long ascribed to Diego Hurtado de Mendoza, although that ascription is to-day doubted. In this novel we follow the career of a rogue (*pícaro*), who, beginning as the guide (*lazarillo*) of a blind beggar, deceives him and, passing into the service of other personages representing various ranks of life, shows himself no less ready to beguile them. There is no attempt at palliation of the truth; it is a picture of the bald and iniquitous fact that is presented to us in the *Lazarillo* and its successors. Two other highly successful books in this genre were the *Guzmán de Alfarache* (1599) of Mateo Alemán (1547–?1614) and Quevedo's *Vida del Buscón*, often called *El Gran Tacaño* (1626).

Realistic fiction of the *siglo de oro* culminates in the magnificent *Don Quijote* of Miguel Cervantes de Saavedra (q.v.) (1547–1616), a novel in which the matter-of-fact philosophy of Sancho Panza stands in sharp contrast with the grotesque idealism of his master. It is not improbable that Cervantes wrote the book in order to destroy the vogue of the chivalrous romances, although it may be urged that their popularity was already on the wane and that at the most he simply gave them the *coup de grâce*. *Don Quijote* (usually *Don Quixote* in English) has become one of the world's imperishable books. The first part of it was published in 1605; the second part was hurriedly prepared for the press in 1615, in order to baffle the designs of a certain Avellaneda, who had published a spurious sequel to the novel in 1614. Cervantes had much less success in another novel, the *Persiles y Sigismunda* (published posthumously), but that he could handle the shorter tale with skill is proved by his *Novelas ejemplares*. Among those who cultivated the tale after the time of Cervantes were Lope de Vega, Tirso de Molina (in his *Cigarrales de Toledo*, 1624), Montalbán (*Para todos*, 1632), María de Zayas, Solórzano, Salas Barbadillo, and Luís Vélez de Guevara (with his famous *Diablo cojuelo*, 1641, the source of Lesage's *Diable boiteux*). Quevedo (q.v.) (1580–1645) was the foremost of the prose satirists of the age; in his witty and sarcastic *Sueños*, *cartas del caballero de la tenaza*, etc., he cries out against abuses with which bitter personal experience had made him acquainted.

As a literary form the drama had been practically unrepresented since the end of the twelfth century, but now, at the end of the fifteenth century, it was to revive and receive an unsurpassed development. Except for the three or four halting efforts made by Santillana, Gómez Manrique, and others, Juan del Encina (c.1468–1534) begins the new order. Encina spent some years in Italy; hence an Italian influence on his work is not improbable. The comic elements in some of the pieces may show an influence of the French farce. Disciples of Encina were Lucas Fernández, who employs the terms *farsa* and *comedia*, the Portuguese Gil Vicente, and Torres Naharro (q.v.) (died ?1531), whose art shows considerable progress over that of the master. In his plays we meet for the first time with a division into acts. The pieces of the foregoing authors were intended for the refined audiences of the court; those of Diego Sánchez (c.1530–47) seem to have been meant for performance amid more popular surroundings. Italian influence is unmistakable in the *comedias* of Lope de Rueda, an actor (?1510–65), famed for his short and witty *pasos* or *entremeses*. The Latin tragedy is obviously imitated in the first really important Spanish tragedy, the *Numancia* of Cervantes. Avendaño in 1533 first adopts the division into three acts instead of five. Juan de la Cueva (q.v.) (c.1550–c.1609), the first Spanish dramatist to deal with incidents taken from the national history, adopted a division into four acts.

But by common consent there is awarded to Lope de Vega (q.v.) (1562–1635) and to his younger compeer, Pedro Calderón de la Barca (q.v.) (1600–81), supremacy among the many gifted dramatic authors. Inventive beyond conception and amazingly prolific in production, Lope is known to have composed over 1500 plays, irrespective of a number of *autos* (one-act plays of a religious and allegorical nature), *loas* (preludes), and *entremeses* (interludes); of these pieces about 500 are still extant. The number of enduring masterpieces among his plays is remarkably large, especially in the case of his historical dramas, such as *El mejor alcalde el rey* and *Los Tellos de Meneses;* and we even still find hardly less interesting and powerful than they such a play as the *Estrella de Sevilla* and not a few of his *comedias de capa y espada*, or plays dealing with everyday life. Lope's disciples included Mira de Amescua (q.v.) (c.1578–1644), Luís Vélez de Guevara (q.v.) (1579–1644), Montalbán, and Ruíz de Alarcón (q.v.) (died 1639). Alarcón wrote the comedy *La verdad sospechosa*, the model of Corneille's *Menteur*. In talent Lope was most nearly approached by the cleric Gabriel Téllez (q.v.) (1571–1648; known also by the pseudonym Tirso de Molina). Nor should we omit the product of the Valencian school, so called, and especially Guillén de Castro (1569–1631) with his *Mocedades del Cid*, which served Corneille as basis for his *Le Cid*.

After Lope's death Calderón reigned on the stage. Though less inventive, Calderón paid more attention to details of form, simplifying somewhat the multitudinous metrical forms in use in the drama. In philosophic insight he was inferior to Lope, yet in *La vida es sueño* (Life is a Dream) he cannot really be deemed unsuccessful in his endeavor to give dramatic reality to one of the most transcendental of ideas. He first gave great importance on the boards to the *pundonor* (the point of honor) as an actuating impulse of the Spaniard's life, and he gave its greatest development to the stock figure of the *gracioso*, or clown. He devoted no little attention to the type of religious play called the *auto sacramental*. Of his followers two were men of distinguished talents: Francisco de Rojas Zorrilla (1607–c.1660), who produced the excellent play, *Del rey abajo ninguno*, and Agustín Moreto (c.1618–69), to whom we owe *El desdén con el desdén*.

Swift and deep was the decline in Spanish letters that followed the *siglo de oro*, and it went hand in hand with a decay in things national and political, which the advent of the French Bourbon house to the throne could do little to check. By the opening years of the eighteenth century Gongorism had thoroughly vitiated lyric verse, the novel had become unimportant, and the stage was controlled by dull or absurdly fantastic imitators of the older national drama. Not a single Spanish writer of the first order made his appearance during the first three decades of the eighteenth century, and during that period the only event of importance was the establishment in 1714 of the Spanish Academy (La Real Academia Española), whose dictionary, which appeared in six large volumes in 1726–39, was so fine a piece of work that, despite its obvious defects, there was no dictionary in any language of Europe to compare with it. With the fourth decade came a new movement, the chief object of which was to chasten popular taste by the introduction of foreign æsthetic canons, particularly those of France. The impulse to the new movement was given by Ignacio de Luzán (q.v.) (1702–54), a man of great talent and greater culture, who set forth in his *Poética*

(1737) the principles that ought to govern poetic production. Luzán preached that the various literary genres should not be intermingled and that the Spanish drama should be subjected to the French system of unities. The doctrines which he thus laid down were taken up and applied by his disciples Nasarre (1689–1751), Montiano (1699–1764), the author of two tragedies (*Virginia* and *Ataulfo*), and by Luís Josef Velázquez (1722–72), in his *Orígenes de la poesía castellana* (1754), which can more profitably be consulted in the enlarged translation (1769) by Johann Andreas Dieze. In his *Teatro crítico* (1726–39) and in his *Cartas eruditas y curiosas* (1742–60) Benito Feyjóo y Montenegro (q.v.) (1676–1764) first made known to a large part of the Spanish nation many of the scientific developments and discoveries of the age. José Francisco de Isla (1703–81), in his amusing though rather long-winded novel, *Historia del famoso predicador, Fray Gerundio de Campazas* (1758), ridiculed unmercifully the extravagance, ignorance, and pedantry that characterized most of the pulpit eloquence of his time. Isla is also famous for his attempt to appropriate to Spanish literature the *Gil Blas* of Lesage, his own translation appearing posthumously (1783).

A party headed by Vicente García de la Huerta (q.v.) (1734–87) strove, but ineffectually, to curb the growing tendency to imitate French models. On the other hand the followers of Luzán formed (c.1771) a strong school, known as the Salamancan school. The foremost member of this new school was Juan Meléndez Valdés (q.v.) (1754–1817). His little volume of lyrics shows more true poetic sentiment than anything that had preceded them since the days of the masters of the sixteenth and seventeenth centuries. Of considerable merit were José Iglesias (q.v.) (1748–91), best known for his *letrillas;* Cienfuegos (q.v.) (1764–1809), whose lyrics come nearest to those of Meléndez in the expression of genuine feeling; and Diego González (1733–94). It was in the drama that the imported French classicism was to have its real triumph. To be sure, one writer of more than average ability, Ramón de la Cruz (q.v.) (1731–94), still kept alive the traditions of the Spanish stage of the golden age in his humorous little plays called *sainetes*, but he stood alone. It was only natural that men of taste, like Nicolás Fernández Moratín (q.v.) (Moratín the Elder, 1737–80) and the dramatist statesman Jovellanos (q.v.) (1744–1811), should, in their love for moderation and order, seek to elevate the fallen stage by adopting for their own compositions the rigid principles of the French theatre. But neither of these became a favorite with the masses, and it remained for Leandro Fernández de Moratín (q.v.) (1760–1828), the son of Nicolás, to compose dramas governed by the French rules, that could captivate Spanish audiences. Moratín the Younger brings us over the threshold of the nineteenth century; still he belongs properly to the eighteenth century. An enthusiastic admirer of Molière, he both imitated and translated plays of that great dramatist. By means of a happy blending of the spirit of romantic intrigue with the cold precision of French rules he made his masterpiece, the *Sí de las niñas* (1806), obtain at once the popularity that it has never since lost, and that constitutes it the first masterpiece produced for the Spanish stage since the days of Lope and Calderón.

Spanish literature of the nineteenth century begins with the patriotic poets, Manuel José Quintana (q.v.) (1772–1857) and Juan Nicasio Gallego (q.v.) (1777–1853), whose lyrics voice the sentiments of a party sprung up to combat the French invader. Quintana was the Tyrtæus of the struggle against the Napoleonic arms, and he attained his greatest success in the heroic ode (*Al armamento de las provincias contra los Franceses* and *A España después de la revolución de Marzo, 1808*). His friend Gallego is also seen at his best in the burning patriotic lyric (e.g., *El dos de Mayo*), and although the bulk of his verse is slight, he was a good literary artist. The classic influence still dominated Quintana and Gallego and is no less clearly marked in the members of a poetical coterie which rivaled the Salamancan school and may conveniently be termed the Sevillan school. The members of this school, of whom the chief were Manuel María de Arjona (1771–1820), José María Blanco (1775–1841, known in the history of English literature as Blanco White), Alberto Lista (q.v.) (1775–1848), and Félix José Reynoso (1772–1841), sought to reform the prevailing bad taste by setting up the authority of a respectable classic tradition. What little influence they had was favorable to the restoration of a proper æsthetic sense in Spanish literary aims, and they also helped to improve the purely formal side of Spanish verse by developing rhyme and metre.

In the thirties of the nineteenth century the Romantic movement began to appear in the Spanish Peninsula, somewhat belated, indeed, but none the less sweeping in its effects. Two elements contributed to the establishment of romanticism in Spain: (1) the influence of foreign literatures, and (2) the influence of the older national literature, and in particular of the drama of Lope and Calderón and of the *romances*. The Romantic writers whom political considerations did not force to abandon their native region founded, about 1830, a club called the Parnasillo, which, as the Cénacle had done in France, was to herald the new ideas.

In the lyrics of Manuel de Cabanyes (1808–33; *Preludios de mi lira*, 1833), which are chiefly inspired by Luís de León, there is a bare suggestion that if he had lived he would probably have become a Romantic; and a transition stage is distinctly visible in the writings of Martínez de la Rosa (q.v.) (1787 or 89–1862), in the main a man of classic tastes, yet who in two plays, the *Aben-Humeya* (1830) and the *Conjuración de Venecia* (1834), entered into the domain of romanticism. Mariano José de Larra (q.v.) (1809–37), best known as Fígaro, showed similar Romantic tendencies in his novel *El doncel de Don Enrique el Doliente* and in his play *Macías*. The triumph of romanticism was insured by the performance in 1835 of the drama *Don Alvaro* of Angel de Saavedra, third Duke of Rivas (q.v.) (1791–1865), one of the writers whom Ferdinand's tyranny had compelled to seek a refuge in England and France. The Romantic principles to which he gave effect in this work governed also the composition of his lyric *El faro de Malta* and of his epic poem *El Moro expósito*, in the latter of which he revived the Old Spanish legend of the Infantes of Lara. In the person of José de Espronceda (q.v.) (1808–42), the author of the magnificent though fragmentary poem *El diablo mundo* and of the *Estudiante de Salamanca*, there are represented both the Romantic element of revolt against social and literary conventions, which in England is strongly marked in the person of Byron, and that element of Bohemianism which characterizes so many of the French romanticists. Lyric supremacy is disputed with Espronceda by José Zorrilla (q.v.) (1817–93), who is, however, more justly celebrated for his treatment of legendary material from the Spanish Middle Ages than for his purely lyric endeavors. In the drama *Don Juan Tenorio* (which, despite its subject, is annually produced in practically every theatre in Spain for a period of about two weeks at All Hallows) he gives a modern version of the story at the bottom of Tirso de Molina's *Burlador de Sevilla*. The Cuban poetess Gertrudis Gómez de Avellaneda (q.v.) (1814–73), who spent most of her life in Spain and there became famous, had affiliations with the Romantic school. Her lyrics owe no small amount of their inspiration to Chateaubriand, Lamartine, and Hugo; her novels reflect the methods of Dumas the Elder and George Sand. Sentimentalism appears in two well-known dramas, the *Trovador* of Antonio García-Gutiérrez (q.v.) (1813–84), on which Verdi's opera is founded, and the *Amantes de Teruel* of Juan Eugenio Hartzenbusch (q.v.) (1806–80), a play which gave new life to an old Spanish story of true love that did not run smoothly.

The passing of the Romantic movement becomes evident after the beginning of the fifth decade of the century. The fertile playwright Manuel Bretón de los Herreros (q.v.) (1796–1873) had temporary connections with it, but he gained his repute mainly as a writer of lively dramas of manners, although in his masterpiece, the comedy entitled *Escuela del matrimonio* (1852), he paved the way for the coming psychological drama of López de Ayala and Tamayo y Baus. Adelardo López de Ayala (q.v.) (1828 or 29–79) gives us, in his mercilessly sociological play *El tanto por ciento* (1861), a detailed analysis of the modern greed for wealth that has stifled the nobler instincts of man and made him capable of the basest treachery, and in his *Consuelo* (1878) he makes another powerful attack upon the positivism and the lack of idealism in our modern life. The psychological development is also obvious in the work of Manuel Tamayo y Baus (1829–98). In *Lo positivo* (1862) he treats the positivism of the modern world with no less severity than does López de Ayala, and in his chief play, *Un drama nuevo* (1867), which is one of the great plays of the world's literature and a perfect example of the play within a play, he portrays the slowly growing and finally all-pervading power of marital jealousy. Tamayo's successor in popular esteem is the versatile José Echegaray (q.v.) (1832–), the author of *El gran galeoto* and *O locura, ó santidad*, who in 1904 divided a Nobel prize with Mistral.

The particular glory of the second half of the nineteenth century in Spain has been the rise and growth of a new novelistic literature. To the development of this a considerable impetus was given by the essay on manners, which had already been handled with skill by Larra in the first half of the century and was now taken up by Estébanez Calderón (q.v.) (1799–1867) and by Ramón de Mesonero Romanos (q.v.) (1803–82), who has left us excellent descriptions of life in older Madrid. These essayists on manners prepared the way for the tale of manners and the novel of manners (*novela de costumbres*). The former was cultivated, though with no brilliancy, by Antonio de Trueba (q.v.) (?1819–89); the latter was written, in a way to attract attention and applause, by Cecilia Böhl von Faber de Arrom (1796–1877), familiar still by her nom de plume of Fernán Caballero (q.v.). A thoroughly delightful figure appeared in the person of the short-lived story-teller and poet Gustavo Adolfo Bécquer (q.v.) (1836–70). All his work is permeated by the highly subjective qualities that are more common in northern Europe. His tales are all of a legendary cast and are everywhere actuated by the instinct of mystery.

Pedro Antonio de Alarcón (q.v.) (1833–91) is most felicitous in the composition of the short tale of manners or adventure of the type; he is less successful in the more ambitious novel, although the less lengthy among the novels, particularly the *Sombrero de tres picos* and the *Capitán Veneno*, continue to delight and amuse their readers. An incomparably greater artist was Juan Valera y Alcalá Galiano (q.v.) (1824–1905), whom a protracted career in the diplomatic service of his country had made one of the most cosmopolitan and cultured of moderns, with a style which for clarity, precision, and beauty has no equal. In his novels Valera differs from the majority of his contemporaries in that he consciously tends towards idealism, whereas they seek rather to render the living fact. The novel of manners has been raised to a higher level than ever before by José María de Pereda (q.v.) (1833–1906), who in his chief works has portrayed life on the mountains and at the seaside in a way hardly to be excelled for detail and charm of description. The *Don Gonzalo González de la Gonzalera* and the *Sotileza* show Pereda in the fullness of his power; where he leaves the scenes of rustic life and ventures into the city and the fashionable whirl, as in the *Pedro Sánchez*, he is still a master novelist, but he treads on uncertain ground. The work of Benito Pérez Galdós (q.v.) (1845–) from first to last has been marked by tendencies frankly revolutionary. One of the most admirable and important divisions of his labors has been the composition of the collection of novels forming the *Episodios nacionales*, but it is by his psychological novels that Galdós has attracted most attention abroad. At least two other novelists of the first rank must be mentioned here, Armando Palacio Valdés (q.v.) (1853–) and the remarkable woman Emilia Pardo Bazán (q.v.) (1851–). Both have had tendencies towards a naturalism not unlike that which has so profoundly affected the French novel of the second half of the nineteenth century.

In the recent period we meet with only two poets of importance, Ramón de Campoamor y Campoosorio (q.v.) (1817–1901), who will continue to be pleasantly remembered for his philosophical and humoristic *Doloras* and a few descriptive poems, and Núñez de Arce (q.v.) (1834–1903), the virile author of the *Gritos del combate*. The latter has had disciples both at home and in Spanish America, but none of them have displayed superior talent. Criticism has flourished, principally through efforts of Marcelino Menéndez y Pelayo (q.v.) (1856–1912), who in his *Historia de las ideas estéticas en España* (1884–91) has raised a noble monument to the glory of his country and whose two principal pupils, Ramón Menéndez Pidal (q.v.) (1869–) and Adolfo Bonilla y San Martín (q.v.) (1875–), continue his work in the fields of philology and philosophy respectively. Other moderns of note are Luís Coloma (1851–1915), Vicente Blasco Ibáñez (q.v.) (1867–), Jacinto Octavio Picón (1851–), Ramón del Valle-Inclán (1870–), José Martínez Ruíz (1876–), Ricardo León (1877–), Joaquín Dicenta (1860–), Jacinto Benavente (1866–), the brothers Alvarez Quintero (1871– and 1873– respectively), Vicente Medina (1866–), Salvador Rueda (1857–), Juan Menéndez Pidal (q.v.) (1861–1915), Rafael Altamira y Crevea (q.v.) (1861–), and Miguel de Unamuno (1864–).

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SPANISH MACKEREL, or SIERRA. Any of several mackerels of southern waters, especially *Scomberomorus maculatus*, a slender, compressed, fusiform fish, bluish green above, a beautiful satiny white below, with yellowish spots on the back and sides, weighing usually from two to four pounds, although sometimes much larger—a fine food fish. They are natives of tropical seas, but range along the Atlantic coast from Brazil to Cape Cod. A California species of high quality for the table is the Monterey Spanish mackerel (*Scomberomorus concolor*), the male steel blue, without spots on its sides, while the female has dusky cloudings and two series of dark spots along the sides. The Spanish mackerel of England is a typical mackerel, known in the United States as chub mackerel (q.v.). Cf. MACKEREL, and see Plate of MACKERELS.

SPANISH MOSS. See BROMELIA.

SPANISH MUSIC. Spanish music has always been imitative. At first the Netherlands influence predominated. This was followed by a prevalence of Roman style, especially that of Palestrina. The sixteenth century may be regarded as the time when music in Spain was at its height, for then it boasted Morales, whose compositions are still sung at Rome, and Vittoria, the master who most closely resembles Palestrina. With the appearance of Italian opera, Spanish composers not only imitated the Italians, but actually wrote Italian operas. With Wagner's innovations Spain was again ready to adopt the new tendencies. At this juncture the name of Pedrell (q.v.) deserves special mention. The rise of the Spanish drama in the seventeenth century exerted a beneficial influence upon lighter music. The earlier musical dramas of the Florentine school had no overture. Instead, a *madrigal* was sung before the curtain rose. The Spaniards adopted this for purely dramatic representations, so that before long even serious tragedies were preceded by such curtain raisers. These were called *cuatros de empezar*, and were always performed by the women of the company to a harp accompaniment. At first the *cuatros* were choruses for four voices; but with the rise of the monodic style polyphonic writing was abandoned and an action was introduced. When the curtain raisers had been developed so far, they were called *tonadillas*. This custom of beginning all dramatic representations with a *tonadilla* was adopted by the Italians, who called the tonadilla *intermezzo*, and soon developed this latter into the *opera buffa*. (See Intermezzo.) Then the Spaniards again imitated the Italians; and the result was the development of the *tonadilla* into the *zarzuela* (q.v.). This form has always been popular in Spain, and about 1850 Hernando gave it a new impetus. Among composers who devoted their talents to this form, four deserve mention: Oudrid, Gaztambide, Barbieri, and Arrieta.

For originality and characteristic traits we must turn to Spanish folk music. Here we notice that the real folk songs are greatly used as accompaniments to dances. The limitations of the national instrument, the guitar, influenced the melodies and rhythms, rendering the latter more attractive than the former. Of the old folk songs composed in the time of the troubadours a great number have been preserved in literary collections called *cancioneros*, but the music has been lost. The music of the folk songs of the fifteenth and sixteenth centuries, however, has been transcribed from the actual performances of blind singers, who even now wander from town to town. The melodies of Andalusia, which are superior to those of the northern provinces, show undoubted traces of Moorish influences, as noted by the elaborate embellishments of the notes, peculiar intervals foreign to European scales, and a strange combination of distinct rhythms in the parts. For melody and rhythm it is only necessary to mention Bizet (*Carmen*), Massenet (*Le Cid*, *La Navarraise*), Weber (*Oberon*), and Moszkowski (*Boabdil*). The best known Spanish dance forms are the bolero, cachucha, fandango, jota, malagueña, rondeña, and seguidilla, which are accompanied by the guitar and castanets. Consult: M. Soriano-Fuertes, *Música española hasta el año 1850* (Madrid, 1857); Juan F. Riaño, *Critical and Biographical Notes on Early Spanish Music* (London, 1887); A. Soubies, *Histoire de la musique, Espagne* (Paris, 1900). See Music, History of, *XXXIX*.

SPANISH NEEDLES. See Bur-Marigold.

SPANISH PLUM. See Hog Plum.

SPANISH POLITICAL PARTIES. See Political Parties, *Spain;* Spain.

SPANISH REFORMED CHURCH. Spain has always been episcopal in its church government. It was one of the last countries in western Europe to submit to the control of the papacy, and it has preserved old liturgies which prove that it was independent of Rome. From the eleventh century down there is little or no evidence of independence from Rome. The religious wars down through the seventeenth century practically exterminated all non-Roman forms of belief. When the modern Spanish Reformers took up their work, they used at the beginning translations of the English Book of Common Prayer, but they soon realized that if they were to make progress they must have a liturgy of their own. For recognition, they appealed to the Lambeth Conference of 1878, which asked the bishop of the Mexican Reformed church to visit the Spanish Reformers and report. It was decided that the Spanish Reformed church should be organized on a synodical independent basis, with a liturgy built on the teaching of the pre-Roman church and preserving the prayers loved by the early Christian ancestors of the members. As a doctrinal basis the Reformers hold by the great creeds and have adopted the Thirty-nine Articles with the necessary local changes. The government of the church is in the hands of a synod consisting of the clergy and lay representatives, who meet at fixed intervals. Until the church shall have three bishops, a temporary arrangement has been made by the synod, whereby the church shall have a council of bishops consisting of its own bishop (or bishops) and three bishops of the Irish church. The first bishop of the Spanish Reformed church is Juan B. Cabrera é Ibars (q.v.). Consult J. B. Cabrera, *La iglesia en España desde la edad apostólica hasta la invasión de los sarracenos* (Madrid, 1910).

SPANISH SUCCESSION, War of the. See Succession Wars.

SPANISH TOPAZ. See Cairngorm.

SPANISH TOWN. A town in Jamaica, British West Indies, on the Cobre River, about 10 miles west of Kingston (Map: Jamaica, C 2). Founded by Diego Columbus in 1525, it was the capital of Jamaica until 1871. Pop., over 5000.

SPANISH WAR VETERANS, UNITED. A society formed in 1904 by the union of the Spanish War Veterans, the Spanish-American War Veterans, the Society of the Service Men of the Spanish War, and the Society of the Hispano-American War. Its purpose is to promote the best interests and general welfare of those and the dependents of those who took part in either the Spanish-American War, the Philippine War, or the Chinese Expedition.

SPANKER. A fore-and-aft quadrilateral sail set on the mizzenmast of ships and barks (qq.v.). It was formerly called the driver.

SPANWORM. See Measuring Worm.

SPAR (AS. *spær*, Ger. *Spar*, gypsum). A term which is used by miners to denote any bright crystalline mineral, and which has been adopted by mineralogists in the names of a number of minerals, as calcareous spar, fluor spar, etc., in which, however, it has no proper generic significance.

SPAR, Adamantine. See Corundum.

SPARGO, spär′gō, John (1876–). An American Socialist reformer and writer, born at Stithians, Cornwall, England. He took extension courses at Oxford and Cambridge universities. An outspoken Socialist at 18, he opposed the Boer War and emigrated to the United States in 1901, settling in New York. Thereafter he was one of the foremost advocates of Socialism and participated in many philanthropic and charitable movements, especially that to improve the condition of poor children. He was one of the founders of the Prospect House Social Settlement and one of the workers in the Rand School of Social Science. His time was largely occupied in writing, and he came to be recognized as an authority on Marxian Socialism. He published, among other writings: *The Bitter Cry of the Children* (1906); *Socialism, a Study and Interpretation of Socialist Principles* (1906; rev. ed., 1909); *Capitalist and Laborer* (1907); *The Common Sense of the Milk Question* (1908); *The Common Sense of Socialism* (1908); *Karl Marx, his Life and Work* (1909); *Sidelights on Contemporary Socialism* (1910); *Applied Socialism* (1912); *Syndicalism, Industrial Unionism, and Socialism* (1913); *Marxian Socialism and Religion* (1915).

SPAR′IDÆ (Neo-Lat. nom. pl., from Lat. *sparus*, from Gk. *σπάρος*, gilthead, sort of fish). An important family of spiny-rayed fishes, to which belong the porgies, sheepshead, scup, etc. (qq.v.). The body is elongate, with the dorsal side more or less elevated. The scales are rather large. There is a single dorsal fin, the anterior portion being spinous. The family contains about 100 species. They are shore fishes, carnivorous in habit, most common in tropical seas.

SPARKS. A city in Washoe Co., Nev., 1½ miles east of Reno, on the Truckee River and on the Southern Pacific Railroad (Map: Nevada, B 3). It is the seat of Nevada State University, and contains a Carnegie library and the State Asylum for Mental Diseases. There are here large railroad repair shops and some mines. Pop., 1910, 2500.

SPARKS, Jared (1789–1866). An American historian, editor, and educator, born at Willington, Conn. He graduated at Harvard College in 1815. Here, after teaching school, he was (1817–19) tutor in mathematics and natural philosophy. During this time he studied theology and (1817–18) edited the *North American Review.* From 1819 to 1823 he was pastor of a Unitarian church in Baltimore; in 1821–23 he edited there the *Unitarian Miscellany and Christian Monitor* (monthly); and from 1824 to 1831 again edited the *North American Review,* of which he was chief proprietor. In 1830 he founded and was the first editor of the *American Almanac and Repository of Useful Knowledge,* published annually until 1861. In 1839 he became professor of history at Harvard, of which institution he was president from 1849 to 1853. During this time he reformed administrative methods, insisted upon the recognition by the Massachusetts Legislature of Harvard's chartered rights, and vigorously opposed the elective system. He is best known, however, as a biographer, and as an editor and collector of documents relating to American history. In this field he was a highly useful pioneer. As an editor he was, with some justice, but extravagantly, criticized for taking liberties with his materials, such as failing to reproduce quoted sources fully and accurately. Perhaps his best-known work is his edition of the *Writings of George Washington* (12 vols., 1834–38), the first volume of which is an excellent biography of Washington, frequently published separately. This edition met with much criticism, involving Sparks particularly in a controversy with Lord Mahon, and it has since been superseded in many respects by that of W. C. Ford. Sparks also edited: *The Library of American Biography* (first series, 10 vols., 1834–38; second series, 15 vols., 1844–47); *The Diplomatic Correspondence of the American Revolution* (12 vols., 1829–30), since superseded in most respects by Wharton's *Revolutionary Diplomatic Correspondence of the United States* (6 vols., 1889); *The Works of Benjamin Franklin with a Life of the Author* (10 vols., 1836–40), since superseded by Bigelow's *Complete Works of Benjamin Franklin* (10 vols., 1887–89); and *Correspondence of the American Revolution; Letters of Eminent Men to George Washington* (4 vols., 1853). He also published a *Life of Gouverneur Morris, with Selections from his Correspondence and Miscellaneous Papers* (3 vols., 1832). He left voluminous manuscript journals, and a mass of valuable documentary material relating chiefly to the diplomatic history of the American Revolution, which was collected by him during several trips to Europe, and which he bequeathed to the Harvard Library. Consult H. B. Adams, *Life and Writings of Jared Sparks* (2 vols., Boston, 1893).

SPARROW (AS. *spearwa,* Goth. *sparwa,* OHG. *sparwe,* sparling; connected with OPruss. *sperglas,* sparrow). A small bird of the finch family (Fringillidæ), generally with dull plumage and slight powers of song, feeding on or near the ground, and nesting in bushes or on the ground. Originally the name belonged specifically to the common European sparrow (see House Sparrow), but now has been inaccurately extended to include certain warblers, weaver birds, etc. Of American sparrows probably the most familiar is the common chipping sparrow (see Chippy), or hairbird, a small grayish bird. The field sparrow (*Spizella pusilla*) is a similar species, which occurs throughout the eastern United States in summer, distinguished by its brighter rufous color and flesh-colored bill. A third species, the tree sparrow (*Spizella monticola*), occurs in the United States only in winter, breeding in Labrador and the Hudson Bay region. It is considerably larger than the chippy and has a conspicuous black spot on the grayish-white breast. Next to the chippy the best-known American sparrow is probably the song sparrow (*Melospiza melodia,* or *cinerea*), which in some one of its varieties ranges throughout practically the whole of North America. It is between 6 and 7 inches in length, the upper surface brown, the under surface dull white, but more or less streaked with black or rufous brown, the streaks on the centre of the breast tending to form one large characteristic blotch. This is an early spring songster in the Northern States, and its refrain is remarkably clear and sweet. Its nest is composed of grasses and rootlets, lined with fine grasses and long hairs, and is frequently placed on the ground. The eggs are variable in color and form, the ground shade ranging from nearly white to deep blue thickly marked with reddish brown. Two broods are often raised in a season. Two other species of *Melospiza* range through eastern North America, the swamp sparrow (*Melospiza georgiana*) and Lincoln's sparrow (*Melospiza lincolni*). They resemble the song sparrow in appearance, but are more shy and retiring in their habits. Some 20 or 30 other birds are called sparrows in the United States, among which the vesper sparrow (*Poœcetes gramineus*), the savanna or grasshopper sparrows (genus *Ammodramus*), or more correctly *Passerculus* (which also includes the sharp-tailed and seaside sparrows), the crowned sparrows of the genus *Zonotrichia,* the wood sparrows or summer finches of the genus *Peucœa,* and the large fox sparrow (q.v.) are especially worthy of mention, while the sage sparrows (*Amphispiza*) and the lark sparrows (*Chondestes grammacus*) are characteristic Western forms. A familiar species of the West is the black-throated dickcissel (*Spiza americana*), a fine singer. The vesper sparrow is often called grass finch or bay-winged bunting, but its more common name has reference to its fondness for singing late in the afternoon. It feeds and nests only on the ground. The outer tail feathers of each side are white and are exposed by the bird when flying. *Ammodramus,* or *Passerculus,* includes upward of a dozen species, widely distributed, but popularly little known, on account of their retiring habits. They are shy, elusive little birds of fresh and salt marshes. The crown sparrows are large, handsome birds, of which the common white-throated Peabody bird (*Zonotrichia albicollis*) is best known. The conspicuous black and white (sometimes golden-yellow) head markings make the crown sparrows conspicuous. The wood sparrows are a group of southwestern and Mexican species of medium or small size, with short rounded wings; one species, known as Bachman's finch or the pine-woods sparrow (*Peucea æstivalis*), occurring in the South Atlantic States, especially Florida, is noted as a superior songster; a variety of this species, the oak-woods or Bachman's sparrow, is found in the Mississippi valley as far north as Illinois. The lark sparrow is notable for the fact that, unlike other sparrows, the sexes are very unlike in color; while the female is streaked grayish brown, the male is black with a large white patch on the wings. This is a prairie species abundant on the central plains, ranging eastward to Illinois, and occasionally, as a straggler, to the Atlantic coast.

Our native sparrows, in contrast to the introduced English sparrow, a pest, are of very great importance to the agriculturist. The great bulk of their food consists of seeds, fruits, and insects. Native sparrows destroy very little grain, hardly any cultivated fruit, but do consume vast numbers of weed seeds. It has been estimated that the tree sparrows in the State of Iowa eat 875 tons of weed seeds in a winter, and many other species of sparrows have been proven to do fully as much in the work of elimination of the future crop of weeds. Insects also make up from 25 to 35 per cent of their diet, so that sparrows are of great importance in our farming areas. Consult: *United States Biological Survey, Bulletin No. 15* (Washington, 1901); Ridgway, *Birds of North and Middle America*, part i (ib., 1901), and authorities there cited; Forbush, *Useful Birds and their Protection* (Massachusetts Board of Agriculture, 1913). See Plate of FAMILIAR SPARROWS and Colored Plate of EGGS OF SONG BIRDS.

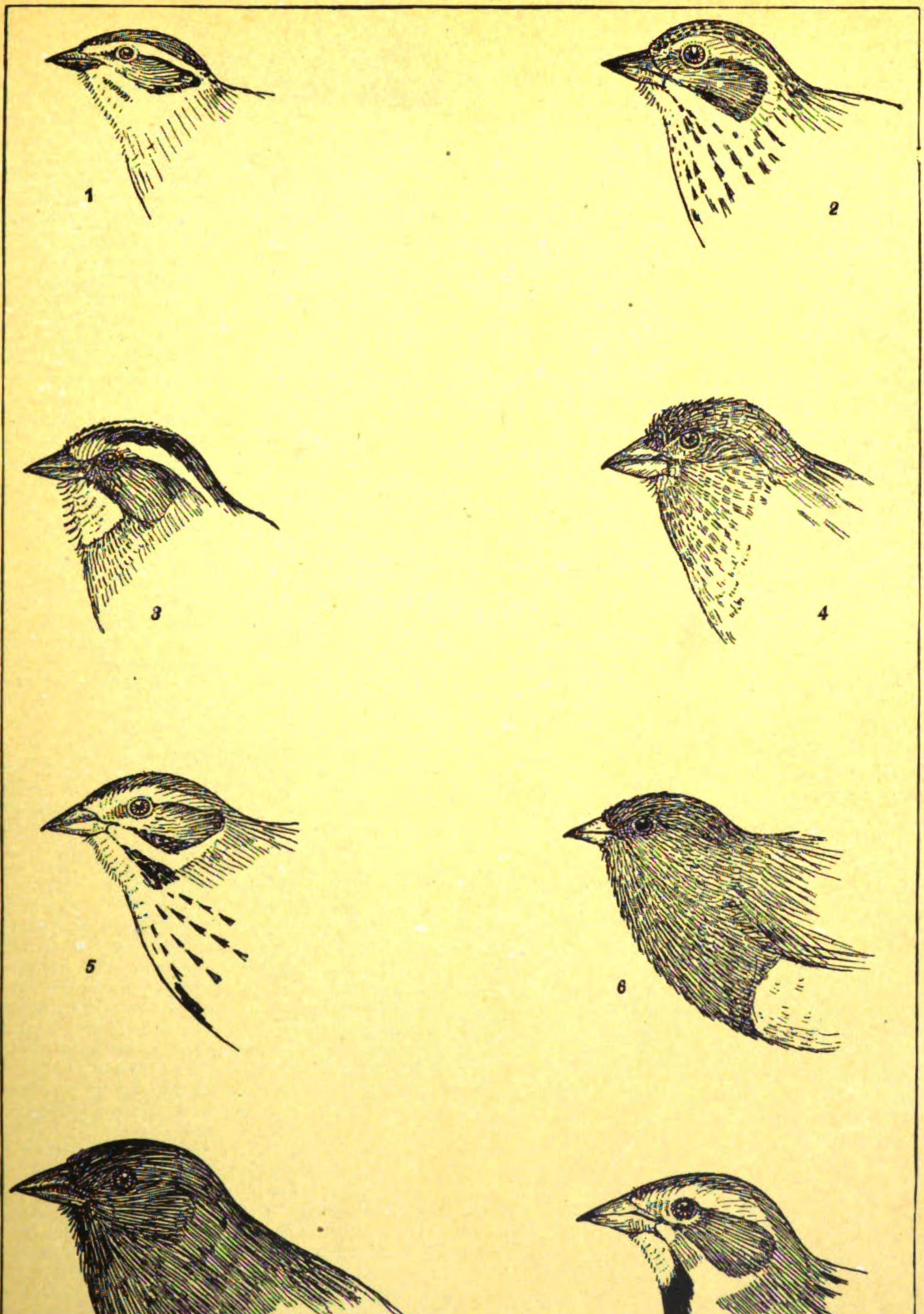
SPARROW HAWK. Any of several distinct species of small hawks, whose prey consists chiefly of sparrows and other small birds, insects, and mice. In America the name is universally given to *Falco sparverius*, a handsome little falcon less than a foot long. It is very courageous and very active, and lives largely on mice and insects. It is rufous above, barred with black; most of the head is slaty blue, and underneath it is buffy. It breeds from Florida to Hudson Bay, winters from New Jersey southward, and is everywhere one of the commonest species of hawk. It nests in a hole in a tree and lays from three to seven creamy or reddish eggs, finely marked with darker tints.

The Old World sparrow hawk (*Accipiter nisus*) is very similar, and has often been trained for the purposes of falconry, to take land rails, partridges, and similar game. See FALCON; FALCONRY; and Plate of EAGLES AND HAWKS.

SPAR′TA (Lat., from Gk. *Σπάρτη*, Doric *Σπάρτα*), also LACEDÆMON. The capital of Laconia, most famous city of the Peloponnesus (q.v.) (Map: Greece, Ancient, C 3). It occupied low hills on the right bank of the Eurotas (q.v.), and the plain between the hills and the river. Its appearance even in its palmiest days was unequal to its renown (cf. Thucydides, i, 10), for it was little better than a group of five villages, with plain and even mean private houses, though there were a few notable public buildings, such as the shrine of Athena or the Bronze House, whose walls seem to have been lined with bronze, probably decorated with reliefs. The passes which lead into the valley of the Eurotas are so easily defensible, and the distance from the sea is so great, that Sparta continued without walls down to the end of the fourth century B.C., and, indeed, was not regularly fortified till the time of the tyrant Nabis (195 B.C.). The five villages, Cynosura, Limnæ, Mesoa, Pitane, and Dyme, were united in the worship of Artemis Orthia and Athena, and had a common agora, or market place, on which stood the public buildings—the senate house and the offices of the ephors (see EPHORI) and other magistrates. Famous public places were the *Choros*, where the youths danced in honor of Apollo; the *Dromos*, or race course, for gymnastic exercises, and where were also temples of the Dioscuri (see CASTOR AND POLLUX) and other gods; and the *Platanistas*, a broad level space, shaded by plane trees, and reached by two bridges where the Spartan youth, divided into two bands, met in strenuous personal conflict. Probably the so-called Acropolis, which was crowded with temples, was situated on the hill to the northwest, on whose southern side the theatre can still be traced. Near by excavations conducted by the American School at Athens in 1892 brought to light the foundations of a circular building which had contained a colossal statue and may have been identical with a structure mentioned by Pausanias (q.v.) as containing statues of Zeus and Aphrodite, said to be a foundation of Epimenides of Crete.

After the Dorian conquest of Laconia (see DORIANS) the supreme power always remained in the hands of the pure-blooded Dorian families of Sparta. The farmer population and the lesser Dorian towns became Periœci (q.v.) or Helots (q.v.). The situation of the Spartans, amid a subject population largely in excess of their own numbers, practically forced upon them a strict military discipline. This formed the basis of their whole system; Sparta was little else than a permanent camp. At the birth of a child the elders decided whether it was strong enough to be reared. A weakling was exposed on Mount Taygetus. After their seventh year boys entered upon severe training, designed to develop physical strength and courage, as well as uncomplaining endurance of hardship and cunning such as might serve the soldier. Music and the dance were added, and perhaps the elements of letters. Girls, too, passed through a training in gymnastics and the dance, that they might be fit consorts and bearers of strong children. Sentiment played but little part in the Spartan system, and the only function of marriage was the perpetuation of the state. At 20 the young Spartan was liable to active service, was admitted to the public meals, and allowed to marry, but, still obliged to live with his companions, he could obtain only stolen interviews with his bride. At 30 he became a full citizen. Discipline, however, was not relaxed. He must still eat regularly at his *Phiditia*, or mess, and contribute regularly to its support from the produce of his farm, which was cultivated by Helots. The government was a development from the old Homeric form of the king and council of elders. In Sparta there was a double kingship. The two lines claimed descent from the twin sons of Aristodemus, Eurysthenes and Procles, but they were named Agidæ and Eurypontidæ, from the second generation, Agis and Eurypon. These two kings were the religious representatives of the state, on whose behalf they offered stated sacrifices, and also exercised

FAMILIAR SPARROWS



1. **CHIPPY** (Spizella socialis).
2. **VESPER SPARROW** (Poōcætes gramineus).
3. **WHITE-THROAT** (Zonotrichia albicollis).
4. **PURPLE FINCH** (Carpodacus purpureus).
5. **SONG SPARROW** (Melospiza melodia).
6. **BLUE SNOWBIRD** (Junco hyemalis).
7. **CHEWINK** (Pipilo erythrophthalmus).
8. **BLACK-THROATED SPARROW** (Euspiza Americana).

limited legal functions. Their chief duty was, however, the command of the army, over which in early times they exercised unlimited power, though in the fifth century B.C. they were subject to the ephors and the assembly. (See ECCLESIA.) In the field their power was absolute. Associated with the kings was a council (the Gerousia) of 28 elders, men over 60 years of age, chosen for life from certain noble families by acclamation in the popular assembly. They discussed and prepared the matters to be submitted to the assembly, and also sat as a court of criminal jurisdiction in crimes against the state, especially where the kings were involved. Once a month the assembly of the citizens (Apella) met at the call of the kings, though in the fifth century B.C. the ephors presided. This body seems ordinarily merely to have voted on the business presented to it. Speeches were in general delivered only by the officials; there was certainly no general discussion. Into this government were introduced at an early date the ephors, who, during the period of Spartan greatness, were the real rulers. (See EPHORI.) They exercised a general oversight over the community and maintained the established order. Elected for one year, they had the power to call any magistrate to account and even to suspend him from office. They presided over the Gerousia (q.v.) and could impeach any citizen before that court. Their short term of office and accountability to their successors were almost the sole limits to their power. Under the iron discipline of this constitution, which was attributed to the mythical Lycurgus (q.v.), the Spartan state gradually extended its power until it had gained complete control over Laconia and Messenia (q.v.) and the recognized leadership of a somewhat loosely joined confederacy, which included most of the Peloponnesus outside of Argos. At the time of the Persian wars Sparta was the leading state in Greece, but the constitution was not adapted for military operations requiring prolonged absence from home, and with the transfer of the war to Asia the Spartans soon withdrew from the scene. (Leading events other than domestic in the history of Sparta have been given under GREECE, *Ancient History*.) The creation of the fleet which decided the Peloponnesian War put a severe strain upon the ancient customs, and long absences in foreign lands, often with free opportunity for luxury, rendered men unwilling to submit to stern discipline on their return. The hegemony of Greece, which had fallen to Sparta on the overthrow of Athens, was used solely as a means of aggrandizement and profit, and in a short time led to renewed wars. In 371 B.C. the defeat at Leuctra (q.v.; see also EPAMINONDAS) at the hands of the Thebans broke forever the power of Sparta, and the disintegration, which had begun with naval empire and the accumulation of gold and silver, forbidden by the ancient laws, went rapidly forward. The attempt of Agis IV (c.244–240 B.C.) to reform the state was defeated and Agis put to death, but Cleomenes III (c.235–219 B.C.) carried through a series of sweeping changes, which increased largely the number of citizens and reëstablished the Lycurgan order. After his death Sparta was ruled by the tyrants Machanidas and Nabis, was then forced into the Achæan League (see ACHÆA), and finally with the rest of Greece passed under the rule of Rome. Treated with favor by the Romans, the city prospered; the old laws of Lycurgus were once more placed in force, and the old training practiced, at least nominally, though the forms of government seem to have been much altered. In the thirteenth century the Acropolis was fortified by a wall, which may still be traced. The Frankish lords of the Peloponnesus built a strong fortress at Mistra (1248–49) on a spur of Taygetus, west of Sparta, and its superior security led to the abandonment of the ancient city. After the Greek Revolution a new town of Sparta was laid out, in 1834, under King Otto, as the capital of the Nomarchy of Laconia. In 1906 excavations were begun on the site of Sparta by the British School at Athens; for these see *Annual of the British School*, xii ff.

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SPARTA. A city in Randolph Co., Ill., 54 miles southeast of St. Louis, Mo., on the Mobile and Ohio and the Illinois Southern railroads (Map: Illinois, E 9). It contains railroad repair shops, coal mines, plow works, also flour and planing mills, etc. Pop., 1900, 2941; 1910, 3081.

SPARTA. A city and the county seat of Monroe Co., Wis., 26 miles east by north of La Crosse, on the La Crosse River and on the Chicago, Milwaukee, and St. Paul and the Chicago and Northwestern railroads (Map: Wisconsin, C 5). It has an attractive situation and artesian mineral wells, and is a fine health resort. There are in Sparta a Carnegie library, the State Public School for Dependent and Neglected Children, St. Mary's Hospital, and St. Mary's Convent. The city is the shipping centre for a rich farming and stock-raising region, and manufactures well-drilling machinery, iron products, monuments, and grain separators. Pop., 1900, 3555; 1910, 3973.

SPAR'TACUS. The leader in a great insurrection of Roman slaves in southern Italy (73–71 B.C.). He was a native of Thrace, originally a shepherd, but afterward a robber chief. He was taken prisoner and placed in a gladiatorial school at Capua. Seventy gladiators, including Spartacus, escaped, defeated the Roman soldiers sent to bring them back, and established themselves on Mount Vesuvius, where they received considerable accessions, chiefly runaway slaves. Spartacus was chosen leader, and proclaimed freedom to all slaves. Thousands rushed to his standards. He defeated Claudius Pulcher, Cossinius, legate of P. Varinius Glaber, the prætor, and finally Varinius himself in several engagements. All southern Italy now fell into his hands; the country was devastated, the cities either pillaged or garrisoned. After the defeat and death of his lieutenants, two Celts, Crixus and Oenomaus, who had separated from him (72 B.C.), Spartacus marched northward through Picenum towards the Po, overthrew first one consular army under Cn. Cornelius Lentulus and then another under Gellius Poplicola, and at the head of a large force meditated a march upon Rome. He was forced, however, by his followers to retreat south, and took up his winter headquarters at Thurii. In 71 the proconsul, C. Cassius Longinus, and the proprætor, Cn. Manlius, were defeated; in Picenum, Mummius, a legate of Crassus, was routed; at last, however, Crassus succeeded in forcing Spartacus into the narrow peninsula of Rhegium. Crassus now built lines of circumvallation to force him to surrender; but one stormy winter night Spartacus broke through and resumed the offensive. Near Petelia, Spartacus again defeated his adversaries; but, seeing clearly that he could not hold out much longer, he made a dash for Brundusium, hoping to seize the shipping in the harbors and get safely across the Adriatic to his native shore, but was baffled by the presence of Lucullus (q.v.). There was nothing left for Spartacus but to die gallantly as he had lived. Drawing up his army in battle array, and solemnly slaying his war horse, he began his last fight in a spirit of heroic desperation, and after performing prodigies of valor he fell unrecognized among the heaps of his slain foes. After his death the slave insurrection was at an end.

SPAR'TANBURG. A city and the county seat of Spartanburg Co., S. C., 93 miles northwest of Columbia, on the Carolina, Clinchfield, and Ohio of South Carolina, the Charleston and Western Carolina, on the Southern and the Piedmont and Northern railroads (Map: South Carolina, B 1). It has the Kennedy Public Library, and is the seat of Converse College, a nonsectarian institution for women, opened in 1890, Wofford College (Methodist Episcopal, South), opened in 1854, a textile school, and the State Deaf, Dumb, and Blind Institute. Spartanburg is the centre of a large cotton manufacturing district, containing some 38 mills with more than 806,000 spindles. There are also ironworks, lumber mills, and manufactories of brooms and roller bearings. The city has adopted the commission form of government. Pop., 1900, 11,395; 1910, 17,517; 1915 (U. S. est.), 20,745.

SPARTEINE, spär'tē-ĭn *or* -ēn (from Neo-Lat. *Spartium,* from Lat. *spartum, sparton,* from Gk. *σπάρτον,* Spanish broom, cable). A volatile, oily liquid alkaloid obtained from the tops of the broom plant (*Cytisus scoparius*), a European shrub of the order Leguminosæ. Sparteine is odorless, very bitter, soluble in alcohol, ether, and chloroform, but insoluble in water. Its sulphate, which is used in medicine, is a colorless, crystalline powder, soluble in water and in alcohol. It is a cardiac stimulant, acting at times when digitalis fails. It is also an uncertain diuretic.

SPARTIUM, spär'shĭ-ŭm. A genus of plants. See Broom.

SPARTIVENTO, Cape. See Cape Spartivento.

SPASM (Lat. *spasmus,* from Gk. *σπασμός, spasmos, σπάσμα, spasma,* spasm, from *σπᾶν, span,* to draw, rend). Involuntary and sudden muscular contraction, due to central nerve disturbance, to peripheral irritation, or to reflex action from irritation of other parts of the body. There are two kinds, tonic and clonic. Tonic spasm is a prolonged involuntary rigidity of a muscle or a group of muscles. Such spasm occurs at the beginning of an epileptic attack, during hysteria major, tetanus, angina pectoris, and meningitis. It also occurs in muscles of the calves of the legs in swimmers, attended with pain, when it is called cramp (q.v.). Clonic spasm is an involuntary contracting and relaxing of groups of muscles, causing twitching, jerking, and rolling movements and contortions. It is the common convulsion, or fit. Such a spasm occurs in epilepsy, hysteria, uræmia, chorea, hydrophobia, and in some cases is due to indigestion or intestinal worms. In asthma (q.v.) there is spasm of the muscles controlling the bronchial tubes, as also in whooping cough (q.v.), together with hyperæsthesia. Spasm occurs also in colic. Treatment consists of the use of antispasmodics: asafœtida, musk, valerian, belladonna, cannabis indica, opium, the bromides, and stramonium, and the administration by inhalation of chloroform or amyl nitrite, or by prolonged hot bathing.

SPASMODIC COLIC. See Horse.

SPASMODIC SCHOOL OF POETRY. See Poetry, Spasmodic School of.

SPAV'IN, Bog (OF. *esparvain, esparvent,* Fr. *éparvin,* spavin; possibly from Goth. *sparwa,* OHG. *sparo, sparwe,* AS. *spearwa, speareowa,* Eng. *sparrow;* in allusion to the hopping gait of a spavined animal). A lesion of the true hock joint of the horse, consisting in distention of the capsule inclosing the joint. It usually arises suddenly from a sprain in action, from overwork, or wounds.

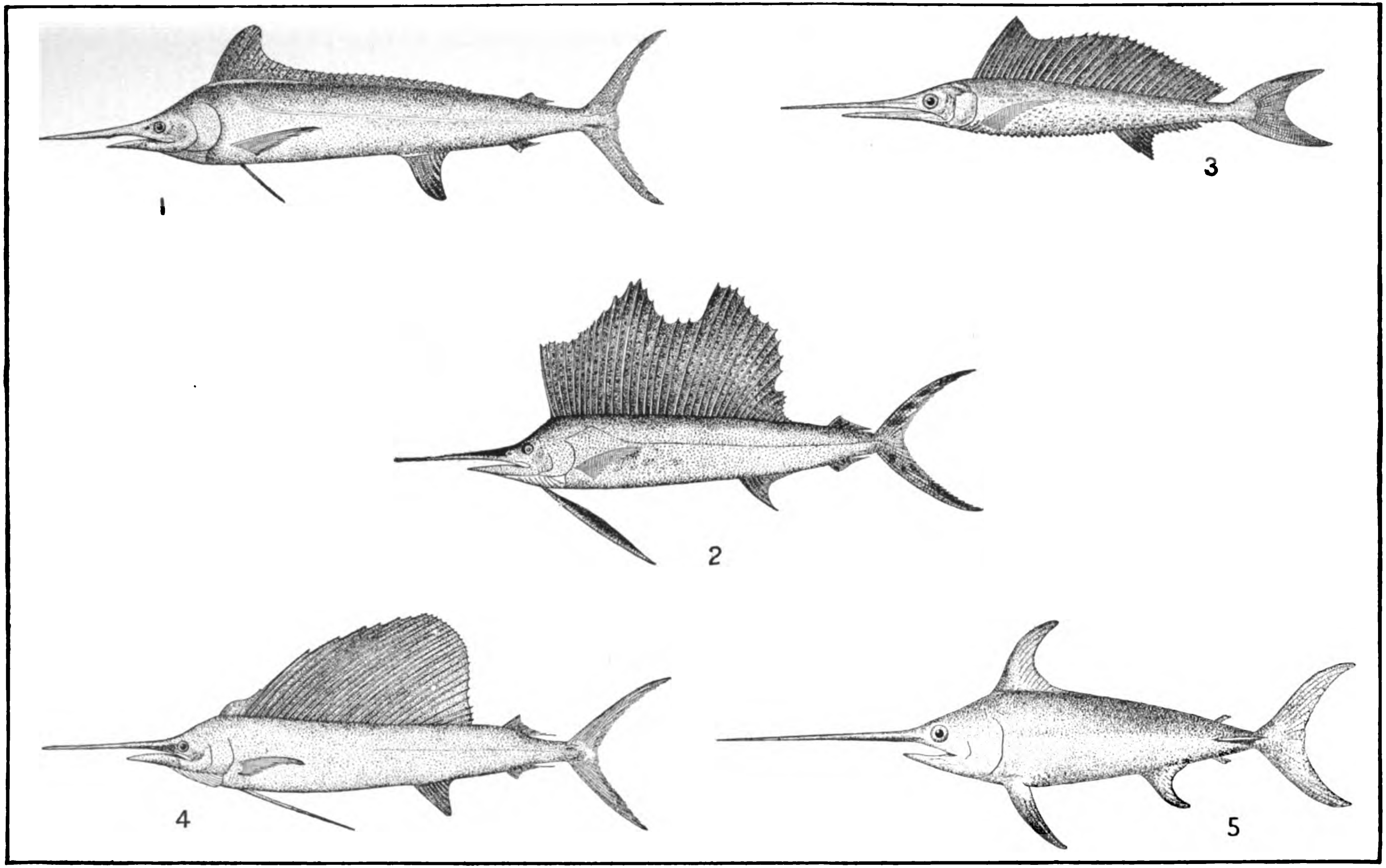
SPAVIN, Bone. An inflammation of and bony deposit on the flat bones of the lower and inner part of the hock joint of the horse. At first there is tenderness, local heat, swelling, and lameness, but as the inflammatory stage passes the lameness is less perceptible, although the horse still continues to go stiffly. If the lameness is only slight it usually disappears after a little exercise. The animal should be given rest.

SPAWN EATER. The spotted-tailed minnow (*Notropis hudsonius*). See Minnow.

SPEAKER. The name of the presiding officer in various legislative bodies. In the English House of Commons the office seems to have existed as early as the reign of Henry III, but the title Speaker was first given to Sir T. Hungerford in the reign of Edward III (1377). The Speaker of the House of Commons presides over the deliberations of the House and enforces its rules. He puts the question and declares the determination of the House. As the representative of the House, he communicates its resolutions to others, and conveys its thanks or its censures. He issues warrants in execution of the orders of the House for the commitment of offenders, for the issue of writs, the attendance of witnesses, the bringing up prisoners in custody, etc. He cannot speak or vote on any question, but on an equality of voices he has a casting vote. The office is nonpolitical; and hence a Speaker may hold during several successive and opposing administrations. A retiring Speaker is usually rewarded with a peerage. See Parliament.

Unlike the English prototype, the Speakership of the United States House of Representatives is a political office of the highest importance. The first Speaker, chosen in 1789, was a modera-

SPEARFISH AND SWORDFISH



1. SPEARFISH (Tetrapturus albidus). 2. WEST INDIAN SAILFISH (Histiophorus nigricans). 3. YOUNG OF SWORDFISH (No. 5).
4. SAILFISH (Histiophorus gladius). 5. SWORDFISH (Xiphias gladius).

tor on the British pattern. But beginning with the right to appoint the standing committees in 1790, the powers of the Speaker have gradually expanded until, by his power to appoint committees, to refer bills to the various committees, and, as chairman of the committee on rules, to direct the course of legislation, he became the majority leader in the House and a sort of American Premier. His power, however, was much curtailed in 1910, when the House took from him the appointment of the committee on rules. (See CANNON, JOSEPH GURNEY.) The Speaker is a member of the House, chosen by the members; and he may exercise his privilege of voting on any measure. From 1874 to 1907 his salary was $8000 a year; since 1908 it has been $12,000. He signs all bills, resolutions, and acts of authority; certifies to the mileage, etc., of members; and appoints three of the regents of the Smithsonian Institution. He may be removed from office by an act of the House.

For the early history of the Speakership, consult Sir William Stubbs, *Constitutional History* (6th ed., Oxford, 1897), and in general, Alpheus Todd, *Parliamentary Government* (London, 1869), together with Michael Macdonagh, *The Speaker of the House* (ib., 1914). The most important work on the American office is M. P. Follett, *The Speaker of the House of Representatives* (New York, 1896). This was preceded by A. B. Hart, "The Speaker as Premier," in *Practical Essays* (ib., 1893).

SPEAKING TRUMPET. An instrument for concentrating the sound waves of the human voice, and enabling the sound to be conveyed to a distance; often used on shipboard. Its inventor was Sir Samuel Morland (q.v.). It is now generally superseded by the megaphone (q.v.).

SPEARFISH. A city in Lawrence Co., S. Dak., 17 miles northwest of Deadwood, on the Chicago, Burlington, and Quincy Railroad (Map: South Dakota, A 3). It is the seat of a State Normal School and also of a United States government fish hatchery. Fruit growing and stock raising are carried on, and there are saw, planing, and flour mills, a cyanide plant, stucco mills, and a creamery. Pop., 1900, 1166; 1910, 1130.

SPEARFISH, or SPIKEFISH. The great billfish, or aguja blanca (*Tetrapturus albidus*) of West Indian waters. It is dark blue above, whitish beneath, and may be 7 feet long, including the spearlike jaws, and weigh 100 pounds. It is probably identical with the Mediterranean species, and others occur in the Eastern tropics. Their habits are similar to the sailfishes and swordfishes. See Plate of SPEARFISH AND SWORDFISH.

SPEAR GRASS. See BLUE GRASS.

SPEAR LILY. See GIANT LILY.

SPEARMINT. See MINT.

SPEARS, JOHN RANDOLPH (1850–). An American author and journalist, born at Van Wert, Ohio. He was early connected with the Buffalo *Express* and with the New York *Sun*. Later, devoting himself to writing, he settled at Little Falls, N. Y. His publications include: *The Gold Diggings of Cape Horn* (1895); *The Port of Missing Ships and Other Stories of the Sea* (1896); *The History of our Navy from its Origin to the Present Day* (5 vols., 1897–99); *The Fugitive* (1899); *The American Slave Trade* (1900; new ed., 1907); *David G. Farragut* (1905); *A History of the United States Navy* (1907); *The Story of New England Whalers* (1908); *A History of the American Navy* (1909); *The Story of the American Merchant Marine* (1910); *Master Mariners* (1911).

SPECIAL ASSESSMENT. A compulsory contribution levied in proportion to special benefits derived from public improvement; designed to cover, entirely or partially, the cost of that improvement. A special assessment is levied frequently on the opening or improvement of streets or highways. It differs from a tax, being levied in proportion to benefits directly derived from the uses to which the contribution is put. (See TAX.) Charges of this nature were imposed in France as early as 1672. In 1807 a general law was passed authorizing such levies, but it has rarely been invoked. In Prussia, since 1875, expenses of certain street improvements have been thus partially defrayed. In England contributions of the same nature were imposed in 1427 and in 1667. The Public Health Act of 1875 permits urban authorities, under certain contingencies, to recover the cost of improvements from property owners in proportion to frontage.

The principle first appeared in America in a law of the Province of New York of 1691. By that law all houses in the city of New York might be assessed in proportion to benefits derived from public improvements. By a law of 1787, assessments were limited to the owners of property which was to be benefited. In other States this form of raising revenue appeared about 1830. After the Civil War the principle became extended, and is now throughout the United States a recognized principle. In a typical case, when a street is graded or paved, after the improvement has been made a board of assessors is appointed, who apportion costs in proportion to benefits received. Such assessments are usually subject to legal limitation as to amount. Consult Victor Rosewater, *Special Assessments* (2d ed., New York, 1898).

SPECIAL JURY. In the English law, a jury consisting of men who are entitled to be called esquires, or persons of higher rank, bankers, merchants, and persons who occupy private dwelling houses, or possess certain other property qualifications. Under the "Juries Act" of 1870, either the plaintiff or the defendant in an action is entitled to demand a special jury, but he must bear the additional expense, unless the trial judge certifies at the end of the trial that the case was a proper one to be tried by a special jury. In some of the United States no provision is made for special juries; but in a few States *struck* or special juries may be ordered, in the discretion of the court, in important cases. See JURY.

SPECIAL PROCEEDING. Under modern codes of procedure, any civil proceeding which is not an action (q.v.). Under the New York Code of Civil Procedure the following have been held to be special proceedings: an application for admission to the bar; proceedings supplementary to execution; a proceeding to vacate an assessment; proceedings for contempt; proceedings for condemnation of land; habeas corpus and other State writs (q.v.). Consult J. N. Fiero, *Practice of Special Proceedings* (2d ed., 2 vols., New York, 1899). See ACTION.

SPECIAL SESSIONS. Under the English judicial system, where two or more justices of the peace sit together for the trial of some important cause, or to transact other urgent judicial business, the sitting is known as Special

Sessions. In New York a criminal court for the trial of misdemeanors and petty criminal cases is called the Court of Special Sessions. See COURT; PETTY SESSIONS.

SPECIALTY. In law, in its broadest sense, any formal, as distinguished from a simple, contract, including judgments, recognizances, statutes staple, statutes merchant, and deeds of grant; the term is more frequently used as synonymous with contract under seal. Contracts under seal were the earliest form of contract known to the law—used from the earliest time both under the common and the Roman law system. Unlike simple contracts, no consideration is required to give them validity at law; that, as in the case of all other specialties, depending on their form and the method of their execution. They must be written or printed on paper or parchment and must be sealed and delivered by the grantor or obligor. It is said that signing a deed by the obligor is not essential to the validity, although it is now the universal practice to execute the instrument by signing as well as by sealing and delivering it. The latter is effected by actual delivery of the instrument by the person executing it to the obligor (or to another for the obligor) with the intent that it should become operative as a deed or contract under seal. After sealing and delivery the instrument remains in full force even if the person executing it take it back into his possession. One executing a specialty may, however, make a qualified delivery of it called a delivery in escrow (q.v.). Formerly specialties were classified as deeds poll and indentures (see DEED), but now the most satisfactory classification of specialties (using that term as applicable only to instruments under seal) is into grants, bonds, and covenants (qq.v.). All statements contained in a specialty are absolutely conclusive against the party making them and executing the instrument, that is, he is conclusively estopped to deny them. Whenever a specialty contract is given on account of or in place of a simple contract, the simple contract is merged and extinguished. (See MERGER.) The statute of limitations provides a much longer period of limitation for specialties than other forms of obligations, usually twenty years. (See LIMITATION OF ACTIONS.) In case of the death of the obligor the holder of specialty obligations executed by the deceased had at common law much higher rights against his estate than the holder of simple contract obligations. (See ADMINISTRATION.) Although consideration is not necessary to give legal validity to a specialty, courts of equity will not grant their peculiar form of relief by way of specific performance to one who has not given consideration for the specialty obligation which he holds. (See SPECIFIC PERFORMANCE; TRUST; USES.) It was formerly held that a corporation could contract only by specialty under its corporate seal. This is no longer the rule in the United States, where it is held that a corporation may enter into contracts by its proper officers without the use of its seal, wherever a private individual might so contract. For further information consult BOND; CONTRACT; CONSIDERATION; COVENANT; DEBT; DEED; EQUITY; SEAL; ETC.; and authorities referred to under CONTRACT and SEAL.

SPECIAL VERDICT. A verdict in which the jury find merely the facts as proved by the evidence and do not apply the law to the facts, but leave it to the discretion of the court as to whether in its opinion the plaintiff or defendant shall succeed. Thus where there is a substantial conflict of evidence as to only one or a few of the facts, proof of which is essential to a recovery, the court may submit that particular issue to the jury for a special finding thereon. The matter is now regulated by statute in most jurisdictions. In some States such a verdict is said to be "subject to opinion." See JURY; VERDICT.

SPECIE PAYMENTS (abbrev. of ML. *in specie*, in coin, Lat., in kind; *in*, in, and *specie*, abl. sing. of *species*, kind), SUSPENSION AND RESUMPTION OF. There are few states which have not passed through crises when the metallic covering of their paper money has become too scanty, and the convertibility of the paper has been suspended. Such a general suspension of specie payments is legalized either directly or tacitly by the government. The effect of suspension is to relax the restrictions upon the issue of paper money, and the general result is a redundancy of such money and its depreciation. The action generally leads to the hoarding or export of such metallic money as remains in the country, thus causing a void in the monetary circulation which the issues of paper money do not at once fill, but the extent of depreciation of paper usually depends upon the facility of issue. On the suspension of specie payments by the Bank of England in 1797, the effect of increased note issues was only gradually felt, for the bank followed a conservative policy. This was true also of the suspension by the Bank of France in 1870. On the other hand, during suspension of specie payments in the United States in 1813, the banks issued notes recklessly and the depreciation was considerable. When the banks of the United States, on December 30, 1861, again suspended specie payments and the government followed their example, large issues of legal-tender notes caused a like result.

The first step towards resumption is the gradual restriction of paper issue; for government notes redemption is accomplished by the aid of taxation, while in the case of bank notes resumption occurs through pressure of the government by taxation of excessive issues or by other means. The second step is to procure metallic money sufficient to meet demands. To effect this government credit is usually called into requisition. The resumption of specie payments restores the convertibility of credit money, but does not destroy the money. It provides for redemption in specie of such sums as may be presented, but not compulsory redemption of the whole.

At the close of the Civil War the monetary circulation of the United States was exclusively paper, government issues, State bank notes, and national bank notes. Specie payments had been suspended since 1861; a return to them seemed the first duty. Fear of a contraction of the currency made the first steps in this direction hesitating. The gradual redemption of the United States notes (in January, 1864, $449,000,000) undertaken under the Law of April 12, 1866, had been arrested in February, 1868 (the amount standing at $356,000,000). In the financial troubles of 1873, the Secretary of the Treasury, upon somewhat dubious authority, had increased the volume, but by Act of June 20, 1874, Congress stopped this increase when the issue had reached $382,000,000. The task of resumption was earnestly taken in hand early in 1875, when an act was passed providing for resumption on Jan. 1, 1879. In the following years the act was repeatedly attacked, but efforts to repeal it failed. This law removed the limitation which had heretofore rested upon the aggregate issue of national bank notes. It provided, moreover, that, as new notes were issued, United States notes to the extent of 80 per cent of the new bank issues should be retired and canceled. Under this provision the volume of the legal-tender notes diminished by May 31, 1878, when this provision was repealed, to $345,000,000. The resumption act further authorized the Secretary of the Treasury, by the accumulation of surplus revenues and by the sale of bonds, to collect a supply of gold wherewith to resume. The amount to be collected and the amount to be maintained after resumption became a fact were left to his discretion. By the sale of bonds at favorable opportunities the Secretary had on hand on the day of resumption $140,000,000 in gold. The growing strength of the Treasury produced a diminishing premium on gold, and the 1st of January, 1879, passed off without any shock. Only a small amount of paper money was actually presented for payment. Consult E. E. Sparks, *National Development, 1877–1885* (New York, 1907), and D. R. Dewey, *Financial History of the United States* (4th ed., ib., 1912). See MONEY.

SPECIES. See CLASSIFICATION OF ANIMALS; EVOLUTION.

SPECIFICATION. In the law of patents, a technical description of the invention mentioned in an application for a patent, and when used without the word "claim" it includes the claims or arguments of the inventor as to the novelty, usefulness, etc., of his invention. See PATENT, and the authorities there referred to.

In architecture and building, and in mechanical work of all kinds in which the contract system is followed, the specification is a document attached to the contract, describing in detail every part of the work to be done, the materials to be employed, the kind and quality of workmanship required, and the time within which and conditions under which the contract is to be fulfilled; and providing in general all the instructions necessary for the contractor's guidance. Separate sections deal with each trade or kind of work involved. The specification supplements and explains the drawings and is made an essential part of the contract. Even for work done by day labor a specification is often prepared providing like detailed information for the guidance of workmen and superintendent. See BUILDING.

SPECIFIC GRAVITY (ML. *specificus*, specific, particular, from Lat. *species*, kind). The ratio between the weights of equal volumes of any substance and of some other, chosen as a standard. For solids and liquids the standard substance is water; for gases, air, or sometimes hydrogen. Since the volume of a given weight of a substance changes with temperature, it is necessary for exact determinations that the standard selected should be at a certain fixed temperature. Thus specific gravity is not the ratio of an equal volume of a given substance to water at any temperature, but only at the standard temperature selected, as described below. Likewise for a specific-gravity determination to be of value the temperature of the substance at the time of making the measurement should be given. For gases not only the temperature but the pressure must be mentioned. For many purposes the term density has replaced specific gravity, but the two are not synonymous. The density of a substance (at a given pressure and temperature) is the mass of that substance in a unit volume, provided it is homogeneous; otherwise it is the mass of a volume so small as to be homogeneous, divided by the volume. Thus density is an absolute term, expressing the quantity of a certain kind of matter in a given space, while specific gravity is merely relative, being in fact the ratio of the density of the substance to the density of the standard. The specific gravity of a gas or vapor is usually referred to air at the same pressure and temperature as that of the gas, but it is also frequently referred to hydrogen under like conditions. In terms of the latter it is equal to half the molecular weight of the gas. See the article MOLECULES—MOLECULAR WEIGHTS.

The specific gravity of solids and liquids is variously referred to water at 4° C., 15° C., or 62° F., and sometimes other temperatures. Specific gravities on these scales are respectively as 1.000045, 1.000913, 1.001180—the density of water at these temperatures being inversely as these numbers. The difference is not of importance except for purposes of extreme accuracy. Density in the metric system is measured in grams per cubic centimeter (kilograms per liter). If a liter of water at 4° C. weighed exactly a kilogram, as was intended, the density of water at this temperature would be one, and metric density and specific gravity referred to water at 4° C. would be identical. The density of water at this temperature is actually 0.999955, so that specific gravity referred to water at 4° is equal to density × 1.000045. Specific gravity referred to air at 0° C. and 76 centimeters' pressure is equal to metric density divided by the density of air, i.e., 0.001293.

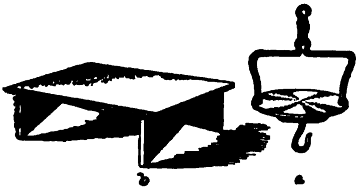
On the English system density is variously expressed in pounds per cubic foot, pounds per cubic inch, grains per cubic inch. To reduce specific gravity referred to water at 62° F. to density on these scales multiply by 62.3546, 0.0360848, 252,593, respectively.

Methods of Measurement. I. **Density.** Two courses may be pursued to determine the density of a substance: (1) Weigh a portion of it and measure its volume; (2) Determine its specific gravity referred to a substance of known density. For approximate purposes the former is better, particularly in the case of solids of regular shape. To attain great accuracy is difficult, since the direct determination of volume is subject to many errors. Hence the density of most substances is found by determining, by one of the methods below, its specific gravity referred to water or hydrogen, the density of each of these having been carefully investigated. The density of water is found by observing the loss in weight of a solid of regular shape when immersed in water, some of the best results being obtained with a glass cube whose exact dimensions were found by a method based on the interference of light.

II. **Specific Gravity of Solids and Liquids.** Most of the methods given below are based on Archimedes' principle—that a solid floating or immersed in a liquid loses weight equal to that of the liquid it displaces. Hence if totally immersed the loss of weight is the weight of a volume of liquid equal to the volume of the solid. Hence:

$$\frac{\textit{Weight of solid}}{\textit{Loss of weight}} = \frac{\textit{Specific gravity of solid}}{\textit{Specific gravity of liquid}}.$$

Thus if either is known the other may be found. For exact purposes the temperature of the liquid must be known, weighings in air must be corrected for the buoyancy of the latter, and the solid must be supported in the liquid so that only a single fine wire cuts the surface. Air bubbles are also a serious source of error, and for this reason water when used should be freshly distilled or boiled.



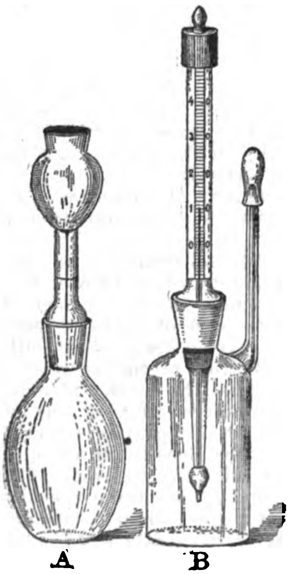
BRIDGE AND PAN FOR USE WITH BALANCE.

A. *Hydrostatic Balance.*—A chemical balance (see BALANCE) so arranged that a vessel of liquid may be placed under one end of the beam without resting on the pan. This is done by replacing the ordinary pan by a shorter (Fig. *a*) or else by resting the vessel on a bridge (Fig. *b*) over the pan.

The solid is weighed in air, then suspended from a hook on the pan or pan support by a wire of known weight, so that it hangs totally submerged in the vessel of liquid, and again weighed.

B. *Jolly Balance.*—A large delicate spiral spring supported by a vertical rod of adjustable length and carrying at the bottom two pans, one below the other. For description see JOLLY BALANCE.

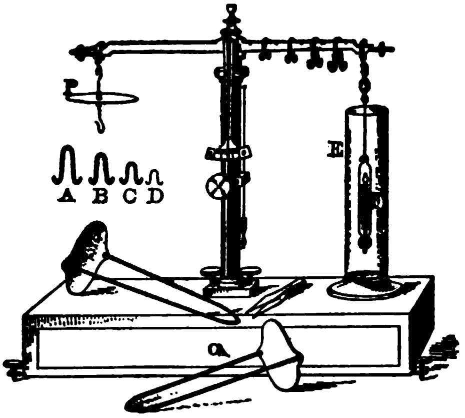
C. *Specific Gravity Bottle.*—A light glass flask with a ground stopper generally pierced with a fine hole so that it may be completely filled. The flask is weighed empty, then full of water. Knowing the density of water, the internal volume is calculated. The bottle may now be filled with a liquid of unknown density and weighed and the density calculated. Or a weighed amount of solid in small pieces may be put in the bottle, which is then filled up with water and weighed. The difference between the weight of the solid plus that of the bottle entirely filled with water and the weight observed is the weight of water displaced by the solid. This is the most accurate method for liquids and solids in small bits.



SPECIFIC GRAVITY BOTTLE OR PYCNOMETER.

A, simple form; *B*, with thermometer.

D. *Mohr's Balance.*—A balance beam divided into tenths carries suspended from one end by a platinum wire a glass cylinder, *F*, almost solid. On the other end is a counterpoise, *P*, balancing the cylinder in air. Riders, *A*, *B*, *C*, *D*, are provided of weight equal to the loss of weight of the cylinder in water at 15° C. and of 1-10, 1-100, 1-1000 this weight. When the cylinder hangs in a jar, *E*, filled with a liquid whose density is desired, these riders are adjusted on the beam so that balance is restored, and the position of the riders then gives directly the specific gravity referred to water at 15°. Thus with the riders as in the figure the specific gravity would be 0.8642. The glass cylinder carries a small thermometer, and the temperature should be adjusted to about 15°. The method is extremely convenient to three places of decimals. The fourth requires many corrections.



SPECIFIC GRAVITY, MOHR'S BALANCE.

E. *Hydrometer.*—A long hollow glass cylinder or "stem" weighted at one end by a bulb containing shot or mercury so that it will float upright in a liquid. The stem is graduated and the specific gravity is given by the mark to which it sinks, read *through* the liquid. The graduations are sometimes in specific gravity or density, but often according to established arbitrary scales, those of Beaumé and Twaddell being best known. Instruments are of different styles for milk, spirits, oil, acids, etc. See HYDROMETER.

F. *Balancing Columns.*—A tube such as that shown is supported vertically in two jars containing two liquids. These are drawn up into the tubes by suction on the tube at the top, which is then closed. The heights of the liquids in the tubes above their surfaces in the tumbler are inversely as their densities. If the liquids do not mix a simple inverted U tube may be used, one liquid being poured into each arm. If tubes less than half an inch in diameter are used the liquids should be drawn up only a little, heights measured, then as far as possible, and the ratio of the *increase* in lengths of the columns taken.

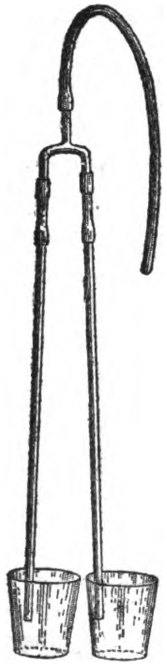
G. The specific gravity of a solid lighter than water is found by either the hydrostatic or Jolly's balance, a weight being attached sufficient to sink it. This weight should hang under water throughout.

III. **Specific Gravity of Gases. Bunsen's**

Method. The rate of effusion of a gas, i.e., the volume escaping per second through a very small opening, is for a given opening and difference of pressure inside and out, inversely as the square root of its density.

Near the top of a long vertical glass tube is a partition consisting of a disk of platinum pierced by a hole about 0.0005 inch in diameter. Above this the tube is closed by a ground stopper. The tube is filled with gas and plunged into a deep bath containing mercury and adjusted until a glass float on the mercury stands at a fixed level. The stopper is removed and the time required for the float to rise to another fixed level as the mercury drives out the gas is measured. The experiment is then repeated in exactly the same manner with the standard gas. The ratio of the times observed is the square of the ratio of the densities, i.e., the specific gravity of the unknown gas referred to the standard gas. See MOLECULES—MOLECULAR WEIGHTS.

HYDROMETER.



APPARATUS FOR METHOD OF BALANCING COLUMNS.

Consult Landolt and Börnstein, *Physikalisch-Chemische Tabellen* (Berlin, 1905), and "Smithsonian Physical Tables," in Smithsonian Institution, *Miscellaneous Collections*, vol. lxiii, no. 6 (6th rev. ed., Washington, 1914).

SPECIFIC HEAT. See HEAT.

SPECIFIC LEGACY. See LEGACY.

SPECIFIC PERFORMANCE. A technical legal term employed to denote the equitable doctrine and rules under which a court may compel a party who has refused to perform his part of an agreement to carry it out according to its terms. In an action at law for the breach of a contract the only relief possible is damages, but as money is not always an adequate compensation for the loss which may be suffered, the courts of equity will in certain cases decree a specific or actual performance of the terms of the contract. This lies in the discretion of the court, but precedents must be followed as a guide. In general, to obtain a decree of specific performance the plaintiff must satisfy the court that the remedy at law is inadequate; that there was a valid, fair, and reasonable contract between the parties; that he has done nothing inequitable on his part. It is a general rule to grant specific performance of contracts for the conveyance of real estate; only in exceptional cases will relief be granted in cases of contracts to convey personal property, and then only when the article is unique in its character and practically unobtainable elsewhere, such as a rare picture not to be duplicated. In a few cases specific performance of a contract to do some act, such as build a structure, will be decreed. For example, where a railroad agreed to build an ornamental bridge over a private roadway in consideration of the right of way through a man's premises, the court decreed that the company should construct the bridge according to the contract. While it is the general rule that the courts will not compel the specific performance of an act requiring personal skill, as in the case of actors, an exception is made where the agreement to do the act for one person is accompanied by an express agreement not to act for any one else. In such cases the courts will enforce the negative agreement and thus indirectly give the desired relief. Consult Sir Edward Fry, *Treatise on the Specific Performance of Contracts* (5th ed., Toronto, 1911). See also CONTRACT and EQUITY and authorities there referred to.

SPECK VON STERNBURG, HERMANN, BARON (1852–1908). A German diplomatist, born at Leeds, England. After studying military and naval science and international law he entered the army and served throughout the Franco-Prussian War. From 1885 to 1890 he was the German military attaché at Washington, D. C. In the following year he entered the diplomatic service as Secretary to the Legation at Peking, China. In 1896 he was sent to Buenos Aires, and soon afterward to Belgrade, Servia. In 1898 he became First Secretary to the German Embassy at Washington and in 1900 was appointed Consul General for British India and Ceylon. From 1903 until his death he served as Ambassador to the United States. The tariff arrangements made between Germany and the United States in 1906–07 were largely the result of his efforts.

SPECTACLED BEAR (so called from the marking on the face). The small bear of the northern Andes. See BEAR.

SPECTACLES, or EYEGLASSES (Lat. *spectaculum*, show, from *spectare*, to behold, from *specere*, to see; connected with Gk. *σκέπτεσθαι*, *skeptesthai*, to look). A device for the purpose of aiding the sight when impaired by age or otherwise. (See SIGHT, DEFECTS OF.) The term "spectacles" is more definitely applied to a frame which has side pieces fitting over the ear. Eyeglasses or *pince-nez* are frames supported by a clasp fitting to the sides of the nose. Spectacles were invented during the thirteenth century. The credit is attributed by some to Alessandro di Spina, a Florentine monk; by others to Roger Bacon. The lenses are made of the best optical glass, and ground with extreme care. Lenses may be mounted as either eyeglasses or spectacles, care being taken that the centre of the lens is opposite the pupil and that the glasses are tilted at a proper angle for reading or distance as desired. When separate lenses are required for these purposes the so-called bifocal glasses may be used. They are made by cementing a small strong lens upon the lower part of the other, so that when the eyes are lowered, as in reading, the line of vision passes through that portion. Lenses are now numbered, with one of a focus of one meter as a unit, known as one diopter. One with four times that strength has a focal distance of one-quarter of a meter and is known as 4 D. (diopters). Convex spherical lenses are used in hypermetropia, presbyopia, and after removal of the crystalline lens for cataract. Concave spherical lenses are employed in myopia. If astigmatism exists a cylindrical lens, either concave or convex as required, is used. As the astigmatism may be in only one meridian, or, since there may be either hyperopic or myopic astigmatism in both, or hyperopic in one and myopic in the other, it is sometimes necessary to employ cross-cylinder lenses, a combination of two cylinders with their axes at right angles to each other. Prismatic glasses are used in cases with weakness of ocular muscles, one being chosen which will make the images seen by the two eyes coincide. Combinations of cylindrical and spherical lenses and prisms are needed when errors of refraction or accommodation are combined with astigmatism and muscular weakness, which cause double vision. Colored glasses, designed to protect the eyes from light, either natural or artificial, are made in tints, viz., smoked, amber, amethyst, greenish yellow (the so-called euphus), blue, and green. Of late years a lens has been perfected which has the same refractive power in every plane, whereas the old-style lens was only absolutely perfect at its centre. Consult: C. F. Prentice, *Ophthalmic Lenses* (2d ed., Philadelphia, 1907); R. D. Pettet, *Mechanics of Fitting Glasses* (Chicago, 1913); Sir William Crookes, *The Preparation of Eye-Preserving Glass for Spectacles* (London, 1914).

SPECTATOR, The. 1. A famous periodical published daily in London from March 1, 1711, to Dec. 6, 1712, to which Addison and Steele were the principal contributors. Addison wrote 274 papers, Steele 236. Addison's essays, almost perfect in form, fixed a new standard in manners, morals, and taste, whose influence lasted for years. The *Spectator* was revived in 1714, when 80 numbers were issued, of which Addison contributed 24.

2. A London weekly periodical, founded in 1828, devoted at first solely to literature and social questions; politics were, however, introduced and it became a strong advocate of the Reform Bill. The first editor was Robert S. Rintoul, who continued in office till his death in 1858. John Stuart Mill was a member of the staff. From 1861 to 1897 it was edited by Richard Holt Hutton, who wielded great influence in literature and theology, while his partner, Meredith Townsend, managed politics, which were liberal until 1886. In 1897 John St. Loe Strachey became editor and owner, and the political attitude of the paper became Liberal-Unionist.

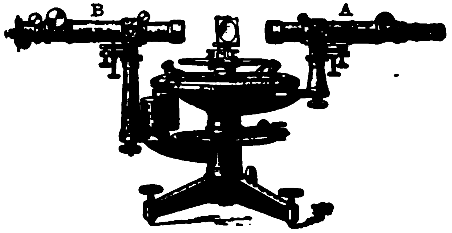
SPECTRAL BAT. See BAT, and Colored Plate of MAMMALIA.

SPECTRAL PHOTOMETRY. See SPECTROPHOTOMETRY.

SPECTRE (from Lat. *spectrum*, appearance, image, apparition). A fanciful book name for one of the small lemurine animals of the Malayan region, the tarsier, on account of its gaunt form, enormous eyes, and nocturnal appearance. Many superstitious notions attach to these and related animals (see LORIS) among the natives of the East Indies, causing them to be regarded with more dread than curiosity. Their nocturnal and irregular appearance have caused certain bats and small owls also to be called spectral.

SPEC'TROGRAPH (from Lat. *spectrum*, appearance, apparition, from *specere*, to see + Gk. *γράφειν*, *graphein*, to write). A particular form of spectroscope (q.v.) in which the apparatus to record the radiations is a photographic plate. The apparatus, then, consists of a collimator, a prism, or a grating, and a telescope in which the eyepiece is replaced by a photographic camera.

SPECTROM'ETER (from Lat. *spectrum*, appearance, image, apparition + Gk. *μέτρον*, *metron*, measure). An instrument especially designed to determine the index of refraction of transparent bodies. The ordinary type of instrument is illustrated in the cut, and, as shown, consists essentially of two arms which are movable around an axis carrying a platform on which rests a prism of the substance to be investigated. One of the arms carries a telescope, *A*, while the other supports what is known as the collimator, *B*. This consists of a tube at one end of which is a slit made by two movable parallel edges, and at its other end is a lens so placed that the slit is in its principal focus. If a source of light, for instance a sodium flame, is placed in front of the slit, a beam of parallel light will proceed from the collimator lens, fall upon the prism, suffer deviation, enter the telescope and be focused by the objective on the cross hairs of the eyepiece. The angles made between the telescope and collimator may be read on a scale attached to the platform of the instrument.



SPECTROMETER.

To determine the index of refraction of a substance in the form of a prism, for radiations of a given wave length, it is necessary to know: first, the angle of the prism, that is, the angle made between the two plane faces of the prism; second, the angle of minimum deviation for the given radiations. Both these quantities can be measured with the spectrometer, care being taken to have the axes of the telescope and collimator perpendicular to the axis of the instrument, and the edge of the prism parallel to it. The following formula then gives the index of refraction, in which *A* represents the angle of the prism and *D* the angle of minimum deviation:

$$\text{Index of refraction } n = \frac{\sin \dfrac{A+D}{2}}{\sin \dfrac{A}{2}}.$$

SPEC'TROPHONE. See PHOTOPHONE.

SPEC'TROPHOTOM'ETRY (from Lat. *spectrum*, appearance, apparition + Gk. *φῶς*, *phōs*, light + -*μετρία*, -*metria*, measurement, from *μέτρον*, *metron*, measure), or SPECTRAL PHOTOMETRY; see also SPECTROSCOPY and PHOTOMETRY). The study of the relative intensities of light of various colors from the same source or from different sources. Not only, as in ordinary photometry, may the relative intensities of two sources of white light or of monochromatic light be compared, but spectrophotometers are provided with dispersing prisms so arranged that the various colors of one beam of white light may be compared with the corresponding colors of another. The general method is to bring some of the light from one source and some from the other source side by side in the same field of view, and by suitable means to alter the intensity of either beam (or of both) in a known degree until a match or photometric equality is secured; this condition of equality being determined by the vanishing of the line of separation between the two portions of the field of view, illuminated respectively by the two sources to be compared. There is also a so-called method of contrast devised by Lummer and Brodhun.

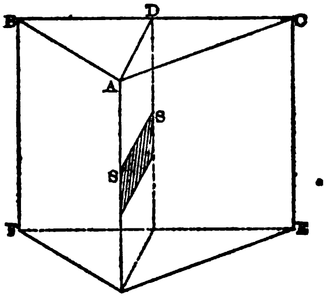


FIG. 1. DOUBLE PRISM, BRACE'S SPECTROPHOTOMETER.

One of the most efficient forms of spectrophotometer is that devised by Professor Brace of the University of Nebraska. It consists essentially (Figs. 1, 2) of a double prism *P* with a narrow silvered strip *SS* on the face *AD* of the right half. *T* and *T'* are two similar collimators symmetrically situated with respect to the prism and provided with adjustable slits through which the light from the two sources enters the optical system of the photometer. The amount of light entering the system through either collimator depends upon the width of its slits. The width of one slit, say *T*, is, after the initial adjustments of the instrument, kept fixed throughout any one series of observations, while the width of the other collimator slit (*T'*) may be altered at will to secure a match in intensity of the two beams. Light of the same wave length (i.e., of the same color) is thus brought by direct transmission from the collimator *T*, and after reflection at the silver strip from *T'*, to the same focus in the observing telescope *R*. When the eyepiece is removed and the prism viewed through a slit in the focal plane of *R*, the eye sees three fields (as in Fig. 3), the central one *ABCD* illuminated by light from the right collimator, *T'*, and the upper and lower ones, *ACF* and *BDG*, by light from the left collimator, *T*. The fields meet in the sharp edges of the silver strip. A match in intensity is secured by altering the width of the slit *T'*, which is controlled by an accurately turned screw carrying a graduated drum so that the width of *T'* can be altered at will by a known amount and thus the total amount of light passing through this collimator can be changed as desired. The intensities of two beams will be inversely proportional to the slit widths required for a match between them and the light coming through the fixed slit *T*. (This simple relation is not quite true; the deviations from it are treated in the articles cited below.) The amount of light coming through the collimator with the fixed slit may be altered without changing the width of the slit by means of a rotating disk with certain sectors cut out mounted directly in front of the fixed slit, so as to cut off the light during a certain fraction of each revolution. This device greatly increases the range of the instrument.

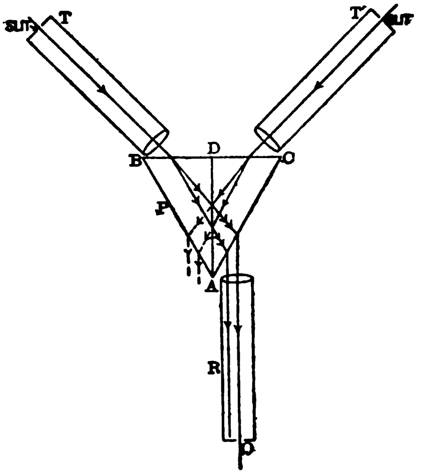


FIG. 2. OPTICAL SYSTEM, BRACE'S SPECTROPHOTOMETER.

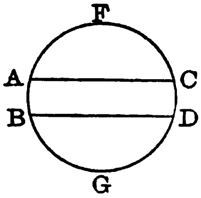


FIG. 3. FIELD VIEW OF SPECTROPHOTOMETER.

By turning the telescope *R* through a small angle the various colors of the spectrum may be brought into the field of view in succession, and the relative intensities of the two sources for each color determined.

A comparison of the intensity distribution in the spectra of the electric incandescent and arc lights with that of the sun gives the following results, where in each case the intensity of the sunlight is cut down until at the D line it equals that of the incandescent (or arc) light for the same wave length:

WAVE LENGTH	Inc. / sun	Arc / sun
800 μμ	11.86	1.67
Line A	4.88	1.37
" B	2.68	1.28
" C	1.25	0.97
" D	1.00	1.00
" E	0.38	0.77
" F	0.17	0.56
" G	0.10	0.83
" H	0.05	1.21

The reflecting power of a polished plane surface or the absorbing power of a thin film or plate of an absorbing medium can be determined for various colors by means of a spectrophotometer, by placing the mirror or the thin film in front of the adjustable slit T', and comparing the intensity of the light after reflection or transmission with the intensity of the light coming directly to the other collimator of the photometer. For example, a polished silver surface reflects 95 per cent of the red light falling on it normally, while for the blue only 60 per cent is reflected. A mirror of solid cyanine reflects 15 per cent of the orange, 2 per cent of the green, and 6 per cent of the violet. The flicker photometer, described under Photometry, can also be used as a spectrophotometer, and it has certain advantages over all others.

Bibliography. The methods of observation and of calibration and the sources of error are fully treated in the following articles: Lummer und Brodhun, in *Zeitschrift für Instrumentenkunde*, 1889 (Berlin, 1889, 1892); Murphy, in *Astro-Physical Journal* (Chicago, 1897); Brace, in *Philosophical Magazine* (London, 1899), and *Astro-Physical Journal* (Chicago, 1900, 1902); H. E. Ives, in *Transactions of the Illuminating Society of New York*, vol. iii (New York, 1908); Uppenborn-Monasch, *Lehrbuch der Photometrie* (Munich, 1912).

SPEC'TROSCOPE (from Lat. *spectrum*, appearance, image, apparition + Gk. *σκοπεῖν*, *skopein*, to view). An instrument designed to investigate the nature of the radiations emitted by various sources of light, it being understood that this term includes all waves in the ether, although only those within certain narrow limits of wave length affect the sense of sight. It is shown in the article on Spectroscopy that radiations are being sent off in the ether from all natural bodies, and that these are in the form of waves of different wave length. When these waves pass through a spectroscope they are dispersed in such a way that the waves of certain wave length are brought to focus at a point different from that to which waves of a different wave length are brought. In this way the radiations from any source are analyzed and spread out in what is called a spectrum. The essential features of a spectroscope are then: first, a slit, or extremely small source of radiation; second, some means of producing dispersion; third, a lens or other means of focusing the radiations at the eyepiece of a telescope, upon a screen, or upon some suitable recording instrument. If the radiations are of such a nature as to affect a photographic plate, i.e., if they are in the ultraviolet or in the visible portion of the spectrum, methods of photography may be used in connection with the spectroscope. (See Spectrograph.) If the radiations are in the infra-red, i.e., if the wave lengths are so long that they do not affect the sense of sight, instruments must be used which are sensitive to such radiations; for instance, a thermometer, bolometer, radiomicrometer, radiometer, or other heat-registering device. It has been found that if a plate of glass covered with some phosphorescent substance, such as Balmain's paint, is exposed to light and then carried into a darkened room, it will continue to be luminous for some time; but, if exposed in a spectroscope to infra-red radiations, the phosphorescence at those points reached by the radiations is destroyed. This furnishes a method, therefore, for the study of these long waves.

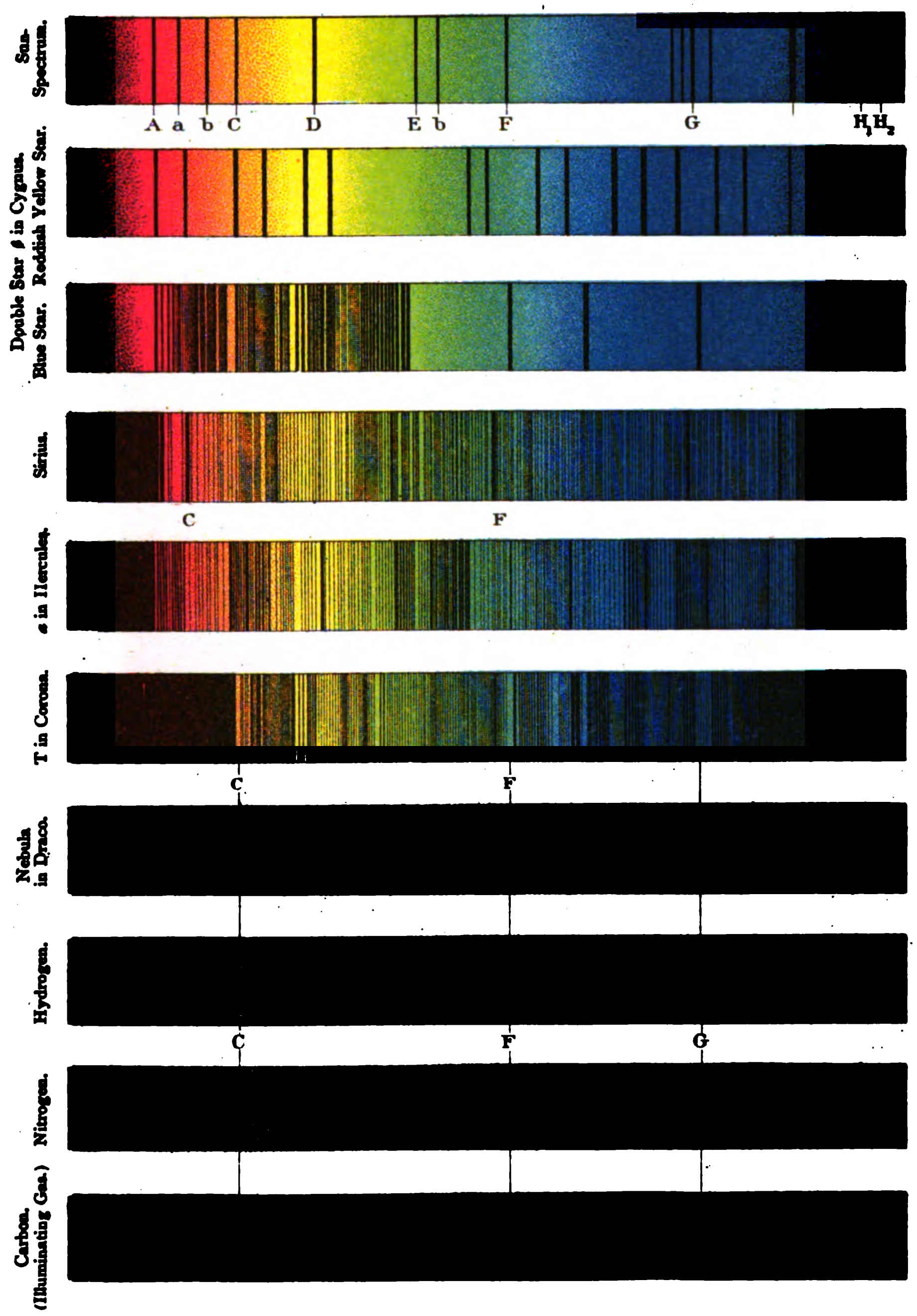
As ordinarily constructed, a spectroscope has the same general appearance as a spectrometer (q.v.). There is, however, in addition, in case prisms are used to produce dispersion, some auxiliary apparatus for the purpose of enabling the observer to record numerically the positions occupied by the waves which he is observing, in comparison with other waves. One method which is in common use is to attach to the instrument a tube containing at one end a transparent scale and at its other end a lens, the tube itself being so placed that when the scale is illuminated by a lamp the waves proceeding from it fall upon the last face of the last prism and are reflected in such a manner as to be brought to focus in the same plane as are the radiations under investigation. By this means there is produced across the spectrum a series of lines regularly spaced and numbered, and the position of any radiation can be recorded.

Various means are used to produce dispersion, but the two methods most generally adopted are (1) to interpose a prism or train of prisms between the collimator and telescope, or (2) to allow the light from the collimator to fall upon a diffraction grating. The dispersing action of a prism and of a grating has been explained before (see Diffraction and Diffraction Gratings); but there are several important differences between the spectra obtained by these two instruments. Prismatic spectra are said to be irrational because there is no simple relation between the material and shape of the prism and the dispersion produced by it; and, further, because prisms of the same shape and size produce quite different spectra, in the sense that the relative deviations of the same waves differ widely when different prisms are used. See Dispersion.

The spectra produced by plane gratings, on the other hand, obey a definite law, there being an extremely simple relation between the constants of the grating and the deviation of a given train of waves, which is independent of the material of the grating, and which enables one by simple means to measure the wave length of the radiations being studied. If a concave grating is used in place of a plane one, as was first done by Rowland in 1882, it is not necessary to have lenses in the spectroscope, the essential parts of the instrument then being simply a slit, a grating, and some receiving apparatus, such as a photographic plate. There is a further advantage in the use of a concave grating (which may also be obtained with a plane grating if suitably adjusted) if this instrument is used in the standard manner, in the fact that the spectra produced are of such a kind that the distances along the photographic plate are proportional to differences in wave length of the waves which are thus recorded. A spectrum of this kind is said to be normal. Consult T. T. Baker, *The Spectroscope: Its Uses in General Analytical Chemistry* (New York, 1907), and H. F. Newall, *The Spectroscope and its Work* (London, 1910).

SPECTROS'COPY. The science which deals with the methods of production of the spectra by various sources of light (or of waves in the ether) and with their study and interpretation. Newton, in 1672, was the first to observe that if sunlight entering a darkened room through a small opening were allowed to fall upon a prism a spectrum was produced, owing to the fact that waves characteristic of different colors suffer different deviations by the prism, and that, therefore, the components of white light were separated. (See Dispersion.) Newton made no

SPECTRUM



SPECTRA OF THE FIXED STARS AND NEBULAE COMPARED WITH THE SUN-SPECTRUM AND OTHER SPECTRA

observations except upon the visible portions of the spectrum; but in the year 1800 F. W. Herschel observed that the spectrum continued beyond the red, as was shown by holding a thermometer in that position; and in 1801 J. W. Ritter proved the existence of the ultra-violet light by showing that silver chloride was affected not alone by the violet portion of the spectrum, but beyond. In 1802 Wollaston made the discovery that the solar spectrum was not continuous, but was interrupted by certain dark lines, using in his experiments a slit and a prism with its edge parallel to the slit. It is remarkable that Newton did not make this same discovery in his investigation on the spectrum of the sun, because he also at times used a slit in the same manner as did Wollaston. The most important investigation, however, on the solar spectrum, one which in fact serves as the foundation of the science of spectroscopy, was that of Fraunhofer, beginning in the year 1814. Fraunhofer (q.v.) was the inventor of the diffraction grating and was the first to measure accurately the wave lengths of light waves. By using both grating and prism spectroscopes he showed that there were numerous dark lines in the solar spectrum, to the strongest of which he gave certain names in the form of letters, A, B, C, etc. He studied, further, the radiations from certain of the stars and from certain sources of light, such as flames, etc. He made the important observation that the position occupied in the solar spectrum by the dark D lines is identical with that occupied by the bright yellow line observed in the spectra of all flames. His whole work was epoch making.

Herschel was the first to investigate the absorption spectra produced by various bodies, that is, to study the effect of interposing between the source of light and the spectroscope a substance which absorbs certain radiations. The next great step was made by Kirchhoff, who showed from theoretical considerations that the emission spectrum and absorption spectrum of a substance should be the same at a definite temperature, and that as the temperature changed the intensity of the spectra would vary. In this way Kirchhoff was able to explain the dark lines in the solar spectrum as due to an absorbing layer of metallic vapors forming an atmosphere around the white-hot central portion of the sun, which was supposed to emit a continuous spectrum. In collaboration with Bunsen he then undertook a careful study of the spectra of various substances and founded the science of spectrum analysis. The explanation of the fact that absorption spectra and emission spectra are identical was first given by Stokes many years before Kirchhoff's statement, and Balfour Stewart had also arrived at the same idea. From the day of Kirchhoff up to the present time all branches of spectroscopy have been pursued most vigorously, the most important discovery being the principle of the concave grating, made by Rowland in the year 1882, which is discussed under SPECTROSCOPE and under DIFFRACTION AND DIFFRACTION GRATINGS.

There are many methods of making vapors luminous, among which it may be sufficient to name the flame, the electric arc, the electric spark. The spectra produced in these various ways have received the names of flame spectra, arc spectra, etc. The standard method of producing flame spectra is to hold a portion of the substance to be investigated or a salt of the substance in the Bunsen flame until it is vaporized, and thus the vapor is raised to the temperature of the flame, and in general becomes luminous. Other flames than that of the Bunsen burner may be used. Extremely minute amounts of the substance may be recognized in this way, as has been shown by Kirchhoff and Bunsen. They state that one fourteen-millionth of a milligram of sodium can be recognized in the Bunsen flame, one sixty-thousandth of lithium, one fifty-thousandth of a milligram of calcium, etc. To produce arc spectra it is customary to bore out a small opening in a carbon rod, fill this with some salt of the substance to be investigated, and then use it as the positive pole in the ordinary electric arc. By this means a high temperature is produced, viz., about 4000° C., and the vapor of the substance is made luminous. To produce the spark spectrum numberless methods are in use. Among these it may be sufficient to mention two. If the electric spark produced by an induction coil or transformer is made to pass between solid electrodes made up of the substance to be studied, they will be vaporized and the vapor will be luminous. If a gas, e.g., nitrogen or hydrogen, be inclosed in a glass bulb into which enter two metal wires to serve as electrodes, and if the pressure be made sufficiently low, a spark can be made to pass through the remaining gas. Changes in the pressure, in the electrical constants of the circuit, etc., produce alterations in the spectra. The main distinction between the flame spectra and arc spectra is one of temperature, but so little is known in regard to the mechanism of a spark that no conclusions can be drawn with certainty. Beyond a doubt the spectra produced in the arc are due in the main to the high temperature of the arc, whereas the cause of the production of spectra in the spark is probably not a temperature effect at all, but something concerned with the transformation of electric energy.

The means of producing spectra are discussed under the head of SPECTROSCOPE (q.v.). Prisms or gratings are used for this purpose. The accepted method at present for measuring wave lengths in the spectrum of any substance is to photograph on the same plate with these lines the spectrum of some substance whose lines are known and then to obtain the desired quantities by a method of interpolation. The spectrum of iron is as a rule used to give the comparison lines.

It has been found as a result of careful observation that, with one or two doubtful exceptions, the spectrum of a solid or liquid is always continuous; and within recent years attempts have been made successfully to express in mathematical form the connection between the temperature of the solid and the distribution of energy in its spectrum as a function of its wave length. These laws have been deduced theoretically and verified by experiment. (See RADIATION.) It has been found further that the spectrum of a gas when rendered luminous is in all cases discontinuous, although occasionally there is a faint continuous background. This fact in regard to gaseous spectra is what would be expected from the kinetic theory. The exact origin of the spectrum is in general inside the atom; but the connection between the parts of the atom and the ether in which waves are produced is not known. The spectra of compounds when rendered luminous at a temperature not sufficient to decompose definitely the substance have been studied with care, and many interesting facts have been discovered.

It has been shown that all gases will produce under varying conditions different spectra, but the reason for this is by no means clear. There are at least three different spectra of hydrogen, many of oxygen, many of argon, etc. The influence of pressure, of temperature, and of the electrical conditions is marked; and these subjects form at present one of the most important fields of research in spectroscopy.

The spectrum of a gas is modified if the source of light is either approaching or receding from the spectroscope, as, for instance, in the case of a star with a motion towards or away from the earth. It is owing to this fact that one is able, by a comparison of the spectra of certain stars with spectra produced here on the earth, to calculate the motion of the stars in the line of sight. See DOPPLER'S PRINCIPLE.

A careful comparison of the lines in the spectrum of any one gas or vapor, and of the spectra of different vapors, has led to the discovery of several simple mathematical laws connecting them. Thus the lines in the ordinary hydrogen spectrum have such wave lengths that they can be expressed in a mathematical formula which is known as Balmer's law. This can be expressed as follows: $\lambda = h\frac{m^2}{m^2 - 4}$, where λ represents the wave lengths, m has in succession the values 3, 4, 5, etc., and h is a constant whose value is approximately 3647.20.

A relation similar to this of Balmer's has been shown by Kayser and Runge to apply to most of the lines in the spectra of the alkalies and the alkaline earths. Another law has been found to express most accurately the distribution of the lines in the well-known bands which are produced by carbon, nitrogen, and other substances. Laws have been found also connecting the spectra produced by different substances, in those cases where these substances are related chemically.

In the year 1896 Zeeman discovered that a source of light if placed in a magnetic field and viewed either along the lines of force or at right angles to them had its spectrum changed by the resolution of its lines into several components. This fact has a most important bearing upon theories of matter and serves to prove that the vibrations in the ether are produced by the vibrations inside the atom of minute electrical charges which have been called electrons. A recent investigation of the Zeeman effect by Runge has shown that the components of these spectrum lines produced by the magnetic field also obey certain mathematical laws.

A most important branch of spectroscopy is the study of the solar spectrum as we observe it on the earth. A few of the absorption lines are due to the fact that the waves coming from the sun pass through the atmosphere of the earth, and, therefore, suffer absorption owing to the water vapor and oxygen in it. The "rain band" is due to the presence of the former. The other lines are, as explained above, caused by the absorption in the atmosphere of the sun itself. The interior portion of the sun, which is at a high temperature, emits a continuous spectrum, but, owing to the presence in the atmosphere of the sun of metallic vapors at a temperature less than that of the interior, there is absorption, and thus the solar spectrum is a continuous one crossed by dark lines. There are radiations also coming to us from the outer portions of the sun, the so-called chromosphere and corona; but these are not easily observed, except at times of solar eclipses. Most of the solar lines can be identified with the spectra of known substances on the earth; for instance, sodium, iron, carbon, etc., are known to be in the sun. It may be stated in general that if the earth were raised to a temperature as high as that of the sun its spectrum as seen at a distance would be practically identical with that of the sun as we see it.

A careful study has been made of the spectra of the various stars, and attempts have been made with more or less success to group the stars in certain classes according to their spectra, the idea being that some knowledge might be obtained in regard to the evolution of the stars and their present stage in this progress. Consult Schuster, "The Evolution of Solar Stars," *Astrophysical Journal*, April, 1893.

The wave lengths of a few of the important Fraunhofer lines in the solar spectrum, as measured by Professor Rowland, are as follows:

B........	6870.186	x 10^{-8} cm.	F........	4861.527	x 10^{-8} cm.
C........	6563.045	"	G.....	4308.081	"
D_1........	5896.357	"		4307.907	"
D_2........	5890.186	"	H........	3968.625	"
E_1........	5270.495	"	K........	3933.825	"
E_2........	5269.723	"			

Bibliography. T. J. H. Schellen, *Spectrum Analysis: Its Application;* English translation by J. and C. Lassell (London, 1872); Sir H. E. Roscoe and others, *Spectrum Analysis* (New Haven, 1872); Joseph von Frauenhofer, *Prismatic and Diffraction Spectra;* English translation by J. S. Ames (New York, 1898); Sir J. N. Lockyer, *Inorganic Evolution as Studied by Spectrum Analysis* (London, 1900); Heinrich Kayser, *Handbuch der Spektroscopie* (6 vols., Leipzig, 1900–12); Stewart and Kirchhoff, *Radiation and Absorption* (New York, 1901); W. N. Watts, *Introduction to the Study of Spectrum Analysis* (ib., 1904); John Landauer, *Spectrum Analysis* (2d ed., ib., 1907); E. C. C. Baly, *Spectroscopy* (new ed., ib., 1912). Bibliographies: W. N. Watts, *Index to Spectra* (rev. ed., Manchester, 1889, with *Appendices;* ib., 1891 to date); Alfred Tuckerman, *Index to Literature of the Spectroscope*, published by the Smithsonian Institution (Washington, 1902). See LIGHT.

SPEC'TRUM. See DISPERSION; LIGHT; SPECTROSCOPE; SPECTROSCOPY.

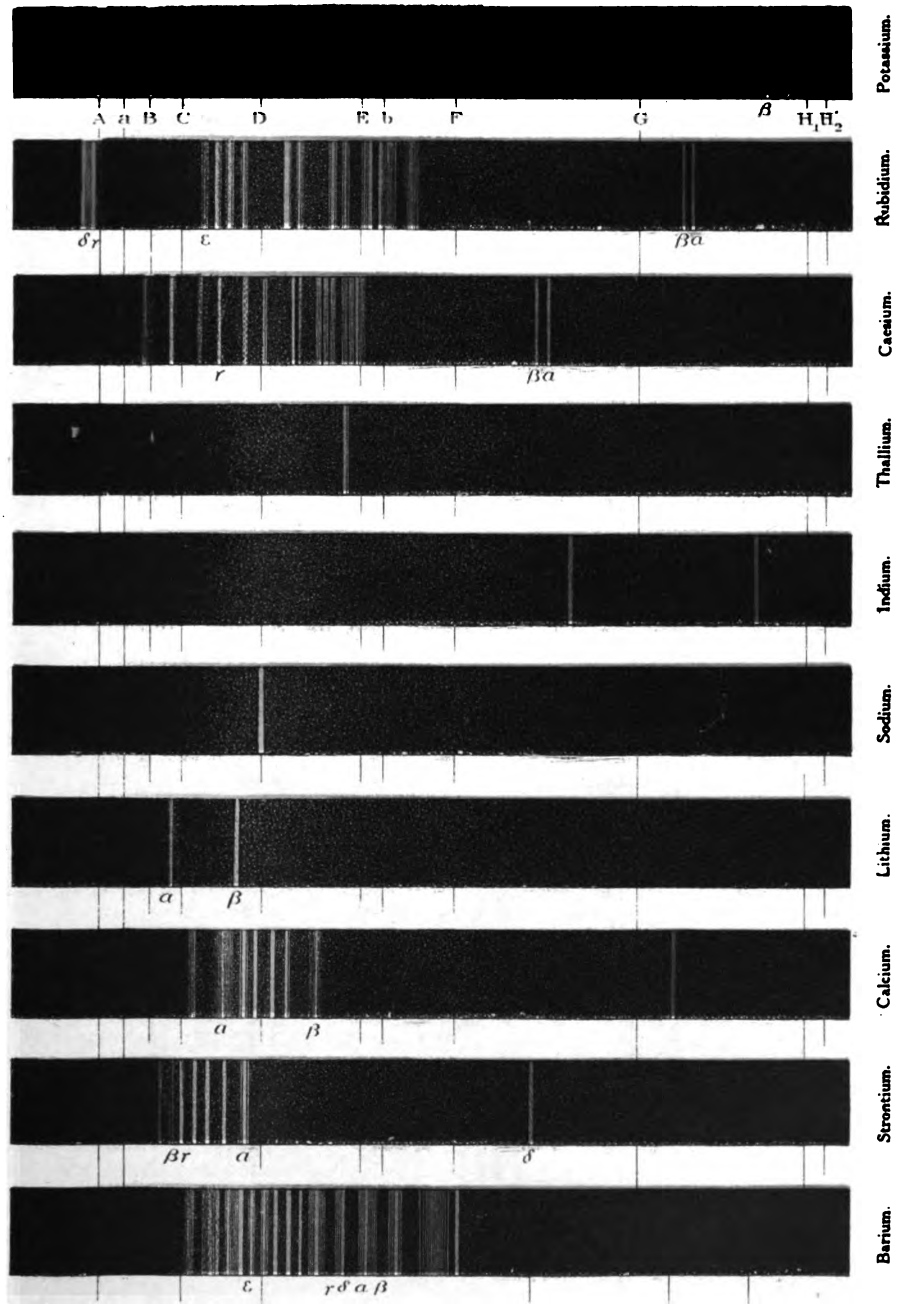
SPECTRUM ANALYSIS. The process of ascertaining the constituents of a substance by means of the spectrum emitted. See SPECTROSCOPE; SPECTROSCOPY.

SPEC'ULAR IRON ORE. See HEMATITE.

SPEC'ULA'TION (Lat. *speculatio*, exploration, contemplation, from *speculari*, to watch, spy out, from *specula*, watchtower, from *specere*, to see). Buying and selling of property chiefly with a view to securing a profit through changes in its price. There is a speculative element in many business transactions; but the term is usually confined to those in which the element of risk is important. Formerly speculation was largely engaged in seeking to take advantage of differences in price in distant markets. Foreign trade 100 years ago was highly speculative. Improvements in transportation and in means of communication have reduced such differences to a matter of exact calculation, and speculative business has come to be confined almost exclusively to transactions involving the time element.

In its simplest form time speculation involved the buying of property outright, and the holding of it in anticipation of a rise in price. This prac-

SPECTRUM



SPECTRA OF THE METALS OF THE ALKALIES AND ALKALINE EARTHS.

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JULIUS BIEN & CO. LITH. N.Y.

tice is as old as civilization, and until lately has usually been regarded as socially injurious. At the end of the seventeenth century the practice developed in Holland of buying and selling the products of fishing voyages before the results of the voyage were actually known. In the early part of the eighteenth century speculation in grain, coffee, etc., was active in Amsterdam, developing many of the practices of modern exchanges. In these early forms of speculation, however, what was bought and sold was the right to a particular lot of goods. With the development of warrants and the grading of goods speculation received a new impetus. It became possible for a man to sell goods he did not possess, since he could at any time secure identical goods upon the market by paying the price. It is largely to this principle that the phenomenal development of speculation in recent years is due. For the extent of speculative dealings and the practices of modern exchanges, see Stock Exchange.

Economic Function of Speculation. When the supply of any commodity is subject to great uncertainty, as the products of agriculture, it is manifestly to the advantage of society that it should be properly distributed through a long period. Individuals who study the conditions of demand and supply endeavoring to buy such commodities when they are abundant and cheap, in order to sell them when they are dear, serve to bring about such a distribution of consumption and render important social service. Again commodities like iron are subject to fluctuations in demand, and hence in price, thus introducing a large element of uncertainty into all the industries which make extensive use of them. The speculator, by making contracts to deliver the article at a future date at a fixed price, frees the consumer from that uncertainty. Legitimate speculation thus serves as a means of insurance against certain classes of risks.

It may be that the speculator is mistaken in his estimates of future supply and demand. In that case he exaggerates the evil which it is his function to minimize. Thus speculation may keep prices abnormally high for a period, only to render prices abnormally low for a succeeding period. Speculation may thus bring about a crisis (q.v.) with attendant industrial stagnation.

A more serious evil results from the fact that speculation is carried on not only by those who are conversant with market conditions, but by a large class of individuals who engage in it without the proper equipment of technical knowledge. Unscrupulous operators, through false reports, or through their own apparent eagerness to buy or sell, often lead unsophisticated speculators to financial ruin. Such influences tend to increase business uncertainty, and diminish considerably the net social gain from speculation.

Popular sentiment in England and America has generally been hostile to speculation, and laws have frequently been passed to prevent it. An act of Parliament was passed in 1733, "To prevent the infamous practice of stock-jobbing." The act had no effect and was repealed in 1860. In America an act was passed in 1864 to prevent speculation in gold, but its operation was so unsatisfactory that it was repealed in two weeks. In several of the States laws have been enacted aiming to prohibit speculation in one form or another. These have proved quite ineffective.

SPECULUM DIANÆ. See Nemi.

SPED'DING, James (1808–81). An editor of Bacon's works. He was born in Cumberland, England. From the grammar school at Bury St. Edmunds he passed to Trinity College, Cambridge, where he graduated in 1831. Leaving Cambridge in 1835, he entered the Colonial Office. This position he gave up in 1841 that he might devote himself to the study of Bacon. For 30 years he continued his researches. Spedding's most delightful book is *Evenings with a Reviewer* (written in 1845, privately printed; published 1881), in which with quiet humor Macaulay's essay on Bacon is torn into shreds. His magnum opus is an edition of Bacon's entire works with an exhaustive life (14 vols., 1857–74), and on this he was in some degree aided by Leslie Ellis and D. D. Heath. The biographical and historical parts of this work, much cut, were published under the title, *Account of the Life and Times of Bacon* (2 vols., 1878). Spedding also contributed articles to J. Gairdner's *Studies in English History* (1881) and wrote several other admirable historical papers. A pamphlet, *Publishers and Authors* (1867), also came from his pen; and *Reviews and Discussions* (1879) is composed of reprints from the *Edinburgh* and *Fraser*. Consult the memoir of G. S. Venables prefixed to *Evenings with a Reviewer* (London, 1881); Edward Fitzgerald, *Letters* (ib., 1889); Baron Tennyson, *Alfred, Lord Tennyson: Memoir* (new ed., New York, 1911).

SPEE, shpā, Maximilian, Count von (1861–1914). A German naval officer, born at Copenhagen, Denmark. Prominent in naval strategy, he was presumably author of the German plans for assembling scattered ships under his command after the outbreak of the European War in 1914. The success of these plans resulted in the surprise and defeat of Admiral Cradock's squadron at Coronel off the coast of Chile on Nov. 1, 1914. On Dec. 8, 1914, Von Spee's fleet was attacked and destroyed by the British fleet under Rear Admiral Sir Frederick Sturdee (q.v.) off the Falkland Islands. Admiral von Spee was lost with the German flagship *Scharnhorst*. See War in Europe.

SPEECH (AS. *spæc, spēc, spræc, sprēc*, OHG. *sprāhha*, Ger. *Sprache*, speech). The faculty of producing articulate sounds or words for the communication of ideas. Speech differs from voice in that the latter is rather the physiological potentiality and mechanical process. Speech is, so far as known, peculiar to man, although attempts have been made to assign it also to monkeys, while gesture language (q.v.) is probably shared by man with certain other animals. In a broader sense speech is also synonymous with language. See Language; Phonetics, etc.; Voice.

SPEECH, Defects of. See Aphasia; Deaf-Mute; Stammering.

SPEECH, Figures of. See Figures of Speech.

SPEECH, Parts of. See Grammar.

SPEECH, Visible. See Visible Speech.

SPEED, Harold (1873–). An English figure and portrait painter. He was born in London and studied at the South Kensington and Royal Academy Schools and on a traveling scholarship abroad. His art is "typical of the academic system in its freest form." He is an admirable draftsman, possesses imagination, a sense of values and of movement, and is conscientious in composition and execution. His men sitters include John Redmond, Holman Hunt, Elihu Vedder, and Sir Robert Baden-Powell. Good examples of his charming portraits of young women and children are Miss Johnson, Miss Craies (1908), and Curtsey O'Sullivan (1906). He also painted figure pieces, mural decorations, including a fresco in the Royal Academy refreshment room (1895), and landscapes. He is represented in the Tate Gallery, and the galleries at Liverpool, Bristol, and Melbourne. In 1913 he published *The Science and Practice of Drawing.*

SPEED, James (1812–87). An American politician, born near Louisville in Jefferson Co., Ky. He graduated at St. Joseph's College, Bardstown, Ky., in 1828 and after studying law at Transylvania University began its practice at Louisville in 1833. In 1847 he was elected to the State Legislature, where he served one term. He was the most effective opponent of the disunion cause in Kentucky, was elected to the State Senate in 1861, and in 1861–64 was in charge of the Kentucky recruiting stations. In 1864 he was appointed Attorney-General of the United States by President Lincoln, but he resigned from the post in 1866 because of his opposition to the reconstruction policy of President Johnson. In 1856–58 and 1875–79 he held a chair in the law department of the University of Louisville.

SPEED, John (c.1552–1629). An antiquary and cartographer, the son of a London tailor. Through the generosity of Lord Brooke he was able to give up manual labor and devote himself to study. Between 1608 and 1610 he published 54 maps of England and Wales, which were collected and described under the title of *Theatre of the Empire of Great Britaine* (1611). He next published the great work on which he had been engaged for many years: *The History of Great Britaine,* from the invasion of Julius Cæsar to King James I (1611). This is regarded as the best history up to that time written by an Englishman. He also published *Genealogies Recorded in Sacred Scripture* (c.1611), of which 33 editions appeared in the course of 30 years, some of them being attached to issues of the Bible, and *A Cloud of Witnesses Confirming the Holie Word* (1616).

SPEEDOMETER, in Motor Vehicle. See Motor Vehicle.

SPEEDWELL (*Veronica*). A genus of about 200 annual and perennial herbs and shrubs of the family Scrophulariaceæ, natives of temperate and cold climates. Some species grow in ditches and marshes, some only on the driest soils. They have generally very beautiful, small, blue, white, or pink flowers, for which several species are cultivated. The bitter and astringent leaves of the common speedwell (*Veronica officinalis*), widely distributed in the Northern Hemisphere, are in some countries used medicinally and as a substitute for tea, as are those of the germander speedwell. *Veronica virginica* is called Culver's physic in North America. Brooklime (q.v.) belongs to this genius. See Leptandra and Plate of Bloodroot, etc. in article Sanguinaria.

SPEER, Robert Elliott (1867–). An American religious leader and authority on missions. He was born at Huntingdon, Pa., graduated at Princeton in 1889, and studied at Princeton Theological Seminary in 1890–91. In 1891 he was appointed secretary of the Presbyterian Board of Foreign Missions. He visited missions in Persia, India, China, Korea, and Japan in 1896–97, and in South America in 1909, and made later similar tours. Under his leadership the foreign missions of the Presbyterian church became remarkably successful. Besides various inspirational books, he published: *A Memorial of a True Life: Biography of H. M. Beaver* (1898); *Presbyterian Foreign Missions* (1901); *Missionary Principles and Practice* (1902); *A Memorial of Horace Tracy Pitkin* (1903); *Missions and Modern History* (2 vols., 1904); *Christianity and the Nations* (1910); *The Light of the World* (1911); *South American Problems* (1912); *Studies of Missionary Leadership* (1914); *John's Gospel* (1915).

SPEICHER, spī'chẽr, Eugene Edward (1883–). An American portrait and landscape painter, born in Buffalo. He studied there at the Albright Art School; in New York at the Art Students' League and the Henri Art School. After studying also for two years in Europe, devoting himself especially to the old masters in Paris, Holland, and Spain, he settled in New York, and soon became known as one of the most promising of the younger group of American painters. His work is characterized by vigorous and sincere presentation and a refreshing sureness of technique. Among his best portraits are those of Miss Helen Appleton (Proctor Prize, National Academy, 1911); Charles Dana Gibson, Miss Mary Stuart Snyder, "The Girl in Rose" (1913), and John Nelson Cole (1914). A charming landscape, "Morning Light" (1912), is in the Metropolitan Museum. He became an associate of the National Academy of Design (1913).

SPEIER. See Speyer.

SPEISS, spīs (Ger. *Speise,* amalgam, food, OHG. *spīsa,* food, from OIt., ML. *spesa,* expense, cost, from OIt., *spendere,* from Lat. *expendere,* to expend, from *ex,* out + *pendere,* to weigh). A mixture of the compounds of copper, iron, and nickel with antimony, arsenic, and sulphur. It collects in the bottom of a crucible when ores of arsenic, antimony, cobalt, or lead, containing sulphur, are smelted with fluxes. Speiss consists usually of iron in large part, but contains often large quantities of nickel and cobalt. It is obtained in smelting the complicated lead ores occurring near Freiburg, Saxony, and also in reducing the copper ores of the Sudbury district and the silver ores of the Cobalt district, both in Ontario, Canada.

SPEKE, spĕk, Hugh (1656–?1724). An English author and agitator, son of George Speke of White Lackington, Somerset, who as a royalist suffered heavily during the civil war. Hugh Speke was educated at Oxford, and studied at Lincoln's Inn in 1680. In 1688 he was a spy for James II, and he obtained the confidence of the Prince of Orange. Speke's appeals to George I and to Queen Anne to reward his services were successful to the small extent of £100, on receipt of which, in 1703, he left for Ireland, where he had hopes of securing employment through Harley. He wrote *Memoirs of the Most Remarkable Passages and Transactions of the Revolution* (1709), reissued with certain changes as *The Secret History of the Happy Revolution in 1688* (1715).

SPEKE, John Hanning (1827–64). An English African explorer. He was born at Jordans, Somersetshire, entered the Indian army in 1844, served in the Punjab campaigns, and distinguished himself as a soldier, naturalist, and sportsman. While in the Indian service he made several trips into the Himalaya and even entered Tibet, bringing back valuable collections. He began his brilliant though brief career as an African explorer in 1854, when he accompanied Captain Burton into Somaliland. He was also Burton's companion on the expedition of 1857–59 from Zanzibar into the interior of Africa. In 1858 they discovered Lake Tanganyika, and in the same year, while Burton was ill at Kaze, Speke reached the Victoria Nyanza. He believed that he had found one of the sources of the Nile, but Burton discredited the information he brought back and Speke could not verify his discovery until 1862, when he returned to the lake with Capt. J. A. Grant, and, proceeding northward, came to the Nile, which he found to be the outlet of the lake. Speke was killed by the accidental discharge of his gun. His books were *Journal of the Discovery of the Source of the Nile* (2 vols., 1863; new ed., 1908), and *What Led to the Discovery of the Source of the Nile* (1864). His companion, Grant, also described their journey in *A Walk Across Africa* (London, 1864). See TANGANYIKA; VICTORIA NYANZA; BURTON, SIR RICHARD F.

SPEKE'S ANTELOPE. See NAKONG.

SPELL. See KNURR AND SPELL.

SPELLING (from *spell*, ME. *spellen*, OF. *espeler*, to spell, from OHG. *spel*, AS. *spell*, Goth. *spill*, tale). The representation of words by combinations of alphabetic symbols. In an accurately constructed alphabet there is but one symbol for each significant speech sound. Under these conditions spelling is determined solely by the pronunciation of the word to be spelled. Such phonetically correct orthography requires no special consideration apart from the alphabet employed. (See ALPHABET; ORTHOGRAPHY; PHONETICS; SPELLING REFORM.) Except in the writing of phoneticians, however, spelling of such precision does not exist, though in certain languages it is approximated. In customary spelling, there is usually alphabetic inadequacy, or a lack of symbols to represent certain speech sounds; redundancy, or use of two or more symbols to represent the same sound; and use of the same symbol or combination of symbols to represent two or more sounds. This divergence of customary spelling from the true alphabetic method has resulted, historically, in part, from defects in the alphabets themselves; but principally from continuous change in the sounds of the languages to which they have been applied. Since in every language pronunciation varies historically and geographically, the true phonetic character of an alphabet could be maintained only by continuous adaptation to these alterations of pronunciation.

As a matter of fact such changes in spelling have always taken place, and in modern European languages in particular (alone considered here) they have occurred abundantly, especially prior to the invention of printing; but ordinarily they have been effected under conditions unfavorable to phonetic precision, with the result that they have often tended to increase confusion instead of promoting accuracy. Ambiguities and irregularities multiplied, new associations between sounds and symbols were formed, and it became increasingly difficult to infer the pronunciation of a word from its written form. Moreover, this tendency towards phonetic corruption was intensified by a cause to which many defects of modern spelling may be attributed, i.e., the establishment of a "standard" orthography, due principally to the introduction of printing. The beginnings of such an inflexible system existed earlier, wherever certain spellings were recognized as customary and then as "correct" from the literary point of view (regardless of phonetic value); but its chief sources were the practical need of uniformity in spelling, which was quickly felt after printing once became established. From this fixation of orthography it resulted that practically all the existing faults of the spelling were rendered permanent. Pronunciation has continued to change, often radically, but spelling has lagged behind. In certain languages notable divergence of the written from the spoken language has thus been effected, while others, like Italian or Spanish, have been more fortunate in having had a relatively rational system of spelling from the beginning, with, accordingly, less need of variation.

These facts are well illustrated by English spelling, which presents a striking case of phonetic corruption. Its early form was to a large extent phonetic—the scribes sought to indicate the actual sounds of the words they wrote, using the Roman alphabet (with modifications) and giving its letters the values assigned to them in Latin pronunciation. As the sounds gradually changed, confusion set in; certain symbols had different values in different combinations; new ones were introduced, others lost; accentual marks over the long vowels used in Anglo-Saxon disappeared, increasing the difficulty in distinguishing the long from the short vowels. But the most important irregularities were due to the influence of Norman, and later of literary (Parisian) French, under which, in the thirteenth and fourteenth centuries, English was practically respelled in accordance with Anglo-French methods. Notwithstanding this confusion, English spelling continued to remain to a great extent phonetic. After the invention of printing, the choice of spellings was too frequently determined, unfortunately, by the judgment of the printer, to the detriment of our language. Alteration in response to phonetic change was not, indeed, wholly stopped, but it was made more and more difficult, and from the sixteenth century on the power of effecting any substantial phonetic improvement of English spelling has been lost. Notwithstanding many later modifications of details (there are still over 3000 words whose orthography is unsettled), the subsequent development of the spoken language is practically unrepresented in English orthography. Although the alteration of sound has been great, we still retain what is essentially the Elizabethan spelling.

Furthermore, under the influence of the revival of learning, which brought words of classical origin into prominence, the idea was developed that (regardless of their pronunciation) such words should be made to conform in spelling as nearly as possible to Latin and Greek terms from which they were ultimately derived. This etymological theory of spelling gained strength, mainly from the difficulty found by the printer in making a selection among existing forms, which offered an opportunity for the activity of pedants; and from the sixteenth century until the present time it has kept its hold upon orthography. There was much tinkering, not only with words directly borrowed from classical tongues, but with words of Romance origin, while native English and Scandinavian elements of the language were little interfered with. A result was the introduction of many forms erroneous from both the phonetic and philological points of view. A familiar example is the present English *debt* (from Middle English *det*, *dette*, from Old French *dette*), in which the *b* was etymologically inserted both in French (though later abandoned) and in English to make the spelling more directly suggest the original Latin *debita*, though it has never been sounded. On the other hand, this process in some cases actually corrupted pronunciation. For example, the *l* in *fault* (Middle English and Old French *faute*), inserted in the same way, to suggest the Latin *fallere*, has actually come to be pronounced, though the correct pronunciation still survived in the eighteenth century for Pope makes the word rhyme with *ought* and *taught*. Of etymological blunders, again, an instance is the *s* in *island*, inserted to indicate derivation from the Latin *insula* and connection with English *isle* (corrupted from *ile*), to neither of which it is related. One might form a long list of corruptions of this kind.

The results of the above-indicated history are briefly as follows:

1. While all of the other principal European alphabets have retained with small variations the Roman or Continental values of the letters, the English has to a very large extent abandoned them. This is especially true of the "long" vowels—at least of their common values: Thus, approximately, "long *a*" (say) = Cont. *ē*; "long *e*" (mete) = Cont. *ī*; "long *i*" (isle) = Cont. diphthong *ai*; "long *o*" = Cont. *ō*; "long *u*" (duty) = Cont. diphthong *iu*. Great confusion thus exists in the vowel nomenclature, as well as an unfortunate divergence from the common usage of those languages most closely connected with English, both historically and practically.

2. The letters of the alphabet are used with a great diversity of sound values: thus, of the vowels, accented and unaccented, *a* has approximately 9 (as in n*a*me, b*a*re, m*a*n, f*a*ther, w*a*ter, w*a*nt, *a*sk, vill*a*ge, dat*a*); *e*, 9 (b*e*, h*e*re, th*e*re, acm*e*, m*e*t, al*e*rt, *E*nglish, s*e*rgeant, prud*e*nt); *i*, 8; *o*, 10; *u*, 9; *y*, 3—48 in all; of the consonants, *b*, 2 (counting silent ones); *c*, 6; *d*, 4; *f*, 3; *g*, 4; *h*, 3; *j*, 5; *k*, 2; *l*, 3; *m*, 3; *n*, 3; *p*, 2; *q*, 3; *r*, 2; *s*, 5; *t*, 5; *v*, 2; *w*, 2; *x*, 5; *y*, 2; *z*, 4—70 in all. To a certain extent this multiplication of values is due to inadequacy of the alphabet, with 26 symbols to represent 40 elementary sounds of cultivated English speech (44 with diphthongs), but it is far in excess of what is necessary.

3. The various English speech sounds are written with an even greater variety of symbols and combinations of symbols. These sounds, which comprise 16 vowels and 24 consonants (with 4 diphthongs), are represented in the standard phonetic alphabet, adopted by the American Philological Association, as follows (the sound being that of the corresponding letter in the word placed within parentheses): i (*i*t), e (m*e*t), a (*a*t), ɑ (*a*sk), ɵ (n*o*t), o (*o*bey), ʊ (b*u*t), u (f*u*ll), ī (p*i*que), ē (th*e*y), ā (*a*ir), ɑ̄ (*a*rm), ɵ̄ (n*o*r), ō (n*o*), ʊ̄ (b*u*rn), ū (r*u*le), p (*p*et), t (*t*ip), ch (*ch*est), c or k (*c*ome), f (*f*at), th (*th*in), s (*s*own), sh (*sh*e), h (*h*e), b (*b*et), d (*d*ip), j (*j*est), g (*g*um), v (*v*at), dh (*th*ee), z (*z*one), zh (a*z*ure), w (*w*it), l (*l*o, e*ll*), r (*r*at, a*r*e), y (*y*e, *y*ear), m (*m*e), n (*n*o), ng (si*ng*); diphthongs, ɑi (*ai*sle, *i*sle), ɑu (*ou*t, h*ou*r), ɵi (*oi*l, b*oy*), iu (f*eu*d, j*ew*). The ways in which these sounds are represented in customary spelling are too numerous to be given, but the orthographic situation will be understood from these examples: i (*i*t), accented or unaccented, is represented by i, y, e, o, u, ie, ee, ui, ai, hi, ive, eo, ia, ei, ey, ea, eig ('), ehea, ewi, ois, uy, oi, igh, ay, ieu, as in the following words: f*i*t, h*y*mn, pr*e*tty, w*o*men, b*u*sy, s*ie*ve, br*ee*ches, b*ui*ld, S*ai*nt John (sin'jun), ex*hi*bit, f*ive*pence (fip'ens), Th*eo*bald (tib'ald), carr*ia*ge, forf*ei*t, donk*ey*, guin*ea*, sover*eig*n, James's, for*ehea*d, hous*ewi*fe (hus'if), cham*ois*, plag*uy*, Jerv*oi*s (jer'vis), Denb*igh*, Rothes*ay* (roth'si), Beaul*ieu* (bew'li). E (m*e*t) = e, ea, a, u, ai, ei, ie, eo, ue, ay, œ, ave, as in g*e*t, h*ea*d, m*a*ny, b*u*ry, s*ai*d, h*ei*fer, fr*ie*nd, l*eo*pard, gu*e*ss, s*ay*s, f*œ*tid, Aberg*ave*nny (abergen'i). O (n*o*) = o, o-e, oa, ow, ou, owe, oe, oo, ew, ewe, ough, oh, eau, eo, au, os, aut, ock, as in h*o*ly, v*o*t*e*, r*oa*d, b*ow*l, s*ou*l, r*owe*d, w*oe*, br*oo*ch (brōch), s*ew*, s*ewe*d, th*ough*, *oh*, b*eau*, y*eo*man, h*au*teur, aprop*os*, h*aut*boy, C*ock*burn, (kō'bn). C (*c*ome) = c, k, q, ck, ch, cc, cq, qu, que, lk, gh, sc, x, ke, lke, quh, cch, as in *c*all, *k*ill, *q*uell, ba*ck*, a*ch*e a*cc*ount, a*cq*uaint, li*qu*or, bar*que*, wa*lk*, hou*gh*, vis*c*ount, e*x*cept, Bur*ke*, Fo*lke*stone, Ur*quh*art, Ba*cch*anal. T (*t*ip) = t, tt, ed, th, tw, bt, ct, pt, cht, phth, te, tte, as in *t*en, be*tt*er, stopp*ed*, *th*yme, *tw*o, de*bt*, indi*ct*, recei*pt*, ya*cht*, *phth*isis, cas*te*, gaze*tte*. In brief, the 44 English sounds are represented by upward of 500 symbols and combinations.

Notwithstanding this confusion English spelling exhibits a certain amount of system and it is possible also to demonstrate in it a very considerable phonetic element. Apart from the inadequacy of the alphabet, its chief practical defects are the ambiguities in the use of *c* and *k* (*c*at, *k*ill), *c* and *s* (*c*inder, *s*eat), *f* and *ph* (*f*ool, *ph*ilosopher), *t* and *d* or *ed* (dropp*ed*, kep*t*), *ch* and *k* (*ch*olera, *k*eep), and the employment of silent letters as in fe*a*ther, je*o*pardy, parl*i*ament, pedagog*ue*, g*u*ard, ad*d*, fei*g*n, g*h*ost, thou*gh*, thorou*gh*, s*c*ythe, etc.

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1913); Michaelis and Jones, *Phonetic Dictionary of the English Language* (Hanover, 1913); E. Müller, *Englische Lautlehre nach James Elphinston, 1765, 1787, 1790* (Heidelberg, 1914).

SPELLING REFORM. The modification of customary spelling in such a way as to remove, or at least lessen, the divergence of orthography from pronunciation. (See Spelling.) Complete reform of this sort involves: (1) the elimination of superfluous letters (e.g. in English, of two of the equivalent letters *c* (hard), *k*, and *q*); (2) the enlargement of the alphabet by the addition of enough symbols (letters or digraphs) to represent all significant speech-sounds in the language (in English there are 40 elementary sounds and but 26 letters); (3) the use of each letter or symbol to represent but one sound; and (4) in English the use of the letters of the alphabet with their Roman values. Rules for partial simplification were adopted in 1883 by the American Philological Association and the British Philological Society, and in 1886 a list of amended spellings, based upon them, was adopted by the Philological Association and published in its *Transactions*. It has since been republished in the leading American dictionaries. Simplification of this sort would greatly enhance the phonetic accuracy and simplicity of English spelling. Up to the present time, however, spelling reform, even in this restricted sense, has made but little headway. The American National Education Association in 1898 adopted 12 simplified spellings: program, tho, altho, thoro, thorofare, thru, thruout, catalog, prolog, decalog, demagog, pedagog.

The Simplified Spelling Board, organized in New York in March, 1906, with Prof. Brander Matthews (q.v.) as chairman, received from Andrew Carnegie an offer of $15,000 a year for five years in support of its work. The board issued a list of 300 words which it proposed to simplify. In this list "ed" and "sed" were replaced by "t," as in addressed, missed, clipped; "er" was used in place of "re" in centre, calibre; the "e" was dropped from such words as acknowledgement; diphthongs "æ," "œ," reduced to "e" in anæmia, æolian; final "ue" in words like catalogue, final "te" in words like cigarette, final "me" in programme, etc., were dropped, as well as "u" in ardour, humour, etc. In August, 1906, President Roosevelt ordered the public printer to adopt the spelling advocated by the board in all documents of executive departments. The order led to such protests that it was afterward withdrawn, except as to official correspondence of the White House. A number of scholars declared their approval of the board's scheme, among them editors of many well-known dictionaries. The board published in September, 1906, a list of 825 American college professors and officers who had agreed to use its simplified 300 words where practicable.

In France, where the peculiarities of orthography give spelling reform a practical importance second only to that of English-speaking countries, much interest in this subject has long existed, but little has been accomplished, owing to conservatism. Nevertheless, a government commission, of which Prof. Paul Meyer was chairman, made a report in 1905 upon a simplification scheme which aroused some discussion at the time. Since then the movement has made but little headway. The reform has also been active in Germany, and something has been done there, particularly in the omission of silent letters (*tat* for *that*, etc.). In Spanish and Italian, spelling is so largely phonetic that the practical reasons for reform have relatively little application.

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SPEL'MAN, Sir Henry (c.1564–1641). An English antiquary and philologist. He was born at Congham, Norfolk, and educated at Cambridge and in law at Lincoln's Inn. He became High Sheriff of Norfolk, and was employed on various public missions by King James. He devoted himself to the relation of ancient law and custom to the English constitution. In prosecuting this work he encountered so many strange and obsolete words that he turned aside to compile a glossary of law terms the first part of which, to the end of the letter L, he published in 1626, at his own expense. The second volume appeared in 1664 edited by Sir William Dugdale. He also compiled a collection of decrees of English church councils from 1066 to 1531. He is best known in modern times by this and his curious *History and Fate of Sacrilege* (1698; new ed. with appendix by C. F. S. Warren, London, 1895). His collected works were published in 1723.

SPELT (from Lat. *spelta*). A species of wheat (*Triticum spelta*), characterized by grains held tightly within the chaff and not hulled in threshing. It is grown where wheat fails, on poor soils of mountainous regions in Germany, Italy, Spain, and France, and is mainly employed as a stock food. The grain commonly called spelt in the United States and

Russia is emmer (*Triticum dicoccum*), with a much shorter and more compact head, and hardier as regards cold, drought, and rust resistance. Both spelt and emmer are grown and harvested like wheat.

SPELTER. See Zinc; Solder.

SPENCE, Francis Stephens (1850–). A Canadian journalist and temperance worker, born at Donegal, Ireland. He went to Canada in early manhood and was educated at Toronto Normal School. After serving as headmaster of several public schools in Toronto, he devoted himself in 1882 to journalistic and temperance work, his attitude being prohibitionist. He became editor successively of the Canada *Citizen*, *Vanguard*, Ontario *Good Templar*, and later managing editor of the *Pioneer*. He was prominent in temperance organization, secretary to the committee organizing the Dominion plebiscite for prohibition in 1898, and in 1886–1907 was secretary of the Ontario Branch of the Dominion Prohibition Alliance. He was elected president of the Ontario Municipal Association in 1911. He published a book in favor of prohibition, *The Facts of the Case* (1896).

SPENCE, Joseph (1699–1768). An English anecdotist, born at Kingsclere, Hampshire, and educated at Oxford. He took orders in 1724. His *Essay on Pope's Odyssey* (1726) led to an intimate friendship with Pope, and to Spence's appointment as professor of poetry at Oxford (1727). While associated with Pope he noted down the conversations of the poet and his friends. These most valuable anecdotes were published in 1820. Consult the *Anecdotes*, edited from Spence's own manuscript, by S. W. Singer (London, 1820; reprint, 1859); *Selections*, edited by Underhill, Camelot Series (ib., 1890); also Austin Dobson, in *Eighteenth Century Vignettes* (first series, New York, 1892).

SPENCE-JONES, Henry Donald Maurice (1836–). An English clergyman and Church historian, born in London. He was educated at Westminster School and Cambridge University; took orders in the Church of England; held various important charges; and after 1886 was Dean of Gloucester. In 1906 he became also professor of ancient history in the Royal Academy. Among his published works are: *Cloister Life in the Days of Cœur de Lion* (1892); *The Church of England: A History for the People* (4 vols., 1897–99); *The White Robe of Churches of the XI Century* (1900); *Early Christianity and Paganism* (1902); *The Early Christians in Rome* (1911); *The Secrets of a Great Cathedral* (1914).

SPEN'CER. A city and the county seat of Clay Co., Iowa, 152 miles northwest of Des Moines, on the Little Sioux River and on the Chicago, Milwaukee, and St. Paul and the Minneapolis and St. Louis railroads (Map: Iowa, B 1). It has a Carnegie library and a fine courthouse. Spencer is known for its large live-stock interests. There are two large cement-block and tile factories and a razor factory. Pop., 1900, 3095; 1910, 3005.

SPENCER. A town in Worcester Co., Mass., 12 miles west by south of Worcester, on the Boston and Albany Railroad (Map: Massachusetts, C 4). It has the Richard Sugden Library, Bemis Memorial, Myrick and Prouty parks, the David Prouty High School, and a handsome monument to Elias Howe (q.v.), the inventor of the sewing machine, and his two brothers. Boots and shoes, wire, woolen goods, brooms, and cast brass goods are manufactured. Pop., 1900, 7627; 1910, 6740. Consult: Draper, *History of Spencer* (Worcester, 1860); Tower, *Historical Sketches Relating to Spencer, Massachusetts* (Spencer, 1901–02).

SPENCER, Ambrose (1765–1848). An American jurist, born in Salisbury, Conn., educated at Yale and Harvard, admitted to the bar in New York, and in 1794 entered the State Assembly, the next year becoming a member of the State Senate, to which he was reëlected in 1798. He was Attorney-General of the State (1802–04), and then became one of the judges of the Supreme Court, serving as Chief Justice from 1819 to 1823, when he resumed private practice. He was Mayor of Albany (1824–26) and (1829–31) a member of Congress. Later he retired to a farm near Lyons. Spencer secured the abolition in New York of the death sentence in all cases except those of murder and treason; took an important part in the State Constitutional Convention of 1821; and later opposed an amendment making the judiciary elective. In 1844 he presided over the National Whig Convention at Baltimore. Consult *Memorial of Ambrose Spencer* (Albany, 1849).

SPENCER, Charles, third Earl of Sunderland. An English statesman. See Sunderland, Charles Spencer, third Earl of.

SPENCER, Claudius Buchanan (1856–). An American Methodist Episcopal clergyman and editor, born at Fowlerville, Mich. He graduated from Northwestern University in 1881 and entered the ministry in the same year. He was editor of the *Rocky Mountain Christian Advocate* from 1892 to 1900, and then became editor of the *Central Christian Advocate*, Kansas City, Mo. He was a member of various important Methodist and other conferences and in 1908 was associate secretary of the Federal Council of the Churches of Christ in America. He was a candidate for Governor of Colorado on the Prohibition ticket in 1896. His writings include: *The Blue Flower of Methodism* (1903); *Easter Reflections* (1909); *The Layman* (1912); *That they May Be One* (1915).

SPENCER, Herbert (1820–1903). A distinguished English philosopher. He was born at Derby, April 27, 1820. His father was a teacher by profession, with views in advance of his time. He believed in training the student's mind in observation and in reflection on objective facts instead of mere ideas. Herbert's health was delicate, and he was largely educated at home, with much outdoor life. A little later he was put under the charge of his uncle, a clergyman of the Church of England. He showed a fondness for nature, and for years his favorite occupation was the catching and preserving of insects and the rearing of moths and butterflies; he also studied botany, and laid the foundation for the scientific character and interest of his later work. His parents were both originally Methodists, but his father became a Quaker. The boy's mind being an independent one, and having early been brought into contact with the intellectual influences centring about John Stuart Mill and with the scientific spirit, he tended towards extreme liberalism in theological matters.

An uncle planned to send him to Cambridge, but the boy "perseveringly objected," and continued to study privately. He had no aptitude for languages, and made little progress in the classics, but showed original constructive power in mathematics and mechanics. His father wanted him to take up teaching, but an accidental opportunity decided in favor of a more suitable vocation. In the autumn of 1837 work was offered to him under the chief engineer of the London and Birmingham Railway, with whom he spent nearly a year. For some 10 years he engaged in engineering. When the railway mania subsided, Spencer, now 26, was left without occupation. The time spent at home while he was looking for something to do was spent in miscellaneous reading. He studied Lyell's *Principles of Geology*, in which the doctrine of evolution as defended by Lamarck was attacked, but came away from the reading with a favorable impression of Lamarck's doctrine as against creationism.

While very young he had written some articles for the *Nonconformist* on "the proper sphere of government," in which he outlined the principles of noninterference which regulated his later thinking. When no more work offered as an engineer he went to London and obtained employment on the *Economist*, becoming its subeditor in 1848. This position, which he held till 1852, gave him time for his studies, and made him acquainted with that brilliant coterie which centred about George Henry Lewes, George Eliot, and John Stuart Mill. During his leisure hours he wrote his first considerable work, *Social Statics* (1851).

In the eight years after his leaving the *Economist* he pursued his studies with eagerness, and published a work on *Psychology* (1855), which he afterward revised and expanded into a part of his *Synthetic Philosophy*. Overapplication brought on a serious attack of nervous prostration, which obliged him for the rest of his life to abridge his hours of study. He became a chronic sufferer from dyspepsia and insomnia, so that all his later work had to be done under a disadvantage. Meanwhile he had conceived a system of philosophy which should embrace the general principles of all existing knowledge. In 1860 he published a prospectus of it, indicating his intention to give 20 years to its development. The first installments of the system did not meet with the reception he expected, and he feared he would have to abandon his undertaking. But the timely aid of American friends, at the head of whom was E. L. Youmans, editor of the *Popular Science Monthly*, enabled him to continue. His health, however, was so precarious that at one time he feared he would not live to complete the system. He suspended his labors on the main part of his work to write *The Data of Ethics*, which had been the chief interest of the whole system, and in which it was intended to culminate. Fortunately his life was prolonged sufficiently to enable him to complete the system, and to revise a part of it in order to bring it up to date. It consists of *First Principles* (1862); *Principles of Biology* (1864); *Principles of Psychology* (1871–72); *Principles of Sociology* (1876–80); *Principles of Ethics* (1879), all of which have appeared in subsequent editions. He also wrote three volumes of *Essays, Scientific, Political, and Speculative* (1858–63), and some fugitive articles including two essays on Weissmannism (1894, 1895). His *Education: Intellectual, Moral, Physical* (1861) has had an immense influence in the development of educational theory and practice. He died Dec. 8, 1903.

It was his intention in the *Synthetic Philosophy* to develop a complete and articulated conception of all cosmic phenomena, including those of mental and social principles. His qualifications for attempting so comprehensive a task were wide powers of generalization, astonishing acquaintance with the facts of the various sciences, and a veritable genius for detecting the relations and connections of phenomena that escape the specialist. No philosopher has surpassed him in exploiting such a wealth of illustration and facts to explain his meaning or to prove his thesis. It is the clearness of his thought, the force of his illustrations, and the ingenuity with which the facts and methods of the inductive sciences were made to serve his views that have given him his popularity. Among professional philosophers he did not secure a strong following. But his attempt to systematize all knowledge in terms of modern science and especially in terms of evolution must always give him a high place among the thinkers of the second half of the nineteenth century.

The *First Principles* endeavors to define the fields of "the unknowable and the knowable," and the postulates with which the study of the knowable must be pursued. The whole weakness of Spencer's system is shown in his discussion of the unknowable. The absolute, space, time, matter, force, and motion were all taken as unknowable. After telling us that all these are unknowable, he asserts that the most certain things in our conviction are the "absolute" and all the other fundamental data for the knowable. Besides, after telling us that all explanation consists in reference to the known, he says that all phenomena are explained as manifestations of the unknowable. Then, in the discussion of the knowable, space, time, matter, force, etc., appear as known. Both the strength and weakness of his system are due to this equivocal import of the term "knowledge."

The whole system is an application of the idea of evolution to the universe, and more particularly to organic life and its forms, and to political and social institutions. Spencer's conception of this process did not go beyond Darwin's in its details, but it was apparently quite as original and certainly more comprehensive, besides involving philosophic generalizations to which Darwin was averse. Spencer was accused of applying the materialistic formula to the explanation of all things, but protested that he was not a materialist, for he claimed that he could equally well have expressed his doctrine in terms of consciousness. In order to adapt the conception of evolution to all forms of phenomena, he variously expressed the process as the passage from the simple to the complex, from the homogeneous to the heterogeneous, from indefinite homogeneity to definite heterogeneity, and so on. This description of the process brought him into controversy with all those who exalt metaphysics, and gave him no credit with those who do not. In his facts and illustrations, however, Spencer gives a clearer idea of his doctrine than in his abstract formulas intended to cover every type of phenomena in the organic and inorganic kingdoms. These facts, he thinks, show a continuous order of things with historical connections and relations which suggest a common origin from some ultimate indefinite form of force which he calls matter and motion. Darwin did not pretend to go beyond the extension of a few types in the organic world or to develop their genesis. He was content to demonstrate the origin of species in the organic world and left unsolved and undiscussed the general origin of things—a much larger task. Spencer sought to make intelligible the process of evolution throughout the whole field of nature, and hence the importance of his formula about "continuous redistribution of matter and motion."

It was Spencer's antagonism to the doctrine of creationism that caused a complete misunderstanding of what evolution really undertakes to accomplish. The theory of creation was equivocal. It assigned a cause for the origin of phenomena, and it was associated with the conception of the miraculous and supernatural. Spencer denied the creational theory and adopted the gradual development of all things in its stead. But what he failed to recognize sufficiently, though he sees it at times, is the fact that evolution is the history of origin, not the explanation of it.

Conceiving evolution, however, as the history rather of events than of causes that originate change, we shall find that Spencer's services to human knowledge can hardly be overestimated. It was a stroke of genius to combine the ideas of the persistence of force, adjustment to environment, and natural selection, for the purpose of explaining the relations of all phenomena. It offered a mode of unifying the cosmos which showed identities and relations throughout the whole not before observed. The persistence of force guaranteed the fundamental identity of all reality, in spite of the differences of form which it assumed, while the varieties of composition explained the differences. The conception supplies an initial presumption of the variation of a single species to account for the varieties; this once done, the whole problem of evolution is at least historically conceived as intelligible. In the ethical world growth is in the form of the substitution of altruism for egoism or selfishness. In the political and social worlds the process is but a repetition of that in the others, except that we deal with collective as distinct from organic wholes. One law prevails throughout the whole process—the redistribution of matter and motion according to the conditions of the persistence of force. Originally Spencer reduced life to a function of matter and motion. But in the last edition of his *Biology* he admitted that life was an "unknown force," a position which involves a complete revolution in his system as recognizing something more in the world as ultimate than matter and motion. The hypothesis of a universal ether and the modification of older views regarding the nature of electrical and magnetic phenomena, with the discovery of a number of forms of energy not suspected a generation ago, threaten to modify greatly the bases of Spencer's system. But they do not disturb the general conception which he formed of the process of evolution, since this is independent of the forces involved and is simply a process of composition and decomposition throughout the cosmos and in all specific forms of reality. It is Spencer's manner of tracing the relations and affinities between the various phenomena of existence that gives his work its interest and has so generally influenced the intelligent public. He knew little of Greek philosophy and less of the modern Kanto-Hegelian movement. The consequence was that he began his speculations with science, eschewed the transcendentalism of German epistemology, and wrote in terms that every intelligent man can understand. The public has not cared whether his abstract formulas were exact or not. It was impressed with his power of illustration and reference to facts which it was willing to use as interpreting his formulas, and as his illustrations and analogies depicted such an interesting unity in the course of nature, it was ready to take him as a prophet of the new gospel and leave subtleties to the transcendentalists.

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SPENCER, JESSE AMES (1816–98). An American Protestant Episcopal scholar. He was born at Hyde Park, N. Y.; graduated at Columbia College (1837), and at the General Theological Seminary; and held pastorates at various times. He served as editor and secretary of the Episcopal Sunday School Union and Church Book Society (1851–57) and as professor of Greek in the University of the City of New York (1869–81). He edited the American reprint of T. K. Arnold's series of Greek and Latin textbooks (1846–56) and other classics, including the Greek New Testament (1847). His works include: *History of the English Reformation* (1846), *Egypt and the Holy Land* (1850), *History of the United States* (1856–69), *Eschatology* (1887), *Memorabilia, 1820–86* (1890).

SPENCER, JOHN CANFIELD (1788–1855). An American jurist and politician, born at Hudson, N. Y. He graduated at Union College in 1806 and was admitted to the bar. In 1813 he was brigade judge-advocate-general in the northern frontier army. He was a Democratic member of the United States House of Representatives (1817–19) and wrote the report condemning the United States Bank, which was afterward used by President Jackson when the author's views had changed. In 1820–21 he was a member of the Lower House of the State Legislature, the first year as Speaker. He was in the State Senate (1824–28), and in 1827 was appointed by Governor Clinton on the committee to revise the statutes of New York. For a time he was an Antimason and was appointed by Governor Van Buren to prosecute the alleged abductors of William Morgan (q.v.), but resigned in 1830. He again sat in the Legislature in 1832, and in 1834–40 was Secretary of State for New York and Superintendent of Schools. In 1841 he became Secretary of War in the cabinet of President Tyler. He was transferred to the Treasury Department (1843), but opposed measures for annexation of Texas and resigned May 2, 1844. He edited a translation of De Tocqueville's *Democracy in America* (2 vols., 1838). Consult Proctor, *Review of John C. Spencer's Legal and Political Career* (New York, 1886).

SPENCER, John Charles, Earl (1782–1845). An English statesman, best known as Lord Althorp. He was the son of the second Earl Spencer, and was born in London. He was educated at Harrow and at Trinity College, Cambridge, entered Parliament in 1804, and became Junior Lord of the Treasury in 1806. From then till 1834 he continuously represented Northamptonshire in the Whig interest, successfully advocating salutary measures relating to bankruptcy proceedings and the recovery of small debts. In 1830 he became Chancellor of the Exchequer and leader in the House of Commons under the Grey ministry, and was active in carrying the Reform Bill of 1832. He held office under the Melbourne ministry (succeeding the Grey ministry) in July, 1834, but in November of that year the death of his father raised him to the House of Lords. He died Oct. 1, 1845. He was a man with slight ability, fond of agriculture and country sports; but honesty and industry raised him to responsible positions, which he filled with credit. Consult Ernest Myers, *Lord Althorp* (London, 1890).

SPENCER, John Poyntz, fifth Earl (1835–1910). An English statesman. The only son of the fourth Earl, he was born at Spencer House, was educated at Harrow and at Trinity College, Cambridge, and in 1857, the year of his graduation, was elected member of Parliament. At his father's death he succeeded to the peerage. He was Lord Lieutenant of Ireland (1869–74 and again in 1882–85), President of the Council with a seat in Gladstone's cabinet (1880–83 and 1886), First Lord of the Admiralty (1892–95), and Liberal leader in the House of Lords (1902–05).

SPENCER, Joseph (1714–89). An American soldier, born in East Haddam, Conn. He became a colonel in the French and Indian War and was one of the eight brigadier generals appointed by Congress on June 22, 1775, served at Boston and New York, became a major general in August, 1776, and commanded in Rhode Island in 1777. He served in Congress in 1779.

SPENCER, Joseph William Winthrop (1851–). An American geologist, born at Dundas, Ontario, Canada. He graduated at McGill University in 1874 and took his Ph.D. at Göttingen three years later. He was professor of geology in King's College, Nova Scotia, in 1880–82, and in the University of Missouri in 1882–87; and was State geologist of Georgia (1888–93). Among his published works are: *Niagara Fossils* (1884); *Glacial Erosion in Norway* (1887); *Geological Survey of Southwestern Georgia* (1891); *Geological Survey of the Paleozoic Belt of Georgia* (1893); *The Duration of Niagara Falls and the History of the Great Lakes* (1895).

SPENCER, Platt Rogers (1800–64). The originator of the Spencerian system of penmanship. He was born at East Fishkill, N. Y. He gave many lectures upon penmanship in various parts of the country, and his work was influential in causing the establishment of business colleges. Spencer published *Spencer and Rice's System of Business and Ladies' Penmanship* (1848), later republished as *Spencerian or Semi-Angular Penmanship.*

SPENCER, Robert, second Earl of Sunderland. An English statesman. See Sunderland, Robert Spencer, second Earl of.

SPENCER, Sara Andrews (1837–1909). An American woman suffragist, long president of the Spencerian Business College at Washington, D. C. She was born at Savona, Steuben Co., N. Y., and in 1864 married Henry C. Spencer, and afterward removed to Washington, D. C. In 1871, with other women, she unsuccessfully attempted to register and vote, and afterward brought suit—the Supreme Court of the United States deciding (1874) that women have not the right to vote without local legislation. She represented the National Woman's Suffrage Association at the Republican National Convention in Cincinnati, in 1876, and signed and presented the *Woman's Declaration of Rights* at the Centennial Celebration at Philadelphia. Her publications include *Problems on the Woman Question* (1871).

SPENCER, William Robert (1769–1834). An English poet and wit, grandson of the third Duke of Marlborough. He was educated at Christ Church, Oxford. Among his friends were Pitt, Fox, Sheridan, and Sydney Smith. In 1796 Spencer published a version of Bürger's *Leonore,* which was praised by Scott; and in 1802 burlesqued German romance in *Urania,* a play performed at Drury Lane. In 1811 he collected his poems in a volume. As a poet, Byron ranked him with Moore, Campbell, and Rogers. Consult the reprint of Spencer's *Poems* with biography (London, 1835).

SPENER, shpā′nĕr, Philipp Jakob (1635–1705). A German clergyman, founder of the German Pietists. He was born at Rappoltsweiler in Upper Alsace and was educated at Strassburg, Basel, Tübingen, Geneva, and Lyons. At Geneva he was influenced by Labadie (q.v.), and his natural disposition led him towards a religion of mystical and untheological type. He preached at Strassburg, was transferred to Frankfort, and in 1666 became first pastor there. He strove to awaken deeper faith and more active Christian life, emphasized the necessity of conversion and regeneration, and scriptural study in opposition to teaching which laid stress on orthodoxy and connection with the Church. His views were set forth in his *Pia Desideria, oder herzliches Verlangen nach gottgefälliger Besserung der wahren evangelischen Kirche* (1673). In 1670 he began meetings at his house for the cultivation of evangelical morality, the so-called *collegia pietatis,* aiming, as he said, to form within the Church (*ecclesia*) a smaller church (*ecclesiola*) with a deeper spirituality. He reorganized the method of catechizing and improved the religious instruction of children. In 1679 a preface he wrote for a new edition of the *Postille* of Arndt, in which he censured the morals of the upper classes, brought him into difficulties; and in 1686 he accepted an invitation to become court preacher at Dresden and member of the upper consistory. Here he effected changes in the theological teaching of the University of Leipzig and in the system of religious catechizing throughout Saxony; but because of attacks from orthodox theologians, and having fallen into disgrace with the Elector Johann Georg III, in 1691 he went to Berlin as provost of the church of St. Nicholas and consistorial inspector, remaining here till his death. The Elector of Brandenburg encouraged his efforts for religious réform and intrusted theological instruction in the new University of Halle to Francke, Breithaupt, and others of his disciples. In 1695 the theological faculty of Wittenberg formally censured as heretical 264 propositions drawn from Spener's writings. There is no collected edition of his works; the full list (180 in number) is given in his biography by Von Canstein (Halle, 1740), and his chief works have been edited by Grünberg (Gotha, 1889). Consult also W. Hossbach, *Philipp Jakob Spener und seine Zeit* (3d ed., Berlin, 1861), and P. Grünberg, *P. J. Spener* (3 vols., Göttingen, 1893–1906). See German Theology; Pietism.

SPENGEL, shpĕng′el, Johann Wilhelm (1852–). A German zoölogist, born at Hamburg and educated at Berlin and Göttingen. He was privatdocent in zoölogy at Göttingen from 1879 to 1881; director of the Municipal Museum in Bremen from 1881 to 1887; and thereafter professor of zoölogy at Giessen. He was editor, from 1886, of *Zoologisches Jahrbucher* and, from 1907, of *Ergebnisse und Fortschritte der Zoologie.*

SPENGEL, Leonhard (1803–80). A German classical scholar, born at Munich. He became known through his edition (1826) of Varro's *De Lingua Latina* and was appointed in 1826 lector, in 1830 professor in the present Wilhelmsgymnasium of Munich. From 1842 to 1847 he was professor at Heidelberg, but he returned to Munich. Among his publications were his edition of the *Ars Rhetorica ad Alexandrum,* which, following Petrus Victorinus, he attributed to Anaximenes of Lampsacus (1844), his edition of the *Rhetoric* of Aristotle (1867), and his text edition of the *Rhetores Græci* (3 vols., 1853). His address *Ueber das Studium der Rhetorik bei den Alten* (1842) is a valuable outline sketch of the art of eloquence in classical times. Consult J. E. Sandys, *A History of Classical Scholarship,* vol. iii (Cambridge, 1908).

SPEN′LOVE-SPEN′LOVE, Frank (1866–). An English landscape and figure painter, born in Stirling, New Brunswick. After 1886 he exhibited regularly at the Royal Academy, London. Among his best-known paintings are "Funeral in Holland in Winter" (gold medal, Paris Salon, 1901); "Too Late" (Luxembourg, Paris); "The Little White Cross," "In the Shadow of the Church" (both in the Manchester Gallery); "Vespers, Holland" (1906, Glasgow Gallery); "Grey of the Morn" (Guildhall, London); "Grey of Evening" (Hull Gallery), and "The Hill-Top" (1912), all of which show his peculiar skill in the rendering of atmosphere. He founded a successful school of modern art at Beckenham, Kent, and is also known as an author.

SPEN′NYMOOR. A town in Durham, England, 4 miles northeast of Bishop Auckland. It has coal-mining and iron industries. Pop., 1901, 16,660; 1911, 17,909.

SPEN′SER, Edmund (c.1552–99). An English poet, born in London. His father has been identified with John Spenser, a London clothmaker. The boy was apparently sent to the Merchant Taylors' School, London, and passed, as sizar or poor scholar, to Pembroke Hall, Cambridge. Here he read widely in Latin, Greek, Italian, and French literature, being especially fond of Petrarch and Chaucer, of Marot and Du Bellay. He formed lifelong friendships with Gabriel Harvey and Edward Kirke. After graduating M.A. in 1576, he seems to have spent two years with kinsfolk in Lancashire, where he fell in love with a young woman whom he celebrated under the name of Rosalind. In 1578 he went to London and found a place in the household of the Earl of Leicester. There he probably met Sir Philip Sidney, to whom he dedicated *The Shepheardes Calender* (1579). In 1580 he was appointed secretary to Lord Grey, the new Lord Deputy of Ireland. Thenceforth Spenser lived mostly in Ireland. There he wrote the remainder of *The Faerie Queene,* begun at Leicester House. By 1588 or 1589 he was living at Kilcolman Castle, in the County of Cork, which with its extensive lands was legally transferred to him in 1591. In the meantime he had written *Astrophel* (1586), a noble pastoral elegy on Sidney, and had received a visit from Sir Walter Raleigh (1589), made memorable by *Colin Clouts Come Home Againe.* In 1589 he accompanied Raleigh to London, was welcomed at court, and published three books of *The Faerie Queene,* a moral and historical allegory. In 1590 followed a volume of miscellanies called *Complaints* including "The Ruines of Time," "The Teares of the Muses," "Mother Hubbard's Tale," "The Tale of the Butterflie," and four other poems. Disappointed of expected court preferment, Spenser returned to Ireland, where he married (1594) a certain Elizabeth, probably Elizabeth Boyle, related to the first Earl of Cork. The courtship is described in the *Amoretti* (published in 1595), a series of sonnets; the marriage is celebrated in the *Epithalamion* (published in 1595), the richest nuptial hymn in the English language. In 1596 he brought to London for publication three more books of *The Faerie Queene.* Spenser intended to continue the work to twelve books, but never got further than two cantos on *Mutabilitie* (printed 1609). While in England he seems to have completed a prose treatise on the *Present State of Ireland* (not published till 1633); he prepared for the press the beautiful *Foure Hymnes* (1596), in honor of love, beauty, heavenly love, and heavenly beauty; and wrote (1596) for a double marriage at Essex House the *Prothalamion,* one of his finest poems. Again disappointed of preferment, he returned to Ireland. In October, 1598, his castle was sacked and burned by the Irish rebels. Spenser fled to England, where he died at a London inn, Jan. 16, 1599. He was buried near Chaucer in Westminster Abbey.

The Shepheardes Calender marks an epoch in English poetry. Conventional in theme, it yet shows a command over rhythm greater even than Chaucer's. It sounded the note of the Elizabethan outburst. As Spenser grew older he became more weighty in substance and discovered new melodies. In *The Faerie Queene* he invented a nine-line stanza known as "Spenserian." It is the Italian *ottava rima* with an added Alexandrine (12 syllables). The rhymes run ababbcbcc. Spenser's imagination dwelt in a realm of beauty and the noblest ideals. His fault is an insistence on the allegory which sometimes becomes monotonous and frequently obscure. Spenser has been a favorite with the poets. The generation following him were Spenserians, and Milton owed much to him. In the Romantic revival at the end of the eighteenth century he was potent, and Keats's *Eve of Saint Agnes* and Byron's *Childe Harold* were written in the Spenserian stanza.

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SPENSE′RIAN STANZA. See SPENSER, EDMUND; VERSIFICATION.

SPERANSKY, spâ-rän′skē, MIKHAIL, COUNT (1772–1839). A Russian statesman. Educated at the St. Petersburg Ecclesiastical Academy, he was appointed professor of mathematics there in 1797 and State Secretary in 1801. He became Assistant Minister of Justice in 1808 and Privy Councilor in 1809. During his administration he remodeled the system of taxation and the system of national education, besides instituting many other reforms. As Governor-General of Siberia (1819–21), he displayed great energy in fighting official corruption and bettering the condition of the exiles. In 1821 he was made a member of the Imperial Council. Nicholas I intrusted him with the codification of the Russian laws, a task which he performed with singular success.

SPERM, IN PLANTS (Lat. *sperma*, seed), ANTHEROZOIDS, SPERMATOZOIDS. The male sexual cell, whose union with the egg is the process of fertilization, which results in the formation of an embryo. An ordinary sperm is an actively moving, naked cell, consisting essentially of a relatively large nucleus with a thin sheath of cytoplasm, forming the body, and delicate, hairlike swimming appendages (cilia). The male organ which produces sperms is uniformly called an antheridium (q.v.). See FERTILIZATION; REPRODUCTION; SEX.

SPERMACETI, spẽr′mȧ-sē′tĭ (Neo-Lat., whale's seed). A solid wax obtained principally from cavities in the head and from blubber of the sperm whale or cachelot (*Physeter macrocephalus*), inhabiting the Pacific and Indian oceans. In the living animal the "head matter" exists as a liquid, which deposits flaky white crystals of spermaceti from the yellow liquid "sperm oil," as a result of trying out and cooling. The so-called sperm oil is really a mixture of liquid waxes.

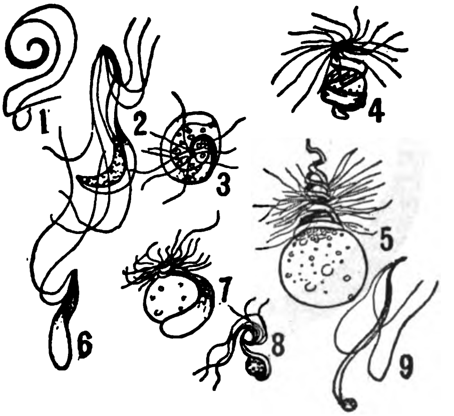
As many as 12 barrels of the crude product are obtained from an ordinary whale.

Spermaceti is purified by chilling, pressure, and crystallization. When pure it is a white translucent solid, smooth to the touch, and without taste or odor, insoluble in water and cold alcohol, soluble in hot alcohol and ether, from which it crystallizes readily. By exposure to air and light it grows yellowish and rancid. Spermaceti burns with a bright clear flame and was formerly used in the best candles. When made of definite weight and size these candles were used as the standard of illumination, but have now been replaced by the pentane lamp.

Spermaceti is a wax and hence contains no glycerin; the ester is known as cetin or cetyl palmitate, $C_{15}H_{31}COOC_{16}H_{33}$. Spermaceti is still used in ointments and toilet preparations.

SPER′MARY. See ANTHERIDIUM.

SPER′MATISTS. A school of physiologists of the seventeenth century, who held that the whole of the material transmitted from the parents to the offspring as the foundation of the embryo was contained in the spermatozoön of the male, opposing those (the ovulists) who asserted that all the material was supplied by the mother in the egg. See PREFORMATION.



TYPES OF SPERMS.

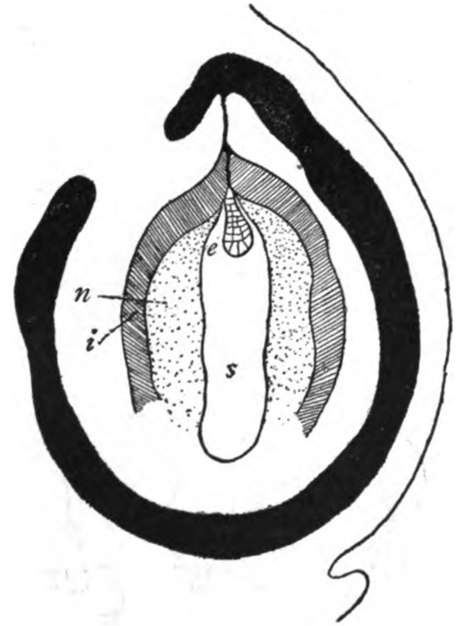
1, *Chara:* 2–4, fern; 5, *Marsilea;* 6, club moss; 7, fern; 8, quillwort; 9, liverwort.

SPER′MATOPHYTES (from Gk. *σπέρμα*, *sperma*, seed + *φυτόν*, *phyton*, plant), SEED PLANTS. The highest of the four primary divisions of the plant kingdom, distinguished from the other groups by the production of seeds.

This group, which includes practically all the conspicuous vegetation (herbs, shrubs, and trees), is by far the most useful group to man, so useful, indeed, that until the closing years of the nineteenth century elementary botanical training dealt with no other group and botanists were thought of chiefly as students of flowers. About 140,000 species of seed plants have been described, and grouped in two distinct but very unequal divisions—gymnosperms (q.v.) and angiosperms (q.v.). They are distinguished by the position of their seeds, which are naked or freely exposed in the former but inclosed in a seed case in the latter.

In all seed plants the alternation of generations (q.v.) is very much obscured by the great reduction of the sexual plants, which are not popularly recognized, and are undiscoverable except by laboratory manipulation, the whole visible body of these plants, contrary to the popular notion, being the sexless phase or sporophyte. All the members of the group are also heterosporous. (See HETEROSPORY.) The pollen grain is a sexless microspore that in germination gives rise to a small plant consisting of only a few cells, among them two male cells, which are formed within the pollen grain or pollen tube and function as sperms. The pollen grain is transferred to the immediate neighborhood of the female plant, usually by the wind or by insects. See POLLINATION; FERTILIZATION.

The megaspore, a large sexless spore that produces the female plant, is developed within the ovule, which is, therefore, a sporangium. The fact that in this sporangium there is usually but a single megaspore, and that is not discharged, but retained, is what makes a seed possible; for the retained megaspore germinates within its sporangium (ovule; see OVULE, and Illustration) and produces the female plant there. This megaspore within the ovule was once thought to be merely a saclike cavity, within which the embryo appeared, and hence was called the "embryo sac." In germination the megaspore produces a female plant, with several or many cells, a tissue which has long been called "endosperm," and recognized as a prominent nutritive tissue within the seed. The female plant, therefore, is entirely inclosed within the ovule, and produces an egg which is reached by a pollen tube and fertilized. This act of fertilization is followed by two conspicuous results, viz., (1) the development of the embryo, and (2) the development of a hard superficial tissue (testa) in the outer part of the ovule, which hermetically seals the female plant and embryo within, the whole complex structure constituting the seed.



OVULE IN OVARY CAVITY.

Showing *i*, integument; *n*, nucellus; *s*, embryo sac; and *e*, embryo.

In the seed condition the plant passes into a dormant condition of greater or less duration, and then, under favorable conditions, the seed is said to germinate. This simply means the renewed growth of the young plantlet, whose embryo, which had begun to develop, was checked by the hard investment of the seed. A seed, therefore, is a complex of three generations: (1) the old sexless generation (sporophyte), represented at least by the seed coats; (2) the following female sexual generation (gametophyte), represented by the endosperm; and (3) the new sexless generation (sporophyte), represented by the embryo.

SPER′MATOZO′IDS. See SPERM, IN PLANTS.

SPER′MATOZO′ÖN (Neo-Lat., from Gk. *σπέρμα*, *sperma*, seed + *ζῷον*, *zöon*, animal). The male germ cell. The phenomenon of sexuality consists of the union of two cells. In the lowest forms these may be alike, but in the higher plants and animals there is a difference in size of the two uniting cells. The larger is called the female cell or egg, the smaller the spermatozoön. This difference in size is advantageous, for it means a division of labor. The large cell is passive and accumulates a large amount of food material by virtue of which the future embryo is better provided for. The spermatozoön, on the other hand, retains the capacity for locomotion; it seeks the passive egg. Consequently the spermatozoön becomes as small as possible and is provided with a large locomotive organ—the tail, flagellum, or lash. The spermatozoön is thus a highly specialized, actively locomotor cell. A typical flagellate spermatozoön consists of three parts: head, middle piece, and tail. The head contains the nucleus, made up of an extremely dense mass of chromatin; also often an apical body or acrosome, lying in a spur of the head. The middle piece is larger than the tail and usually contains the centrosome. The tail is a cytoplasmic thread, containing a central delicate thread and having a lateral membrane or fin which makes the stroke of the tail more effective.

The spermatozoa develop in a special organ of the body called testis, typically a mass of germ cells, young and old. In the young male this gland is made up of epithelial cells known as primordial germ cells; from these by cell division arise spermatogonia, still undifferentiated cells. The spermatogonia grow until they become very large, and are then called spermatocytes. Each spermatocyte divides and the daughter cells promptly divide again into spermatids, four of which thus arise from each spermatocyte. But each spermatocyte has only half the number of chromosomes that the original spermatocyte had. Each spermatid now undergoes a change of form by which it becomes a spermatozoön, and not until then is it ready to fertilize the egg. See FERTILIZATION.

SPERMIN, spĕr′mĭn (from Gk. *σπέρμα*, *sperma*, seed + *-ina*). A substance found in the thyroid and thymus glands, spleen, ovaries, testes, and blood in the form of a phosphate. It is believed by Poehl to be a leukomain and to be produced by the retrogressive metamorphosis of albumens. It is a powerful stimulant to the oxidizing properties of the blood and is given for its action in this respect. It has been administered with marked benefit in certain forms of ataxia, in epilepsy, in senile degeneration and the nervous affections of the aged, and as a tonic in tuberculosis. Spermin is given hypodermically in the form of the hydrochlorate. See ORGANOTHERAPY.

SPER′MOPHILE (from Gk. *σπέρμα*, *sperma*, seed + *φιλεῖν*, *philein*, to love). A ground squirrel of the genus *Spermophilus*, of which more than a dozen species occur in the United States, but only one or two in Europe. They are terrestrial, live under ground, feed chiefly on herbage and seeds, are very prolific, and are commonly called gophers (see GOPHER), thus being confused with an entirely different group of mammals. Three species at least are sufficiently abundant to damage lawns and cultivated fields. An effective means of destroying them is by soaking some absorbent in carbon bisulphide and placing it in the burrows. In size, form, color, and length and shape of tail, they show great variety, being usually some shade of brown, mottled, spotted, or striped with other shades. With the tail they will average about a foot in length. All are western, and denizens of open regions, only two species occurring as far east as Illinois. The flesh is edible. Consult Bailey, "Prairie Ground Squirrels," in Department of Agriculture, Division of Ornithology and Mammalogy, *Bulletin 4* (Washington, 1893). Compare CHIPMUNK.

SPERM WHALE. See WHALE.

SPERRY, CHARLES STILLMAN (1847–1911). An American naval officer, born in Brooklyn, N. Y. He graduated from the United States Naval Academy in 1866 and passed through the various grades of the service to commander in 1894, captain in 1900, and rear admiral in 1906. During the Spanish-American War he was on ordnance duty at the Brooklyn Navy Yard, but in 1899 went on active duty in command of the *Yorktown* at Manila. When the Filipino Insurrection broke out he attempted to cut off Aguinaldo's retreat with a landing party, but during the land manœuvres half of the *Yorktown's* men were captured. The remainder of the crew pursued the insurrectos and finally recaptured the American prisoners after a long chase. In 1903 Sperry was appointed president of the Naval War College at Newport, and in 1907 was one of the American representatives at the Second Hague Conference. During the cruise of the American battleship squadron around the world in 1908, Admiral Sperry commanded the Second Squadron until the fleet arrived in San Francisco, when he succeeded Admiral Evans (q.v.) in command of the entire fleet. He was retired in 1909.

SPERRY, ELMER AMBROSE (1860–). An American electrical engineer, born at Cortland, N. Y. In 1879–80 he attended Cornell University. About this time he perfected one of the first electric arc lights in America. Sperry was a pioneer in the manufacture of electrical mining machinery, electrical street-railway cars, and electric motors. In addition he perfected the gyroscopic compass, produced apparatus for stabilizing ships and aëroplanes, and invented electrochemical apparatus for the production of caustic alkali and chlorin compounds. In 1915 Sperry was appointed a member of the United States Naval Advisory Board. See AËRONAUTICS, *Monoplanes*.

SPES (Lat., hope). The Roman goddess of hope, represented as a youthful divinity clad in a long robe and bearing a bud in one hand. Spes personified hope for good harvests and for children, and was invoked at births, marriages, and other important times.

SPES′SARTITE. See GARNET.

SPET. See BARRACUDA.

SPEUSIP′PUS (Lat., from Gk. *Σπεύσιππος*) (c.400–c.339 B.C.). An Athenian philosopher, nephew and pupil of Plato, with whom he is supposed to have visited Syracuse. In 347–339 Speusippus was head of the Old Academy. He went even further than Plato in his mystical interest in the Pythagorean numbers, but in general agreed with his master, save that he denied the perfect goodness of the primordial unity, inasmuch as bad must be held to proceed from it as well as good. Consult: Fischer, *De Speusippi Atheniensis Vita* (Rastatt, 1845); E. Zeller, *Plato and the Older Academy* (Eng. trans., London, 1888); P. Lang, *De Speusippi Fragmentis* (Bonn, 1911); Ritter-Preller, *Historia Philosophiæ Græcæ* (9th ed., Gotha, 1913).

SPEY, spā. A river of Scotland, rising in Inverness-shire and, after a northeast course of about 110 miles, falling into the Moray Firth, 3 miles west of Port Gordon (Map: Scotland, E 2). The Spey is the second longest river in Scotland. It has salmon fisheries.

SPEYER, spī′ẽr, or **SPEIER** (in Eng. often *Spires*). The capital of the Palatinate, Bavaria, at the confluence of the Speyerbach and the Rhine, 23 miles north of Karlsruhe (Map: Germany, C 4). The chief feature is the magnificent cathedral, a vast Romanesque edifice. It was begun in 1030 by Conrad II, the founder of the Franconian dynasty of German emperors, and in its original form was completed in the reign of his grandson, Henry IV. It was long the burial place of the German emperors. The cathedral suffered in 1689 and 1794 from the vandalism of the French invaders, who spared nothing. Restoration was completed in 1853. The interior has magnificent frescoes, statues, and reliefs by Schraudolph and other masters. Among other architectural monuments of the city is a splendid gate (thirteenth century). There is a fine museum of antiquities. Manufactures include woolens, machinery, shoes, tobacco, vinegar, and sugar. Speyer, the Roman Augusta Nemetum (later Noviomagus), was created an episcopal see in 348. It was a favorite residence of the German emperors, and became a free Imperial city in 1294. At the Diet of Speyer in 1529 the followers of Luther presented their protest, which gave them the appellation of Protestants. The city belonged to France from 1801 to 1814, when it passed to Bavaria. Pop., 1900, 20,911; 1910, 23,045.

SPEYER, JAMES (1861–). An American banker, born in New York City. He was educated at Frankfort-on-the-Main, Germany, where he entered the family's banking house in 1883. He was then employed in the Paris and London branches, and later returned to New York to take charge of the branch there. Finally he became head of the firm. He was elected trustee or director in various other financial and industrial organizations. In 1902 he presented the Speyer School to Teachers College (Columbia)—he served as trustee of the university—and he was a director of Mt. Sinai Hospital. In 1894 he was a member of the Committee of Seventy that helped to overthrow Tammany Hall's control of the city.

SPEYERS, spī′ẽrz, CLARENCE LIVINGSTON (1863–). An American chemist, born in New York City. He graduated from Columbia University in 1884 and was assistant in chemistry in the University of Missouri during 1885–

91 and associate professor at Rutgers College from 1891 to 1908. Thereafter he was research associate of the Carnegie Institution. He published numerous papers on physicochemical subjects, such as heat of solution, vapor pressures of mixed liquids, osmotic pressure, dielectric constants of solutions, and compressibilities of substances as related to their surface tensions.

SPEZIA, spĕt′sē-ȧ. A city in the Province of Genoa, Italy, on the Gulf of Spezia, 56 miles by rail southeast of Genoa (Map: Italy, B 2). Its scenery and mild climate have made it a favorite winter resort. Its advantages as a naval station were pointed out by Napoleon, and in 1861 the Italian government made it the chief naval harbor of Italy. On surrounding hills there are strong fortifications. Some of the largest Italian warships have been constructed at the shipbuilding yards. The city has a technical institute, a school of navigation, and a marine hospital. Considerable trade is carried on, chiefly in olive oil, wine, fruits, and marble. There are manufactures of furniture, hemp linen, and leather. Spezia is near the site of the ancient Luna, of which some remains exist. Pop., 1881, 30,732; 1901, 65,612; 1911, 73,599.

SPHACTE′RIA, or SPHAGIA. A small island off the southwest coast of Messenia, Greece, commanding the entrance to the Bay of Navarino (Map: Greece, C 7). The island is hilly and characterized by the steep slopes of its heights.

SPHAG′NUM (Gk. *σφάγνος*, *sphagnos*, a sort of moss), or BOG MOSS. A genus of mosses intermediate between the liverworts and true mosses (see MUSCI) remarkable for their whitish or pale color. They often grow in considerable masses, absorbing water like sponge, but becoming friable when dry. They contribute much to the formation of peat. Gardeners employ them for covering and moistening the roots of plants because they readily absorb moisture from the air. The cells of the leaves are remarkable for their spiral structure and for large pores in their sides. See Plate of BRYOPHYTES and Colored Plate under MUSCI.

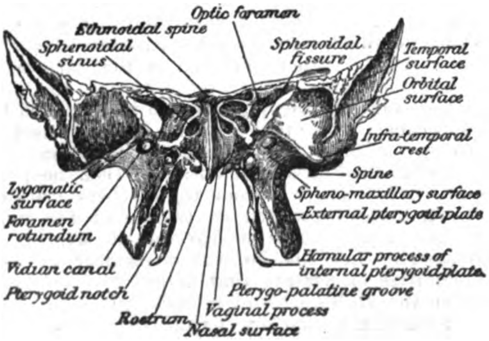
SPHAL′ERITE, or ZINC BLENDE. A zinc sulphide and important ore. See BLENDE.

SPHENE (from Gk. *σφήν*, *sphēn*, wedge; from its crystal shape). One of the light-colored (yellow or green) varieties of titanite (q.v.), sometimes cut as a semiprecious stone.

SPHENISCI, sfē-nis′sī. A group of birds, the penguins (q.v.).

SPHE′NODON. See HATTERIA.

SPHE′NOID BONE (Gk. *σφήν*, *sphēn*, wedge + *εἶδος*, *eidos*, form). A bone situated at the anterior part of the base of the skull and articulated with all the other cranial bones, which it wedges firmly together. It somewhat resembles a bat with its wings extended, and hence was termed the *os vespertilionis*. It is divisible into a body, the greater and lesser wings, and various processes. The greater wings present three surfaces: a superior or cerebral surface, forming part of the floor on which the brain rests; an anterior surface, which helps to form the outer part of the orbit of the eye; and an external surface with a rough ridge, giving attachment to the external pterygoid muscle, one of the most powerful muscles of mastication. The second, third, fourth, fifth, and sixth cranial nerves emerge from the cranial cavity through foramina in this bone.

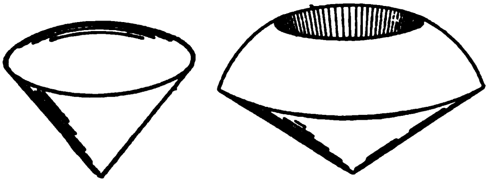


SPHENOID BONE AS SEEN FROM THE FRONT.

SPHE′NOPAL′ATINE GANGLION. See MECKEL'S GANGLION.

SPHERE (Lat. *sphæra*, ball, globe). A solid bounded by a surface every point of which is at a given distance from a fixed point. The given distance is called the radius and the fixed point the centre of the sphere. A spherical surface may be generated by revolving a semicircumference about its diameter. Sections of a sphere made by planes are circles. If the plane passes through the centre of the sphere, the circle is a great circle, otherwise a small circle of the sphere. If the segments into which a plane divides a sphere are unequal, the smaller is called the minor and the larger the major segment. That portion of the spherical surface which is included between two parallel planes which cut or touch the surface is called a zone. The portion of a sphere generated by the revolution of a circular sector about any diameter of its circle as an axis is called a spherical sector.

The surface of a sphere is equal to four times the area of a great circle of the sphere, that is, to πd^2 or $4\pi r^2$, d and r being respectively the diameter and the radius of the sphere. Its volume is $\frac{1}{6}\pi d^3$ or $\frac{4}{3}\pi r^3$. The rectangular equation of a sphere, the origin being at the centre, is $x^2 + y^2 + z^2 = r^2$. (See COÖRDINATES.) (For the formulas for areas and volumes relating to zones, segments, and sectors, see MENSURATION.) A remarkable property of the sphere is that its surface is equal to the curved surface of the circumscribed cylinder and its volume is two-thirds of that of the cylinder, a property said to have been discovered by Archimedes (q.v.). If a sphere and a double cone are inscribed in an equilateral cylinder, the sphere and the volume between the cone and the cylinder are Cavalieri bodies. See CAVALIERI.



SPHERICAL SECTORS, THE LEFT ONE A SPHERICAL CONE.

SPHERICAL TRIGONOMETRY. See TRIGONOMETRY.

SPHEROGRAPH. See SAILINGS.

SPHEROID. See ELLIPSOID.

SPHEROI′DAL STATE (from *spheroid*, like a ball or sphere). The phenomenon observed when a drop of water placed on a highly heated surface remains in its spherical shape and moves about over the surface, evaporating gradually, instead of vaporizing instantaneously. The experiment to show this condition of a liquid is generally performed by using a metallic disk heated by a lamp or Bunsen burner, on which one or more drops of water are carefully let fall. If the disk is sufficiently heated a layer of vapor will be formed between its surface and the drop which is known as the Crookes's layer. The liquid remains suspended on this vapor and the drop takes the form of an oblate spheroid, the temperature, however, never rising above the boiling point, being in the case of water about 206° F. or 96.6° C., while the disk itself must have a temperature of at least 340° F. or 171° C. The explanation of this fact is that the latent heat carried off in the course of vaporization is sufficient to keep the temperature below the boiling point. The drop does not actually touch the disk but is supported on a cushion of vapor, which is evaporating towards the hot plate so rapidly as by its reaction to keep the water from falling. This may be seen by looking at a flame through the intervening space, or by attempting to pass an electric current from the drop of water to the metal disk, using a galvanometer to detect its passage, there being no deflection of the needle unless the two substances are in actual contact. The liquid takes a spherical shape owing to capillary action. Other liquids and bodies that are solid at ordinary temperatures also show this phenomenon. Consult: G. F. Barker, *Physics* (New York, 1893); B. Stewart, *Elementary Treatise on Heat* (6th ed., Oxford, 1895); Alfred Daniell, *Text-Book of the Principles of Physics* (new ed., New York, 1911).

SPHINCTER MUSCLE (Lat. *sphincter*, that which binds tight). A circular band of muscular fibres, whose function is to antagonize the expellent action of certain viscera, especially the bladder and the lower part of the intestinal canal. It is to the presence of these muscles that the higher animals owe the power of retaining for a considerable period the excrementitious matters collected in the bladder and rectum, and of discharging them at intervals, the sphincter muscles being, like those engaged in the process of respiration, mainly, but not entirely, under the control of the will.

SPHINX (Lat., from Gk. σφίγγειν, *sphingein*, to strangle). A composite monster, famous in Greek mythology, having the head of a woman, the body of a lion, the wings of a bird, and the tail of a serpent. According to the legend, she proposed a riddle to the Thebans, slaying all who were unable to guess it, and when Œdipus finally solved her riddle, she threw herself over a cliff and perished. She is said to have been the daughter of Echidna and her son Orthrus, or of Chimæra and her brother Orthrus. The name "sphinx" was applied by the Greeks to a class of composite figures, familiar in Egyptian art, having the body of a lion and the head of a man or of some animal.

The most remarkable of all Egyptian sphinxes is the Great Sphinx of Ghizeh, lying about 300 feet east of the second pyramid, and made, according to Budge, to protect the neighboring tombs from evil spirits. It is sculptured out of the native rock, to which masonry has been added in certain places to complete the form. The body is roughly hewn out, but the head was originally executed with great care. The entire height of the monument, from the crown of the head to the pavement on which the forelegs rest, is about 66 feet. In length the figure measures 172.5 feet; the forelegs are 50 feet long; and the head is 30 feet long by nearly 14 feet in breadth. The face was originally colored red, but the coloring has almost entirely disappeared. In 1816 the front of the Sphinx was cleared of sand by Caviglia, who found close to the breast a shrine, or small temple, containing an inscription of Thothmes IV and one of Rameses II. Both monarchs had cleared away the sand that had accumulated about the monument. From the inscription of Thothmes IV it is clear that the Sphinx was considered to represent Harmachis (q.v.), a special form of the sun god, and its office was to serve as a guardian of the necropolis near the pyramids. It has been supposed to be the work of King Chephren of the fourth dynasty, and some archæologists have even assigned it to an earlier period, but the existing evidence is insufficient to fix its date with any degree of accuracy. See Plate of Pyramids.

Bibliography. H. Vyse, *Operations at the Pyramids of Gizeh* (3 vols., London, 1840–42); K. R. Lepsius, *Denkmäler aus Ægypten und Æthiopen* (Berlin, 1850–59); Perrot and Chipiez, *History of Art in Ancient Egypt* (London, 1883); E. A. T. Wallis Budge, *A History of Egypt* (New York, 1902); id., *The Gods of the Egyptians*, vol. ii (London, 1904); W. M. Flinders Petrie, *History of Egypt* (ib., 1905); Baedeker, *Egypt* (7th ed., Leipzig, 1914).

SPHINX MOTHS. Moths of the family Sphingidæ, described under Hawk Moth. Prominent American examples are depicted on the Colored Plates of Moths and of Insects.

SPHYGMOGRAPH (from Gk. σφυγμός, *sphygmos*, pulse + γράφειν, *graphein*, to write). An instrument invented by Vierordt and perfected by Marey, by which are ascertained and recorded the force and frequency of the pulse beat and the changes it undergoes. It consists of two parts: (1) Two levers, one of which is so delicately adjusted on the vessel the pulsation of which it is desired to examine, that on each expansion of the vessel the lever undergoes a corresponding slight elevation; this lever communicates by a perpendicular arm with a second, transmitting the impulse received from the vessel; the extremity of this second lever has a pen point, which records the movement thus indicated on a movable plate, controlled by the second part of the instrument. (2) A plate, moved by clockwork, and bearing a strip of paper on which the sphygmogram is written. The instrument may be combined with a microphone, constituting a sphygmophone. The pulsations may be seen by an appliance termed a sphygmoscope.

The sphygmograph is only one of several instrumental methods of studying the cardiac rhythm. Another is the electrocardiograph. The usefulness of this instrument depends on the fact that contracting muscles give rise to electrical changes, and the further observation that if the legs or arms are used and connected by means of lead electrodes with a galvanometer (q.v.), the electrical reaction which then occurs with the heart contractions will affect the magnet. By means of the string galvanometer, invented by Einthoven, the movements of the heart are registered as follows: a thread of platinum is placed between the poles of the magnet. In this magnetic field the thread becomes sensitive to the slightest electric change. The right arm or left leg or right arm and left arm are immersed in a basin containing salt water and a sheet of copper, the latter connected by wires with the platinum thread lying in the magnetic field. Electrical disturbances set up by heart contractions are conveyed to the thread and cause it to execute slight movements. By a series of lenses and an arc light suitably placed the shadow of the thread is shown upon a movable photographic plate and its movements photographically recorded. Such a record is called an electrocardiogram; students of these records are able to distinguish the separate movements of the ventricles and auricles and draw definite conclusions as to the normal or pathological conditions of these portions of the heart. Consult Lewis, *Electrocardiography* (London, 1913), and Hoffman, *Die Electrographie als Untersuchungmethode des Herzens* (Wiesbaden, 1914). See PULSIMETER.

SPICCATO, spē-kä'tō (It., separated). A term in music indicating a distinct and detached mode of performance—usually applied to music for bowed instruments, and implying that each note is to be played with a springing bow. The bow is allowed to fall upon the string; it rebounds, and falls again for the next tone, etc.

SPICEBUSH. See FEVER BUSH.

SPICE ISLANDS. A group of islands in the Dutch East Indies. See MOLUCCAS.

SPICES. See FLAVORING PLANTS.

SPIDER (from AS. *spinnan*, to spin). Any member of the Araneida, an order in the class Arachnida. The arachnids are distinguished from insects by the possession of four pairs of legs; while spiders are separated from other Arachnida by the presence of spinning organs near the tip of the body. The body of a spider is divided into two portions connected by a small slender pedicel. The anterior part, the cephalothorax, is supposed to represent the combined head and thorax of insects. The posterior part is the abdomen. On the anterior part of the cephalothorax are the eyes, commonly eight in number, and frequently arranged in two transverse rows of four each. In the lower front margin of the cephalothorax are the mouth parts. These consist of a pair of jaws, sometimes called mandibles or falces; a pair of palpi, whose basal joints are enlarged into maxillæ; and a median unpaired lower lip. The mandibles are two-jointed; the basal joint is very large and stout, the apical one is small, clawlike, and called the fang. The palpi are filiform and six-jointed. In the female they are simple and often terminate in a claw; in the male, however, the apical joint is curiously modified into a complicated accessory sexual organ, suited to carry and apply the seminal fluid. The four pairs of legs are similar in structure but variable in length. Each consists of seven joints and ends in two or three toothed claws. The spiders that live on webs usually have three claws, the median more curved than the others; while other spiders commonly have but two. In place of the median claw is sometimes a dense fascicle of hairs. The abdomen of spiders is generally soft, tumid, and has no apparent joints. The genital organ opens near the base of the abdomen beneath. The male aperture is inconspicuous, but the female vulva or epigynum is often very prominent and sometimes quite complicated. At the apex of the abdomen are four to six short, often two-jointed, pieces, the spinnerets or spinning organs. Each spinneret has on its surface many minute orifices, from each of which may issue a thread, and the many threads joined together make the spider's line. The substance which exudes from the spinnerets is glutinous but dries on contact with the air. Some spiders possess an accessory spinning organ, a transverse surface in front of the base of the spinnerets known as the cribellum. Correlated with this is a row of curved hairs on the hind metatarsus called the calamistrum. The spider draws the row of hairs over the cribellum and combs out a curled or tangled thread of silk.

The mouth of the spider opens into a short œsophagus, which leads to a sucking stomach which draws up the liquid food. From the posterior part of this organ arise two branches which extend upward and forward and meet over the mouth; each branch gives off on the outer side four smaller branches, one in front of each leg, and these unite below the sucking stomach. From the stomach arises the intestine, which passes into the abdomen and opens just behind the spinnerets. In the abdomen just above the intestine is a long tubular heart or pulsating vessel, with openings in front, behind, and along the sides. The nervous system is represented by a large, long ganglionic mass lying on the floor of the cephalothorax. In front is a smaller mass which gives rise to nerves to the eyes and jaws. At the base of the abdomen below there is a cavity on each side, nearly filled by a series of thin plates through which the air reaches the blood. These are the lungs. Spiders also have a pair of branching tracheæ, which open just in front of the spinnerets. The silk glands lie above the spinnerets and along the floor of the abdomen. They are of two kinds, most of them short, but two are larger and very long. Each silk gland has a separate opening or duct in the spinnerets.

The eggs are deposited (10 to 2000 in number) within silken cases or cocoons made by the mother spider for this purpose. The young spider on hatching is in general appearance much like the parent, but with larger hairs and less distinctly marked. As the young spider grows it is obliged to molt the skin. The number of molts varies from six to nine. The spider's silk is not used solely in the construction of webs but serves a variety of purposes. With many spiders the web is a loose, irregular maze of crossed threads, which are the true cobwebs. In other cases it is a flat sheet of threads with a tubular retreat at one corner. The geometric or orb webs consist of a varying number of radiating lines crossed by many parallel or spiral threads. The whole is supported by several guy lines or stouter threads. At one corner or in the near vicinity is a silken nest or retreat, where the spider remains concealed during the day or when not using the web. This retreat is connected by a line to the centre of the web. When waiting for prey the spider rests upon the centre of the web, head downward and legs extended. See ORB WEAVER.

The male spider is usually smaller than the female, with longer legs, and often is more highly colored; sometimes he has additional spines on the legs or spurs on the coxæ. In many of the minute species the male has the front of the cephalothorax greatly swollen and elevated, often molded into grotesque shapes. The courtship of spiders is frequently attended with grave peril to the male. The female, if not in the suitable temper, may attack and devour her devoted admirer. In some cases, however, the male is larger than his mate.

As a rule spiders can see clearly only for a few inches. They have an acute sense of hearing, as well as of touch. A number of spiders are so shaped or colored as deceptively to resemble ants, an appearance heightened by their erratic movements. Others resemble the surfaces upon which they usually occur, as the bark of trees, dead leaves or twigs, and the petals of flowers. A few are able to produce sounds; some by rubbing the base of the abdomen over the base of the cephalothorax, others by rubbing the palpi against the sides of the mandibles. A considerable number, known as trap-door spiders, dig holes in the ground, line them with silk, and cover the entrance by a close-fitting door, the upper surface of which is made to resemble its surroundings. Some species make similar nests in trees. A few spiders are social and produce webs in common, or closely connected to each other. Some of the large spiders are very powerful and can kill small birds, rats, fish, and other animals. All spiders have poison glands and use them in capturing prey, but with most spiders the mandibles are so small and weak as to be incapable of piercing the human skin, and if they did so the small amount of poison injected could have no deleterious effect. With the large tarantulas it is different, although cases of death from their bites are few and doubtful. There is one group of spiders, however (genus *Latrodectus*), which appear to merit the name of poisonous spiders. The New Zealand species, locally known as katipo (q.v.), certainly appears to be dangerous. A species of *Latrodectus* occurs in the southern United States, where it is called malmignatte, but its bite (as far as known) has not proved fatal.

The classification of spiders, formerly quite simple and based on their habits and webs, has undergone a complete revolution. Thirty-five or 40 families are now known; several, however, contain but few species. The more prominent families may be grouped in two classes for convenience. Of the nonweb-building kinds are the Theraphosidæ, or tarantulas, and trap-door spiders. They have vertically moving fangs, four lung slits, and are of large size. The Dysderidæ possess but six eyes and live in dark places. The Drassidæ are flat, with prominent spinnerets, and live on the ground or under stones. The Clubionidæ are convex and occur on bushes or among dead leaves. The Sparassidæ are very flat and broad and are abundant in the tropics. The Thomisidæ, or crab spiders, are flat, broad, can walk sidewise, and catch prey by the forelegs. The Lycosidæ, or wolf spiders, have the eyes in three rows, those of the lowest very small; they wander in woods and fields. The Attidæ, or jumping spiders, have eyes in three rows, those of the lowest row the largest; they jump and stalk their prey.

Among web-building forms are the Agalenidæ, which make flat sheets of web with a tubular retreat at one side; the Dictynidæ, which possess a cribellum and make irregular webs with curled threads; the Theridiidæ, which make the familiar cobweb; and the Epeiridæ, which make geometric or orb webs.

Consult: H. C. McCook, *American Spiders and their Spinning Work* (3 vols., Philadelphia, 1889–93); J. H. Emerton, *The Common Spiders of the United States* (Boston, 1902); J. H. Comstock, *The Spider Book* (New York, 1912); Cecil Warburton, *Spiders*, in "Cambridge Manuals of Science and Literature Series" (Cambridge, 1912), containing a bibliography; J. H. Fabre, *Life of the Spider*, English translation by A. Teixeira de Mattos (London, 1912).

SPIDER CANCER. See Nævus.

SPIDER CRAB. Any crab in which the legs are of unusual length in comparison with the body. The famous giant crab of Japan (*Macrochira kempferi*) is the largest known spider crab, and has legs from four to six feet in length. On the eastern coast of the United States the name is usually given to species of Libinia, especially *Libinia canaliculata*, very common on muddy shores or flats. See Plate of Crabs.

SPIDER MONKEY, or Coaita. Any American monkey of the genus *Ateles* or *Ateleus*, characterized by slenderness and agility. (See Monkey.) They frequent in small bands the tallest forest trees, moving swiftly by astonishing leaps, sprawling out like spiders, and catching by their perfectly prehensile tails. Most are black or nearly so, with the face shaded by projecting hair, which is either light or dark in color. They are mild, intelligent, and make interesting pets. Ten species occur between southern Brazil and central Mexico, of which the Amazonian red-faced (see Plate of Monkeys) and the Mexican one are best known. Their food is mainly fruits and insects, and their flesh is eaten.

SPIEGEL, shpē′gel, Friedrich von (1820–1905). A German Orientalist. He was born in Kitzingen, studied at Erlangen, Leipzig, and Bonn, then (1842–47) in the libraries of Copenhagen, Paris, London, and Oxford, and from 1849 to 1890 was professor in the University of Erlangen. His early studies on Pali did much for the knowledge of southern Buddhism. The edition of the greater part of the extant Avesta, together with the Pahlavi translation (2 vols., 1851–58), was followed by a German version (3 vols., 1852–63), and supplemented by a commentary (2 vols., 1865–69). He published a number of Persian works, as well as a grammar of Old Bactrian (1867). Other of his important publications include: *Die altpersischen Keilinschriften* (1862; 2d ed., 1881), *Erân* (1863), *Erânische Altertumskunde* (3 vols., 1871–78), *Vergleichende Grammatik der alterânischen Sprachen* (1882), and *Die arische Periode und ihre Zustände* (1887). Mention should also be made of the *Grammatik der Parsisprache* (1851) and of the *Einleitung in die traditionellen Schriften der Parsen* (2 vols., 1856–60). In 1908 a memorial volume, edited by J. J. Modi, was published in his honor at Bombay by his pupils and admirers. The work is prefaced by a sketch of his life by W. Eugen.

SPIEGELEISEN. See Iron and Steel, *Blast Furnace.*

SPIELHAGEN, shpēl′hä-gen, Friedrich (1829–1911). A German novelist, born at Magdeburg and educated at Berlin, Bonn, and Greifswald. He taught for a while at Leipzig, and in 1859 became editor of the *Zeitung für Norddeutschland* in Hanover. Thence he moved in 1862 to Berlin, and edited (1878–84) Westermann's *Illustrirte Monatshefte.* Spielhagen's first successful work was *Problematische Naturen* (1860; 50th ed., 1907), championing extreme political liberalism, and then for a while he dealt with social problems, arising from the irrepressible conflict between the stolid landed nobility and the intelligence of the nation. In several books (*Durch Nacht zum Licht*, 1861; *Die von Hohenstein*, 1863; *In Reih, und Glied*, 1866, schemes for the good of the laboring classes; *Hammer und Amboss*, 1869, dealing with the conflict between capital and labor) he treated the subject with an aggressive optimism that won him a popularity which he afterward maintained by sensational novels of a somewhat lower type. Of these *Sturmflut* (1877), *Ein neuer Pharao* (1889), and *Freigeboren* (1900) are sufficient exemplars. Excellent are his critical *Beiträge zur Theorie und Technik des Romans* (1883). His own ideal for the novel is to present an artistically composed picture of the times, and for this he makes constant hardly veiled allusions to persons of contemporary prominence, so that his novels lose with time something of their significance and actuality. Among his briefer works may be mentioned *Die Dorfkokette* (1868), *Ultimo* (1874), and *Quisisana* (1880). Spielhagen's popularity ran from 1860 to 1880; but his best works, *Problematische Naturen*, *In Reih, und Glied*, and *Hammer und Amboss*, though excellent in descriptions of nature and ingenious in their somewhat complex plots, still have too large an element of political or social purpose to be rated now as artistic productions of the first class. As a translator Spielhagen rendered into German Curtis's *Howadji*, Emerson's *English Traits*, a selection of American poems (1859; 2d ed., 1865), and Roscoe's *Lorenzo de' Medici*. He also translated from the French minor works of Michelet, *L'Amour*, *La femme*, *La mer*. His collected novels appeared in 22 volumes in 1895; new series, 7 vols. (Leipzig, 1902 et seq.). Consult his autobiographical *Finder und Erfinder* (Leipzig, 1890), Karpeles, *Friedrich Spielhagen* (ib., 1889), H. Henning, *F. Spielhagen* (ib., 1910); R. Gottschall, *Die deutsche Nationallitteratur des 19. Jahrhunderts*, vol. iv (Breslau, 1892).

SPIELMANN, spēl′man, MARION H. (1858–). An English art critic and author. He was born in London and studied at University College, London, with a view to becoming an engineer. He wrote articles on art for the *Pall Mall Gazette* (1883–90), and was art critic of the *Daily Graphic*, art editor of *Black and White*, and from 1887 to 1904 editor of the *Magazine of Art*. Among his publications are the *History of Punch* (1895); *Millais and his Works* (1898); *The Unidentified Contributions of Thackeray to Punch* (1899); *John Ruskin* (1900); *Notes on the Wallace Collection in Hertford House* (1900); *British Sculpture and Sculptors of To-Day* (1901); *Kate Greenaway* (1905), with G. S. Layard; *British Portrait Painting* (1910); *Iconography of Andreas Vesalius* (1914).

SPIERS, spērz, R. PHENÉ (c.1841–). A British architect, educated at King's College, London, and at the Ecole des Beaux-Arts, Paris. He was architect of two board schools, London, of Lord Monkswell's house on Chelsea Embankment, of Locke Park, Barnsley, and of painters' studios in London. He was elected president of the British Architectural Association and member of various foreign architectural societies. Besides writing architectural essays and works on architectural drawing, he reëdited Pugin's *Normandy* (1870), Fergusson's *History of Architecture* (1893), and published: *The Orders of Architecture* (1902); *Architecture East and West* (1905); and in collaboration with W. J. Anderson, *The Architecture of Greece and Rome* (1907).

SPIGELIA, spī-jē′lĭ-ȧ (Neo-Lat., named in honor of Adrian van der *Spiegel*, a Belgian physician and professor of anatomy at Padua in the seventeenth century). A genus of plants of the family Loganiaceæ. *Spigelia marilandica*, often called worm grass and Carolina pinkroot, a native of the southern United States, occurring from New Jersey to Wisconsin, and west to Texas, is a perennial plant with a simple quadrangular stem. The root has been employed in the United States as a vermifuge, as has also *Spigelia anthelmia*, a tropical American annual with spikelike racemes of purplish flowers.

SPIKE. A kind of inflorescence (q.v.).

SPIKEFISH. See SPEARFISH.

SPIKE′NARD (from Lat. *spica nardi*, spike of nard), or NARD. A costly perfume of India highly prized by the ancients and used both in baths and at feasts. The ointment of spikenard (John xii. 3) was probably an oil or fat impregnated with the perfume. The plant which produces it has been ascertained to be *Nardostachys jatamansi*, a native of the mountains of northern India. *Andropogon nardus* yields an oil sometimes called oil of spikenard; and in the United States *Aralia racemosa*, a tall herb with large perennial aromatic roots, is known as spikenard. False spikenard is *Smilacina racemosa*. See ARALIA.

SPIKE RUSH. See CYPERACEÆ.

SPILLER VON HAUENSCHILD, RICHARD GEORG. See HAUENSCHILD, R. G. S. VON.

SPIL′LIKINS. See JACKSTRAWS.

SPI′NA BIF′IDA (Lat., cleft spine). A congenital hernia of the membranes of the spinal cord through a fissure in the wall of the bony canal. A tumor is thus formed, which is nearly round, in size from that of an egg to that of an adult head, lying in the middle line of the back, fluctuating, and adhering to the adjacent vertebræ either directly or by a pedicle. The sac may contain only the spinal membranes (meningocele) or a part of the cord with the membranes (meningo-myelocele), or, lastly, the spinal cord so distended by the expansion of the central canal as to form a neural lining to the sac. The usual termination of the condition is death. As the size of the tumor increases, fatal convulsions ensue; or the skin investing the tumor may ulcerate, and infection of the cerebrospinal fluid follow. Occasional cases are recorded in which patients have survived till middle life. Active surgical treatment usually hastens death and should be used only in urgent circumstances. Moderate support by means of a hollow truss, or a well-padded concave shield, may tend to keep the tumor from increasing; any interference beyond this is, in most cases, unadvisable.

SPINACH, spĭn′āj, -ĕch, or **SPIN′AGE** (from Lat. *spina*, thorn), *Spinacia*. A genus of herbs of the family Chenopodiaceæ; probably natives of Asia. Common spinach, or garden spinach (*Spinacia oleracea*), is an annual widely cultivated for its young leaves, which are used as greens. Two very distinct botanical varieties are cultivated: prickly spinach, with somewhat triangular and arrow-headed leaves and rough knobby fruit; smooth spinach, or round spinach (*Spinacia glabra* of some botanists), with round and blunt leaves and smooth fruit. Upon poor soil and after the appearance of the stem, which reaches a height of two feet, the leaves become bitter, hence the more luxuriantly spinach grows, the better it is. It may be sown in spring in rows about one foot apart, but it is generally sown in autumn for early spring use. The smooth spinach is very generally preferred for the former purpose and the prickly kind for the latter. Several unrelated plants are also called spinach, of which the best known is New Zealand spinach (*Tetragonia expansa*), a plant of the family Aizoaceæ, a trailing, succulent annual that withstands the heat of summer and is a valuable successor to true spinach. See Anthracnose, Plate of Yam, Sweet Potatoes, etc.

SPI'NAL ANÆSTHESIA. A method of inducing insensibility to pain first suggested by Dr. Leonard Corning, of New York, in 1885. Its earliest application in European surgical practice was by August Bier of Berlin. Corning subsequently dealt with the subject in his book on *Pain*, published in 1894. Matas employed the method in the United States in 1899; and Tuffier, of Paris, Severeanu, and Racoviceanu-Priteeci, both of Bucharest, together reported 220 cases. At first cocaine was used, but later eucaine and stovaine were substituted, being less toxic. Jonnesco, of Bucharest, advocated injections into the dorsal region of the spinal canal, using a solution of stovaine and strychnine and thus rendering possible operations upon the upper extremities, the trunk, and even the head. Up to 1910 Jonnesco had reported 1386 cases without a death, 195 of which were superior dorsal injections. Nevertheless this method is regarded as dangerous, particularly in the United States.

As generally practiced, the anæsthetic solution is injected through the fourth lumbar interspace, this being located by drawing an imaginary line across the back at a level with the superior iliac spines. The needle is introduced a little to one side of the median line until it penetrates the dura and lies free in the subarachnoid space. The patient should be in an upright sitting position. Such an injection anæsthetizes the parts below the point of penetration so that painless operations can be performed upon the lower extremities, the perineal and genital regions, and pelvis. The disadvantages of the method are that the patient is conscious during the operation; that it is apt to be followed by general weakness, lasting for a day or two, nausea, vomiting, severe headache, chills, elevation of temperature, and delirium. The procedure itself is not painless. A number of deaths have been reported, and disturbances of sensation, transient paralyses, and the like, are not uncommon, due, according to Spielmeyer, to toxic degeneration of the motor ganglion cells of the anterior horns of the spinal cord.

SPINAL COLUMN (Lat. *spina*, thorn, spine), or Spine. The most important and characteristic part of the skeleton of the highest animal subkingdom, including mammals, birds, reptiles, amphibians, and fishes. In each of these classes it is composed of a series of bones placed one above or in front of another and called vertebræ; hence these animals having this characteristic in common are all included in the term "vertebrates." The vertebræ vary in number in different animals, and in shape they differ extremely, even in parts of the same spine, in accordance with their special functions. In man the number of vertebræ which collectively form the spinal column is 7 in the neck (cervical vertebræ), 12 in the back (dorsal vertebræ), 5 in the loins (lumbar vertebræ), 5 ossified together, forming the sacrum, and 4 similarly united forming the termination of the column or coccyx. However long or short the neck may be, every mammal has 7 cervical vertebræ, excepting the three-toed sloth, which has 9, and the sea cow, which has 6. In other regions of the spine no such law exists. Each vertebra is attached to the two adjoining by numerous strong and somewhat elastic ligaments, and between each pair of vertebræ there is interposed a lenticular disk of fibrocartilage, which acts as a buffer. By these arrangements the spinal column is rendered highly elastic, communication of jars or shocks is prevented, and a considerable general range of movement permitted, although the motion between any two adjacent vertebræ is slight. The elasticity of the column is further increased by the component vertebræ being arranged in curves, instead of being placed perpendicularly. These curves enable the spine to bear a greater vertical weight than it could otherwise maintain; they facilitate movements of the body, especially in the act of running; and they are so disposed as to protect the cord in movements of the spine.

The vertebral canal formed by the apposition of the spinal foramina, or neural arches, and containing and protecting the spinal cord, varies in its size at different parts of the column. The intervertebral foramina through which the nerves emerge vary in shape and position in different parts, but are always of sufficient size to prevent injurious pressure on the nerves during movements of the spine; and in the dorsal region, which is the usual seat of angular curvature, the nerves are so protected by bony arches that they may escape injury, even when the bodies of several dorsal vertebræ have been destroyed by ulceration.

SPINAL CORD. See Nervous System and Brain.

SPINAL MENINGITIS. See Meningitis.

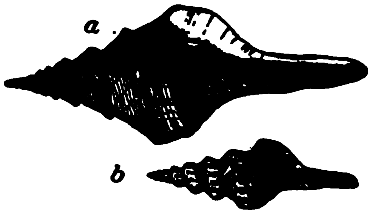
SPINDLE. See Dragon Fly.

SPIND'LER, shpĭnd'lĕr, Karl (1796–1855). A German novelist, born at Breslau. He studied law at Strassburg, fled thence to escape being drafted into the military service of France, and became an actor. In 1825 he turned to literature, and became one of the group, including Hauff and Häring (Wilibald Alexis), which imitated in historical fiction the *Waverley* methods of Scott. Most of his work, which fills 101 volumes in the Stuttgart collective edition of 1854–56, while fascinating as to plot, is careless in execution. In a few cases, however, as *Der Jesuit* (1820); *Der Jude* (1827), his best work; *Der Invalide* (1831; new edition, 1913), and *Der Vogelhändler von Imst* (1842), he skillfully depicted the historical background, and merited, though he did not gain, a more than temporary success.

SPINDLE SHELL. A genus (*Fusus*) of gastropodous mollusks nearly allied to *Murex* (q.v.), having a spindle-shaped shell, with a very elevated spire, the first whorl often much dilated, and with a straight elongated canal. About 100 existing species have been described, and more than three times that number of fossil ones. See Illustration, page 398.

SPINDLE TREE (*Evonymus*, or *Euonymus*).

A genus of about 60 species of shrubs or small trees of the family Celastraceæ. The common spindle tree (*Evonymus europæus*), a European shrub with an orange-colored aril, is often planted for ornament. The hard, fine-grained wood is used for fine turnery and for skewers. It was formerly used for making musical instruments and for spindles, whence the name. Charcoal made of it is much valued for crayons. In the United States wahoo, or burning bush (*Evonymus atropurpureus*), is a small crimson-fruited tree or shrub, which occurs from New York to Nebraska and southward. Strawberry bush (*Evonymus americanus*) is a low shrub often found along wooded river banks from New York to Illinois and southward. The Japanese species, *Evonymus japonicus*, and especially its variegated forms, are extensively planted as an ornamental shrub.



SPINDLE SHELLS (Page 397).

a, a living species (*Fusus proboscidalis*); *b*, a fossil (Miocene) species (*Fusus longirostris*).

SPINDLE TREE (*Evonymus europæus*).

SPINE. See SPINAL COLUMN.

SPINE, CURVATURE OF THE. There are two distinct forms of curvature, lateral curvature, arising from weakness of the bones, ligaments, and muscles, and angular curvature, which results from carious disease of the vertebræ.

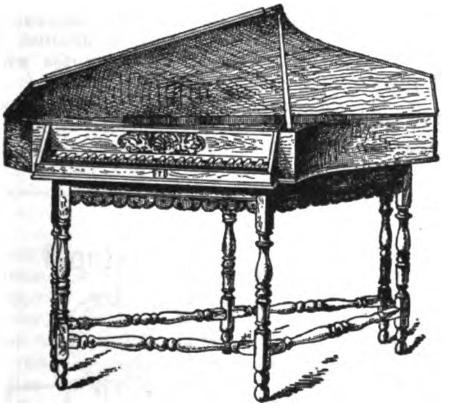
Lateral curvature of the spine, or scoliosis, is not simply a bending of the spine laterally. In addition there is also considerable rotation or twisting of the vertebral bodies which normally are held in their proper relation and position by the ligaments and muscles. Muscular action is necessary for the maintenance of the erect pose; and if, through fatigue and exhaustion or through muscular weakness, from disease, such as rickets (q.v.), the muscles fail to act, a temporary deformity is brought about. If this is not remedied the ligaments become relaxed, the bones which are not yet fully developed adapt their growth to conform to the new relations, and the deformity persists. Postural habits, such as standing on one leg or sitting incorrectly at a desk, tend to distort the spine and to stretch certain ligaments, and often result in permanent deformity. Lateral curvature is more frequent among girls than among boys, for their muscles are less developed by physical exercise and their strength is often unequal to the strain put upon them in their school life. In lateral curvature the bodies of the vertebræ rotate towards the convexity and the spines towards the concavity of the curve. In the dorsal region the ribs are carried with the vertebræ in their rotation, and the chest becomes deformed and the functions of heart and lungs are seriously interfered with. In order to maintain the erect position a compensatory curve develops. In the dorsal region the tendency is to the right, while in the lumbar region it is to the left. The subjects of this affection do not usually complain of pain and often nothing wrong is noticed except awkwardness in gait or a tendency to carry one shoulder higher than the other. An examination will show the prominent spinal processes and the abnormal curve of the spine. Spinal supports and plaster jackets are not to be used. The treatment should be directed to strengthening the muscles by exercise and massage. Orthopedic appliances, braces, etc., and specially prescribed calisthenics are of the greatest value. Exercise must not be carried to excess, as this will only aggravate existing conditions.

Angular curvature of the spine, commonly known as Pott's disease, is the result of caries of the vertebræ. It occurs most frequently in children between the ages of three and twelve years, but is also met with in babes and in adults. The most common seat of disease is the dorsal vertebræ. The inflammation begins in the bodies of the vertebræ, and as they become softened or destroyed the spinal column above settles upon the healthy portion below and the spines of the diseased vertebræ are pushed backward. See ORTHOPEDICS; POTT'S DISEASE.

SPIN'EL (from Lat. *spina*, thorn, spine). A mineral magnesium aluminate crystallized in the isometric system. Spinel has a vitreous to dull lustre and is found in various shades of red, passing into blue, green, yellow, brown, black, and occasionally nearly white. It is prized as a gem, and the transparent red crystals are called spinel rubies; the violet and purple ones are known as almandine; the rose-red to pink, balas rubies; the black, pleonaste; the yellow or orange, rubicelle, and the pale to sapphire-blue, sapphirine. The gem varieties are found for the most part in Ceylon, Siam, and other Eastern countries, and crystals yielding small gems have occasionally been found near Franklin, N. J., and in Orange Co., N. Y.

SPINELLO ARETINO, spê-nĕl'lô ărâ-tē'nô, properly LUCA SPINELLO (c.1333–1410). A Florentine painter of an Aretine family, a prominent representative of the late school of Giotto. His birthplace is uncertain, but he was probably a pupil of Jacopo di Casentino and was employed in decorating numerous churches of Florence, notably the sacristy of San Miniato, in the Campo Santo of Pisa, where he painted scenes from the lives of Saints Ephesus and Potitus, and in the Palazzo Pubblico of Siena. He also executed extensive frescoes at Casentino and Arezzo. A large panel of "The Magdalen" by him is in the Metropolitan Museum, New York. Spinello's work is facile in composition and vivacious in presentation, but superficial in form and execution and often gaudy in color.

SPIN'ET (from Lat. *spina*, thorn, spine). A stringed musical instrument with a keyboard, smaller and weaker than the harpsichord, and, like it, one of the precursors of the pianoforte. The general outline of the instrument nearly resembled that of a harp laid in a horizontal position, with the keys occupying the position of the sounding board. The oldest extant specimen is dated 1490.



SPINET.

SPIN'GARN, Joel Elias (1875-). An American literary scholar, born in New York City and educated at Columbia (A.B., 1895; Ph.D., 1899) and Harvard universities. At Columbia he rose through various positions, being professor of comparative literature in 1909–11. From his pen came: *A History of Literary Criticism in the Renaissance* (1899; It. trans., 1905); *The New Criticism* (1911); *The New Hesperides and Other Poems* (1911); *A Note on Dramatic Criticism* (1913); and a contribution to the *Cambridge History of English Literature*. He edited *Critical Essays of the Seventeenth Century* (3 vols., 1908–09), and *Temple's Essays* (1909).

SPIN'NAKER. A triangular racing sail carried by yachts. It hoists to the foremast or foretopmast head and is spread by a boom which is, at other times, carried up and down the foremast. The spinnaker is set only when the wind is free. See Yacht.

SPIN'NER, Francis Elias (1802–90). An American political leader, born at German Flats, now Mohawk, N. Y. From 1845 to 1849 he was auditor of the naval office in New York City. In 1854 he was elected to Congress as a Free-Soil Democrat, but soon identified himself with the newly organized Republican party, and was twice reëlected to Congress (1857–61), and was then appointed Treasurer of the United States. In 1875 he resigned on account of failing health and afterward lived in Florida. During his administration women were first employed as clerks in the Treasury.

SPIN'NING (from AS. *spinnan*, to spin). The art of drawing, twisting, and combining either animal or vegetable fibres so that they are formed into continuous threads for the further operations of weaving, knitting, or sewing. The principal textile fibres are silk, wool, flax, jute, and cotton (q.v.), and the method of spinning each of these differs slightly from the rest.

The most ancient instruments for spinning were the spindle and distaff, pictured on the earliest Egyptian monuments. The distaff was a staff upon which a bundle of the prepared material was loosely bound, and which was held in the left hand or stuck in the belt; the spindle was a smaller tapering piece to which the thread was attached. By a twirl of the hand the spindle was made to spin round and at the same time recede from the spinster, who drew out between the forefinger and thumb of the right hand a regular stream of fibres so long as the twisting of the spindle lasted. It was then drawn in, the new length of thread wound upon it, and the operation renewed. An improvement in this device was to set the spindle in a frame and make it revolve by a band passing over a wheel, driven by occasional impetus from the hand.

The Saxony wheel is said to have been invented in Nuremberg in 1530. This wheel, used only for flax spinning, contained the germ of Arkwright's invention, described later. A bobbin or pirn with a separate motion was placed on the spindle, which had a bent arm—a flyer or flight—for winding the yarn on the bobbin. The spindle and bobbin revolved at different speeds, revolutions of the spindle giving the twist, and the difference of the speed causing the winding on. The two-handed wheel had two spindles and pirns a little apart, with the distaff stuck into the frame between them, and the spinster produced a thread with each hand.

During the last half of the eighteenth century three inventions were made which completely revolutionized the art of spinning. These inventions were Hargreaves's spinning jenny, Arkwright's throstle machine or roll-drawing spinning machine, and Crompton's mule spinner. In the spinning jenny a number of large reels of fibre, formed into a thickish coil, called a roving, were set on upright fixed spindles, and the ends of the rovings were passed between two small movable bars of wood placed horizontally and under the control of the spinner, who could thus make them press more or less on the roving, and consequently increase or decrease the draw upon it from the spinning spindles, set in a row at the other end of the frame, and all capable of being set in motion simultaneously by the wheel. The spinner drew out the rovings by moving the bars back and forth and at the same time turned the crank with his right hand to rotate the spindles. The throstle machine, patented by Arkwright (q.v.) in 1769, had for its object the drawing of the rovings through a succession of pairs of rollers, each pair in advance of the others, and moving at different rates of speed. The first pair receive the sliver, compress it, and pass it on to the second pair, which revolve at a greater speed, and thus pull it out to exactly the number of times greater length that their revolutions exceed those of the other pair, and as the first roving is passed through a second, third, and sometimes fourth machine, the finished roving is 32 times longer than the sliver. As the roving issues through the last rollers of each machine it is received on spools or reels, calculated to hold a given quantity; and these are transferred to the spinning frames, which resemble the roving frames. Here the roving takes the place of the sliver, and, as it unwinds from the spool, is drawn through successive pairs of rollers, moving as before at different rates, each succeeding pair faster than the backward ones, so that the roving gets thinner and thinner, until tenuity is carried as far as desirable. It is then carried on to a rapidly revolving spindle, which, by means of a simple arrangement, is made both to twist the thread and wind it on the spindle ready for the weaver. Arkwright's machine was too heavy to be driven by hand, hence horse power was used at first, and later water power, which gave it the name of the "water frame." Steam power was applied to it in 1790.

It was found that the process of spinning by rollers produced too great a strain upon the thread in its progress to admit of its being drawn as fine as is wanted for many purposes; this led to the invention of the mule jenny by Crompton in 1779, with its traveling frame upon which the spindles are set, which in its modern form is described below.

During the nineteenth century many important improvements were made in the details of the construction of spinning machinery, but the general principles are those worked out a hundred years ago. The greatest improvements have been changes in the construction of spindles, allowing more rapid and free revolution. In the modern factory spinning is the final process in a series of operations necessary to convert the raw fibre into thread. Each of these processes has for its object the removal of smaller and smaller impurities and the production of a finer and stronger thread. These are: (1) opening and picking; (2) carding and combing; (3) drawing; (4) roving; (5) spinning. Other intermediate operations may be introduced.

The opener or breaker, picker or lapper is a similar machine to the intermediate or finisher lappers, as shown in Fig. 1 and described below. In the breaker lapper the cotton as taken from the bale is fed to it in a hopper or by some kind of automatic feed and delivered in laps which are then placed on the intermediate lapper, either 3 or 4 laps being doubled on the same and the cotton after being loosened and further cleaned is delivered in laps to be placed on the finisher lapper, 3 or 4 laps from the intermediate being again doubled and delivered in a single lap ready for the card. The function of the lappers is thoroughly to loosen the lumps of cotton as taken from the bale, to remove dirt and dust and as much leaf, trash, and motes as possible. There are usually three of these—the breaker, intermediate, and finisher lapper. Fig. 1 is a section of an intermediate or finisher lapper. The cotton enters these machines in a sheet made up from the laps, *A*, delivered onto the slowly moving apron, from which it is taken by the feed rolls and delivered to the rapidly revolving beater, which forces it against the grid bars, loosening the dirt and motes which fall through the grids into the mote box. The cotton is left in a light and feathery mass, drawn in between the squeeze rolls by suction of the fan, which also draws dust and fine dirt from the beaten mass, discharging them by the dust flue. The sheet of cotton from the squeeze rolls is taken by the calender rolls, and compressed and finally rolled into the lap *B*. The lap is about 1 inch in thickness, 40 inches to 48 inches wide, and usually from 48 to 52 yards long.

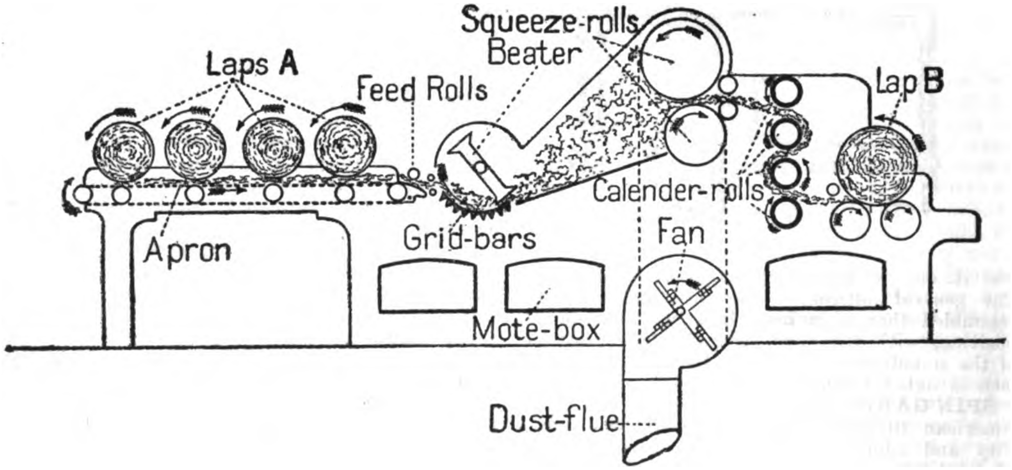


Fig. 1. SECTION OF INTERMEDIATE OR FINISHER LAPPER.

After the cotton has passed through the series of lappers the laps from the finisher lapper go to the card (Fig. 2). (See CARDING.) The cotton in the lap *A* is delivered to the feed roll of the card and is grasped by the teeth of the licker-in, or taker-in, from which it is taken in a thin sheet by the fine wire teeth of the card clothing on the cylinder *B*, and carried upward to come in contact with the teeth on the clothing of the top flats, and the fibres are combed into a degree of parallelism—the cylinder revolving rapidly, while the flats, which are in a chain, move slowly forward so that new flats are continually coming in contact with the cylinder—and much of the short and broken fibre is removed; the comb, *C*, removes the short fibres from the flats and they are rolled upon the rod, and the flats are further cleaned by the brush. The carded cotton is taken from the cylinder by the doffer cylinder, the latter having a surface velocity somewhat less than that of the main cylinder, and is removed from the doffer by the comb, *D*, in a thin evenly carded film; this film is drawn through the trumpet by the calender rolls, in a round strand about 1 inch thick called a sliver, which is automatically coiled in the sliver-can by the coiler.

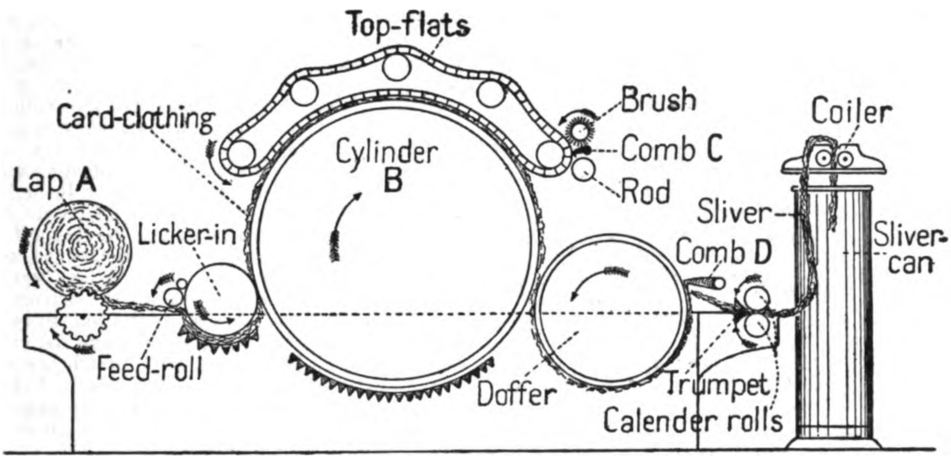


Fig. 2. SECTION OF REVOLVING TOP-FLAT CARD.

As all the processes are arranged to double the mass of cotton and then reduce the mass in size by drawing it out to several times its original length until the yarn is finally produced, an examination of Fig. 3 will help the reader to understand how the drawing acts on the fibres. On the left is shown the sliver from the card, the cotton being in a more or less tangled condition, but after passing between the successive pairs of drawing rolls, 4.4′, the last or right-hand pair, revolving faster than the others, draws the fibres past each other and straightens them, bringing them into a nearly parallel position.

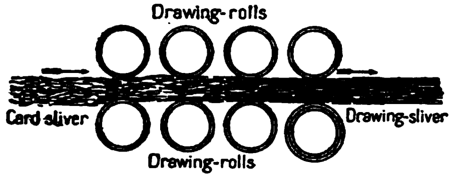


Fig. 3. DETAIL OF DRAWING PRINCIPLE.

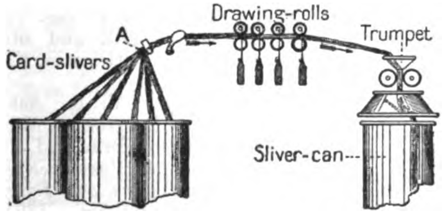


Fig. 4. SECTION OF DRAWING FRAME.

The card sliver goes first to the drawing frame, Fig. 4, and four to eight slivers, *A*, are combined by passing them through the drawing rolls as above described. The drawing sliver is carried through the trumpet and deposited in the can by the coiler the same as from the card. This drawing process is repeated two or three times as the work may demand, always doubling and drawing, but without putting in any twist.

After the drawing frames the drawn sliver is placed in cans, behind the first of the roving frames, which have rolls similar to the drawing frames, but have spindles by which the stock, then called roving, is twisted and wound on bobbins. The first of the roving frames is called the slubber, and is heavier than the intermediates and fine frames, as the other roving frames are designated. The full bobbins, *A*, from the slubber are placed in the creel of the intermediate frame, as shown in Fig. 5, and two strands combined are delivered to the rolls and drawn, the new strand of roving is carried to the top of the flyer, on the spindle *B*, is passed through one arm of the flyer, which is hollow, and delivered to the bobbin, *C*, by the presser foot. The

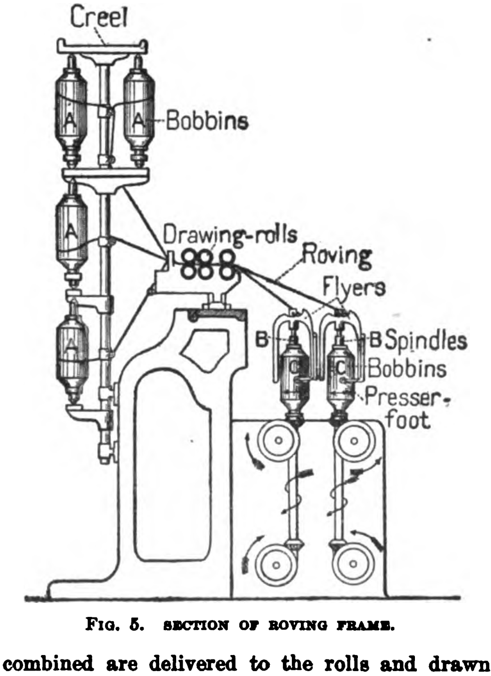


Fig. 5. SECTION OF ROVING FRAME.

revolving of the flyer puts the twist into the strand of roving, while the difference in speed between the flyer and the surface of the bobbin winds the roving on the latter.

The fine frame is a similar frame to the above and delivers the roving finer and more even than any of the preceding machines and ready for the spinning frame (Fig. 6). The roving may be doubled or run singly on the spinning frame, the rolls produce the drawing effect as on the preceding machines, and the revolution of bobbin and spindle puts in the twist. The bobbin, *A*, is fast on the spindle, *B*, and draws the yarn through the traveler, a small wire loop attached to and movable on the spinning ring, which surrounds each spindle. The spindles are made to revolve by an endless cotton band, which passes around the whorl of the spindle and is driven by the cylinder, *D*. The production of the spinning frame is technically frame-spun yarn, either warp or filling. This is wound on the bobbins by the moving up and down of the ring rail, which holds the spinning rings with the travelers, the pull or drag of the travelers winding the yarn on the bobbin.

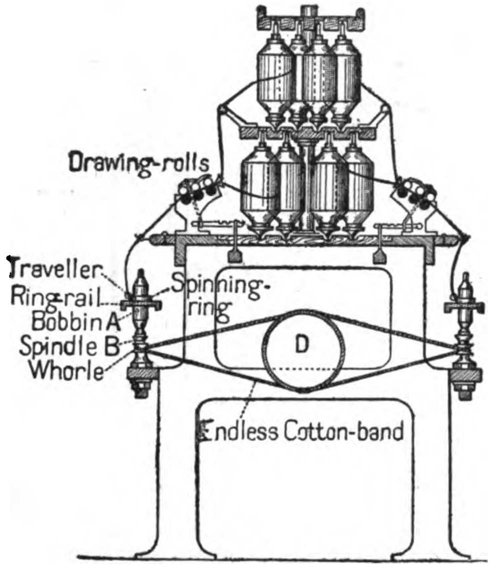


FIG. 6. SECTION OF SPINNING FRAME.

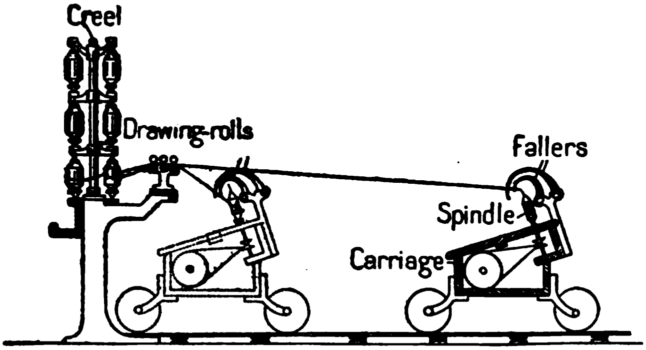


FIG. 7. SECTION OF SPINNING MULE.

Mule-spun yarn is produced by spinning the roving on a mule (Fig. 7), the roving coming from the fine frames as for frame-spun yarns, but the drawing and twisting being accomplished in a different manner. On the spinning frame the roving is drawn, twisted, and wound continuously, while on the mule it is drawn out while the twist is being put in and is spun intermittently, and then wound on bobbins or cops intermittently. The roving is placed in a creel and passed through the drawing rolls, as on the spinning frame, and carried to the spindles, which, instead of being in a stationary rail, are mounted in a carriage, which runs away from and back to the rolls alternately, traveling about 5 feet each way. As fast as the rolls deliver the roving, the carriage and spindles recede from the roll stand and the spindles revolving twist the yarn over the top of the spindles, where it is held by the fallers. In some cases the carriage travels several inches more than the delivery of the front roll and causes additional drawing. The movement out of the carriage is called stretch, and at the end of each stretch the rolls are stopped automatically, the required twist being completed, the spindles are stopped and reversed in motion, while the fallers guide the spun yarn away from the top of the spindle and wind it on the cop or bobbin, the carriage approaching the rolls again, after which the same movements are repeated continuously. The spinning frames are arranged with an average of 104 spindles to a side of about 27 feet in length, but this number varies according to the gauge, or distance between centres of spindles. The mules, not having spinning rings, admit of the spindles being nearly twice as near together, the average number per mule being 480, though some are built much larger.

In a general way the spinning of other textile fibres is the same as for cotton, the desire being to reduce the strands and to make them of uniform diameter throughout their entire length and to give them the requisite amount of twist. Woolen yarn is spun on a mule as described for spinning cotton, except that the carded roving comes to the mule in a different shape, being carded differently and without twist until spun on the mule. Worsted and some cotton yarns are produced by a combing operation which is a special drawing process to increase the parallelism of the fibres, the cotton being afterward worked on the roving frames, while worsted is spun on a frame not unlike the roving frame, the twist being put in by flyers, as the twist in the cotton roving. For the spinning of silk and other fibres, see special articles on those fibres.

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SPINNING GLAND. One of a class of glands (see GLAND) possessed by the larvæ of many kinds of insects and by the majority of spiders. See SPIDER.

SPINNING MITE. See HOP INSECTS.

SPÍNOLA, spē'nō-lȧ, AMBROSIO, MARQUÉS DE LOS BALBASES (1569–1630). A Spanish general, born in Genoa, Italy. In 1602 he led a force of 9000 veterans to the Netherlands against Maurice of Nassau. Made chief commander of the Spanish army there, he forced Ostend to surrender in 1604. He continued his operations against Maurice till the 12 years' truce of 1609, when he took command of the Spanish troops in Germany. He took the field against the Elector Palatine Frederick V and the Protestant Union in 1620, and forced the Union to disband in 1621. He captured Jülich in 1622, and Breda in 1625. Disease forced him to give up his command, but he afterward commanded the Spanish army in Italy. Consult Antonio Rodríguez Villa, *Ambrosio Spínola, primer marqués de los Balbases* (Madrid, 1905).

SPINOZA, spē-nō'zȧ, BARUCH, or BENEDICT (1632–77). A famous Dutch-Jewish philosopher, born in Amsterdam, Nov. 24, 1632. His father, a Portuguese merchant, had fled from Catholic persecution to the Netherlands. Spinoza was carefully educated in Jewish theology and speculation. He was, however, alienated from the orthodox belief by studies of physical science and of the writings of Descartes and probably those of Giordano Bruno. His heresies resulted in threats of severe punishment from his instructors in the Talmud and the Cabala, and the relation soon became so unpleasant that Spinoza withdrew from the synagogue. The rabbis, in 1656, excommunicated him and secured his banishment from Amsterdam. However, he remained in the neighborhood of the city for five years, supporting himself, as in later years, as a lens maker. His first work, *Tractatus de Deo et Homine ejusque Felicitate,* was discovered in a Dutch translation in 1852 (the Latin original not being extant), in which the form of his developed system is foreshadowed. And the *De Intellectus Emendatione* and *Tractatus Theologico-politicus* are also probably referable to the period of his Amsterdam residence, although the latter was not published until 1670 and the former until 1677.

In 1661 Spinoza went to Rhynsburg, near Leyden, and two or three years later to Voorburg, near The Hague. Shortly after, yielding to the solicitations of friends, he removed to The Hague itself. The Elector Palatine, Charles Louis, offered him a chair at the University of Heidelberg, but Spinoza declined the position in order to be free from any restrictions upon his thinking. An offer of a pension, on the condition of his dedicating a work to Louis XIV, he rejected with scorn. His domestic accounts after his death show that he preferred to live on a few pence a day rather than be indebted to another's bounty. He died Feb. 21, 1677. His constitution was no less undermined by consumption and overwork than his sensitive mind was wrought upon by persecution and the violent severance of natural ties. But no word of complaint ever passed his lips; simplicity and heroic forbearance, with a warm, sympathizing heart, were the salient features of his character. His life, in its nobility and suffering, is perhaps the most convincing plea for the vitality of the philosophy for which it served as the human context.

Spinoza's philosophy finds its most adequate expression in his great work, *Ethica Ordine Geometrico Demonstrata* (posthumously published in 1677). The basis from which it was developed was mainly Cartesian. This treatise, on the analogy of geometrical demonstrations, consisted of a series of axioms with corollaries, propositions, and elucidations, designed to render bias or extraneous inference impossible, and there can be no doubt that Spinoza was one of the most conscientious of thinkers in his effort to eliminate the personal equation. Nevertheless, there are few philosophers in whom the personal element is more distinctive. The very fact of Spinoza's severance from his own race and religion, together with his failure to adopt Christian thought, made the individuality of his system the more inevitable; he was bound by no tradition and so followed to the fullest the instincts of his reason. He was influenced by Descartes in method and probably by Bruno in his pantheism, but his system is still his own to a degree seldom true in the history of philosophy.

This system is a thoroughgoing and complicated pantheism. The universe is identical with God, who is the substance of all things. The conception of substance (which Spinoza inherited from the Scholastics) is not that of a material reality, but of a logical subject—the self-sufficient and comprehensive basis for all reality, capable of sustaining as modes of its attributes all temporal existences. Spinoza recognized the possible existence of an infinite number of such attributes, but held that only two kinds are known to us—extension, or the world of material things, and thought. These two comprehended humanly knowable existence.

The idea of extension as the gist of physical reality, and of thought as a nonextended reality, Spinoza derived from Descartes. But Descartes had made each of these into independent substances and conceded to them the power of causal interaction in the privileged case of human mind and body—mind acting upon body and vice versa. Spinoza, as we have seen, makes both forms of reality dependent upon an ultimate substance—God—in which is their existence. Furthermore, he denies their power of causal interaction. Cause and effect in his conception are always similar; extension and thought are wholly dissimilar; therefore their causal interrelation is impossible. Causation may subsist between individual objects in the attribute extension, i.e., between physical bodies, or between individual ideas in the attribute thought, but not between ideas and things. To explain the apparent causal interactions of the latter Spinoza resorted to an elaborate theory of parallelism (q.v.). Every idea has a physical counterpart in the attribute extension; every physical object has its corresponding idea. This is not only true for the individuals in each attribute, but necessarily for their relations also. Hence parallel with every physical causal series there is an ideational causal series reduplicating it; neither is dependent upon the other, but both depend upon the divine substance made manifest through them.

The individuality of things, whether ideas or physical objects, Spinoza explained as particular modes or affections of substance. All particular things in space are the modes of God in the attribute extension; all particular thoughts and feelings are modes of God in the attribute thought. The modes are natura naturata; substance or God is natura naturans. The modes are ephemeral and their existence assumes temporal form; God is eternal, transcending all modal changes. Particular things, accordingly, whether of body or mind, are evanescent and finite. All existence is mortal.

Nevertheless there is an indestructible world. It is not to be found in the realm of existences, but in a realm of essences—something wholly different. The Spinozistic conception of essence is most nearly related to the Scholastic conception of realism and to Plato's conception of a world of ideas. It is an hypostatization of the universal aspect of things, i.e., of their essential nature in a logical or definitive sense, and in many respects is a striking forecast of Hegel's logic of the absolute. The most distinctive difference between Spinoza's world of existences and his world of essences or attributes is that the former exists in time, while the latter has no temporal being. But mortality can pertain only to temporal being; therefore the world of essences, being timeless, must be immortal. Furthermore, the world of essences is a world of immanent being. Every existence has a universal or essential character, though to realize this character it must transcend its own intrinsic form, i.e., free itself from whatever gives it particularity. The world of essences thus has a kind of being within the world of existences—as the immanent cause of the latter—though it does not share its temporal limitation. Now this is precisely true of the divine substance; and so it is that the world of essences represents the essential nature of God.

Immanent causation means self-causation, and that which is self-determined is free. From this reasoning Spinoza derived his doctrine of freedom to be won in the world of essences. Existence in the attribute is bondage, for each existent thing is determined by its own causal series; every particular object or idea is subject to other objects or ideas, and the form of its being is determined by them. Only in non-temporal, self-caused being, i.e., in the universal and immanent, is freedom possible; only by identification with the eternal verities, with substance or God, is immortality—and with it peace—to be obtained.

From this conception springs Spinoza's ethical doctrine, developed in the third, fourth, and fifth parts of the *Ethica*. In its practical form his teaching assumes that everything, so far as in it lies, strives to remain in its own being. The effort by which this striving is manifest is nothing but the actual essence of the thing. This effort, when it is in the mind alone, is will; when in mind and body, it is appetite. If desire is satisfied, we have pleasure; if not, we have sorrow. All affections and emotions resolve themselves into desire, joy, and sorrow, accompanied by ideas. A thing is not desired because it is good; it is good because it is desired. Knowledge of good and bad can be a cause in the moral world, counteracting passion and raising us from the world of appetite and mortality to the world of eternal truths.

Spinoza's position in the development of philosophical thought is in many respects unique. He belonged to no school and he founded none. While in a measure his work was based upon that of his predecessors, it is too strikingly individual to be conceived a mere continuation, even of Cartesian thought. In the vigor and comprehensiveness of his conception, in synthetic daring, he must be ranked with the greatest philosophical thinkers; and though his system gave rise to no sequential development, he has had perhaps the most pervasive influence of all modern philosophers except Kant. Not only metaphysicians, but poets such as Goethe, Wordsworth, and Shelley, have gone to him for inspiration, and the essence of his thought has been in large part appropriated in the poetic pantheism of modern interpretations of nature.

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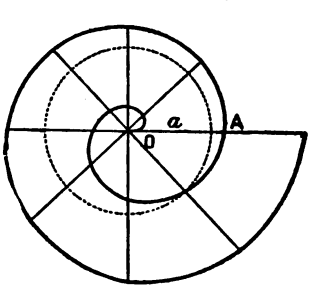
SPINTHARISCOPE. See RADIOACTIVITY.

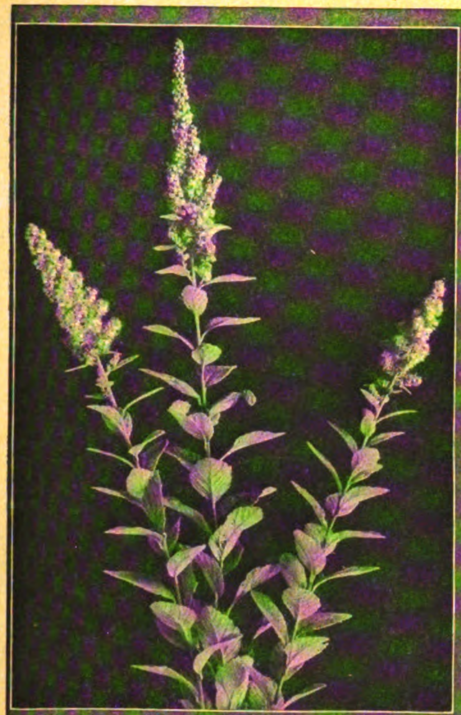
SPIRÆA (Lat., from Gk. σπειραία, *speiraia*, meadowsweet). A large genus of herbs and low deciduous shrubs of the family Rosaceæ, natives of the Northern Hemisphere. Dropwort (*Spiræa filipendula*) and meadowsweet or queen of the meadow (*Spiræa ulmaria*, now called *Filipendula ulmaria*) are European species. Two other species are shown on the accompanying plate. Many species are cultivated in shrubberies for their flowers. *Spiræa tomentosa* is sometimes called hardhack. The name "goatsbeard" is applied to *Spiræa aruncus*, or *Aruncus sylvester*, on account of its long panicles of white flowers.

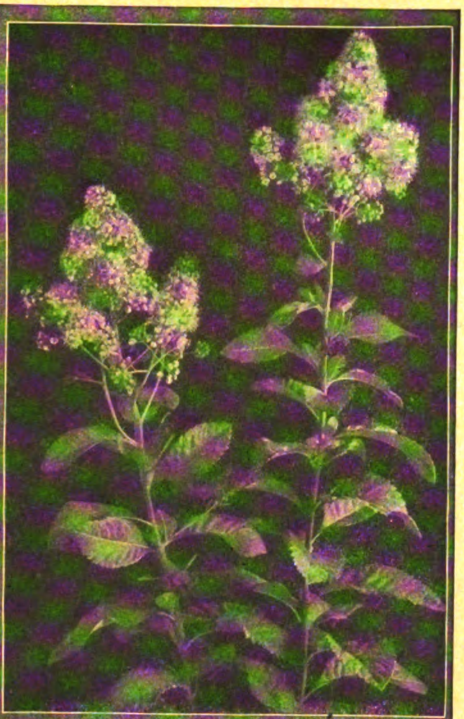
SPIRAL (ML. *spiralis*, from Lat. *spira*, coil). A curve which during its gradual regression from a point winds repeatedly around it. A plane spiral is generated by a point moving along a line according to a fixed law, while the line revolves uniformly about a fixed point in the



SPIRAL OF ARCHIMEDES.

SPIRÆA, ETC.





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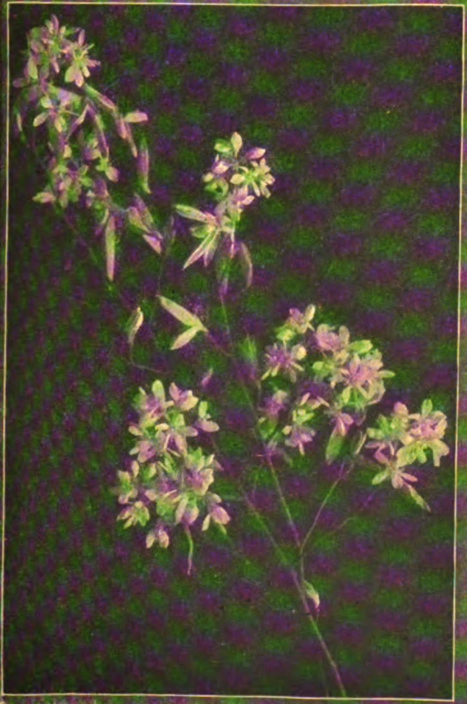
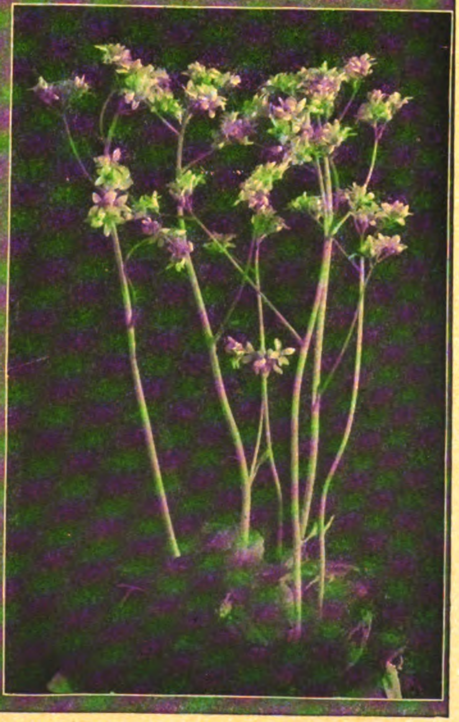


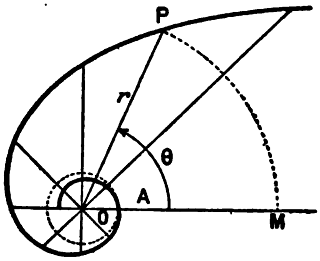


4

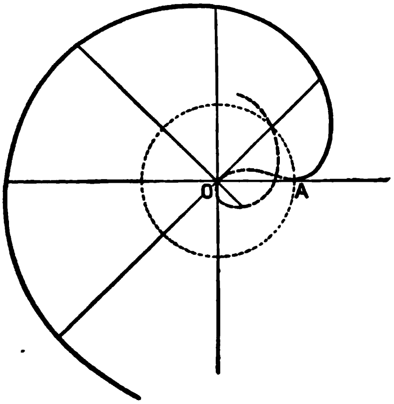
1. HARDHACK (Spiræa tomentosa).
2. WILLOW-LEAVED SPIRÆA (Spiræa salicifolia).
3. SHADBUSH (Amelanchier Canadensis).
4. SAXIFRAGE (Saxifraga Virginiensis).

plane. A spiral which is not plane is generated by a point moving on a given surface other than a plane, about a fixed point according to a given law, e.g., the loxodrome (q.v.). A great many spirals have been studied. Of these the most common are the spiral of Archimedes, the hyperbolic, parabolic, Cotes's, logarithmic or equiangular spirals, and the lituus.

The spiral of Archimedes, probably discovered by Conon, has the equation $r = a\theta$. In this curve the point moves with a constant velocity along the radius vector, and the length of the radius is proportional to the angle described. The curve may be constructed by points as follows: Draw a circle of radius a about O as a centre; draw radii dividing the circumference into n equal parts, and lay off from O on these radii the distances $\frac{a}{n}$, $\frac{2a}{n}$, $\frac{3a}{n}$, $\frac{4a}{n}$, etc. The circle used in this construction is called the measuring circle of the spiral. If the point so moves that the radius vector varies inversely as the angle described, the curve is called a hyperbolic or reciprocal spiral. Its equation is $r = \frac{k}{\theta}$, k being the circumference of the measuring circle. It follows from the equation that an infinite number of spires are necessary for the curve to reach the origin. The curve received its name from the fact that it can also be constructed by means of an auxiliary equilateral hyperbola. If r varies directly as the square root of θ the equation becomes $r^2 = a\theta$, and we have the parabolic spiral. The figure represents the curve for both positive and negative values of r.

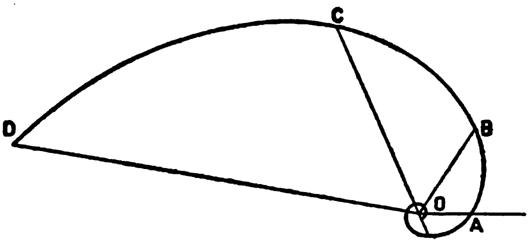


SPIRAL HYPERBOLIC.

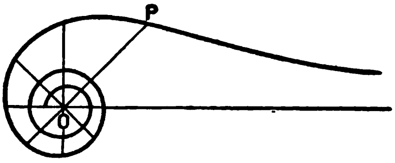


PARABOLIC SPIRAL.

If p denotes the perpendicular distance from the pole to the tangent at any point P of the curve, and if $p = \frac{br}{\sqrt{a^2 + r^2}}$, various spirals may be formed representing this equation. These are known as Cotes's spirals, and are of scientific interest, especially in their relation to trajectories (q.v.). If $b = a$ the equation is that of the logarithmic or equiangular spiral. The characteristic property of this spiral is that the angle between any radius vector and the corresponding tangent is constant. The equation of the logarithmic spiral is $\log r = a\theta$. It is evident from the equation that the curve has an infinite number of spires. The evolute (see Evolute and Involute) of the logarithmic spiral is a similar logarithmic spiral.



LOGARITHMIC SPIRAL.



LITUUS.

A spiral in which the square of the radius vector varies inversely as the angle described is called the lituus or trumpet, a curve described by Cotes (1682–1716). Its equation is $r^2 = \frac{a}{\theta}$. The curve begins at infinity and winds round the origin, but cannot reach it by a finite number of spires. Consult: Pfaff, *Betrachtungen über die Spirale* (Munich, 1830); Brocard, *Notes de bibliographie des courbes géométriques* (Bar-le-Duc, 1897–99); also *Nouvelles Annales de Mathématiques* (Paris, 1846, 1860, 1869, 1880).

SPIRAL PUMP. See Archimedes' Screw.

SPIRE (AS. *spir*, stalk, Ger. *Spier*, needle, pointer). A high pyramidal roof surmounting a tower. The earliest examples of the spire are the pyramidal roofs of towers in the Romanesque buildings of the eleventh century in France and in the Rhine valley. In the twelfth century, especially in France, these stone roofs were often made octagonal and began to assume the slender proportions later characterizing the Gothic spires. In England such spires became common in the thirteenth century; in Italy the square campanile (q.v.) was generally preferred to the spire. The earlier German spires were commonly of wood, covered with slate or lead. In France the point where the square tower merged into the octagonal base of the spire was marked by angle turrets and pinnacles, to which tabernacles and windows often corresponded in the alternate faces of the spire. This masking afterward was carried still farther up by galleries, flying buttresses, and pinnacles, and the outlines of the spire were serrated at the angles with crockets. Before the close of the thirteenth century the masonry was often more or less pierced with ornamental openings, which the Germans in the fourteenth and fifteenth centuries developed into the type of openwork or traceried spires seen in the examples at Freiburg, Strassburg, Ulm, Cologne, Vienna, etc. Two of the finest French examples are those at the west front of Chartres Cathedral; the finest English spire is that of Salisbury, 406 feet high; those of Cologne are 512 feet high, while those of Vienna and Strassburg are of nearly the same height as Salisbury's.

SPIRES. A town of Germany. See SPEYER.

SPI'RIFER (Neo-Lat., from Lat. *spira*, coil, spire + *ferre*, to bear). A genus of long hinged fossil brachiopods of Paleozoic age. The shells are biconvex with the greatest width on the hinge line, the hinge areas are well marked and usually large, the ventral beak prominent and overreaching that of the dorsal valve, the surface marked by strong radial folds or striations, and with a pair of calcified spirally coiled brachidia within the interior of the shell. These brachidia served as supports for the breathing organs and are coiled in the form of cones with the apices of the cones directed towards the outer angles of the shell. The genus has many species, ranging from the Silurian system upward into the Carboniferous and distributed all over the world. Consult Schuchert, "Synopsis of American Fossil Brachiopoda, etc.," in United States Geological Survey, *Bulletin No.* 87 (Washington, 1897). See Plate of BRACHIOPODA.

SPIRIL'LUM. See BACTERIA.

SPIRIT (Fr. *esprit*, from Lat. *spiritus*, spirit, breath, air, from *spirare*, to breathe). A term used in connection with a variety of volatile substances, and more especially with solutions of volatile substances in alcohol. Spirits of wine is ordinary (ethyl) alcohol; spirits of wood, or pyroxylic spirit, is wood alcohol, or methyl alcohol; spirit of hartshorn is aqueous ammonia. Among the spirits, i.e., alcoholic solutions, used in medicine may be mentioned aromatic spirits of ammonia, composed of ammonium carbonate, ammonia water, aromatics, and alcohol.

SPIRIT. See PSYCHOLOGY; SOUL.

SPIRITS, ARDENT. See DISTILLED LIQUORS.

SPIR'ITUALISM (from *spiritual*, Lat. *spiritualis*, relating to spirit or breath, from *spiritus*, spirit, breath, air, from *spirare*, to breathe). A term which, as most commonly used, describes the belief of those who think that communications are occasionally established between the living and the dead who survive in some other mode of existence. This conception, in so far as any general acceptance of the doctrine is concerned, is probably not more than half a century old, although sporadic instances of the belief are possibly as old as human nature.

In modern times the first definite movement in the direction of a general interest in spiritualism took place in 1848 in America, and was associated with the Fox sisters, at Hydesville, New York. The phenomena associated with these sisters were the traditional raps and knockings, the meaning of which required that the experimenter agree upon some certain number of raps as an indication of an affirmative or negative answer to questions. In more complicated matters the answers were spelled out by pointing to letters, etc. The *modus operandi* of the communications is not important, as it was only the familiar production of physical phenomena supposed to be evidence of some transcendental origin. The Fox sisters (who moved to Rochester) performed their wonders for all classes of men and women and numbered among their followers many intelligent people. But opinion was divided as to the value and significance of their phenomena. The more intelligent investigators discovered fraud in them, and finally the sisters confessed to the manner in which they had consciously produced the raps and knocks. Meantime the excitement and interest in spiritualism had spread to England and the Continent. It was probably much less the actual facts in the alleged phenomena that created the widespread interest in the subject than it was two facts in the mental condition of the age wholly independent of the inciting cause. The first was the immense strides which skepticism and criticism had made in discrediting the older theology; the second was the growing faith in scientific experiment and methods.

It was about the same time that hypnotism (q.v.) began to arouse a scientific interest and to contribute to the spiritualist's cause. It had arisen about 1770 or 1780 under Mesmer and was called mesmerism (q.v.) after him. But the quackery and incautiousness associated with it, encouraged by the inertia of scientific academies, brought it into neglect, and it was not heard of more until Dr. Braid, of Manchester, England, reopened the question by showing that there were genuine phenomena in it worthy of scientific attention. This was about 1840. He changed the name of mesmerism to hypnotism and employed suggestion as the explanatory principle as against magnetic fluids of Mesmer. But the peculiar methods of producing hypnosis and the strange psychological susceptibilities exhibited by hypnotic patients were well calculated to impress the popular mind with the belief in occult forces, and in spite of the scientific treatment to which it has been exposed, it still suggests to the public the possibility of supernormal phenomena. Its facts were more easily demonstrable, and could be put to more dignified uses, than the ordinary absurdities of the séance room.

Another type of phenomena occurred about the same time to encourage the spiritualist in his general theory. It was the production of Andrew Jackson Davis, who discovered in 1844 that he could go into a trance, and that he had a strange power of performing intellectual feats in this condition, which were not natural to him in his normal state. He made a bargain with two friends to mesmerize him and to take down in notes what he said during the trance. A volume was published as a result representing the work of fifteen months. His utterances, which were very slow and deliberate, were taken down verbatim, and the volume was called *The Principles of Nature, Her Divine Revelations, and a Voice to Mankind.* The work dealt with the physical, chemical, and vital phenomena of the cosmos, on a large scale, and treated of astronomical matters in a manner to excite curiosity, especially when the prediction of a new planet was verified soon afterward by the discovery of Neptune by Leverrier and Adams. At the same time the man was practicing clairvoyance, and the book asserted the existence of spirit communication. But it was not the philosophic nature of the work that gave it its influence. It was the apparent illiteracy of the man who produced it, and its association with clairvoyance and alleged spirit communications.

Davis himself said that, up to the time of his work, he had read but one book in his life, and this was a romance called *Three Spaniards*. This claim, however, seems to be fairly well controverted, and it is probable that the man had read scientific matter in a casual way. But no amount of casual reading will easily explain in a normal way the systematic character of this work. There are indications in the man's history, and the fact that he was clairvoyant or subject to the trance state is evidence, that his was a remarkable case of secondary personality. See DOUBLE CONSCIOUSNESS.

In 1853 a work was published by Judge Edmonds and Dr. George Dexter that was second in interest only to that of Davis. Mr. Edmonds was a judge of the Supreme Court of New York State and Dr. Dexter was an eminently respectable citizen of New York City. Their attention had been called to the subject of spiritualism by the excitement about the Fox sisters, and they set about investigation for themselves, and soon developed personal phenomena of a peculiar interest. They entered upon a system of experiments in coöperation upon themselves and various mediums, with the result that they published a work which soon became classic, owing to the reputation of the authors. The phenomena recorded and described purported to represent more or less direct communications with discarnate spirits. At first they investigated with a view to ascertain whether the phenomena were genuine, in any sense of the term, and having convinced themselves that they were dealing with spiritistic influences, they published, as the bulk of their work, the alleged messages from Swedenborg and Bacon, and the respectability of the men availed to carry their work through many editions. But the subject of secondary personality was not understood in their time, and was not worked out until a generation later, when the result was to discredit the spiritistic claims of Edmonds's and Dexter's work.

The most remarkable personality, however, in this movement was William Stainton Moses. He was born in 1839 and was educated at Oxford, in England, becoming a clergyman in the Established church. In 1872 he became interested in spiritualism through his friend, Mrs. Speer, and soon developed mediumistic powers in himself. He fought against their influence on his mind for a long time, but his skepticism was finally overcome, and he became a spiritualist, and abandoned the church, and at last became the editor of the chief spiritualist paper, *Light*. No one ever questioned his sincerity and honesty. The phenomena which he records were of a type and variety which tend to excite astonishment. They included the physical and the trance phenomena, of the usual kind, such as the alleged movements of physical objects without contact, and even through other matters, and automatic writing evincing the personal identity of deceased persons and the spiritual and hortatory counsel of discarnate spirits long since deceased. His two works, *Spirit Identity* and *Spirit Teachings*, were widely read. But he resented scientific investigation because he thought it a reflection on his honesty, and hence, though there is some independent testimony to the nature of his phenomena, they depend mostly upon his own asseverations; and though there is no reason to impeach the probity of these, neither he nor his contemporaries reckoned sufficiently with the problems of abnormal psychology and secondary personality to assure the elimination of influence in the production of the phenomena that were quite compatible with honesty and yet were inconsistent with their supernormal character.

After the excitement produced by the Fox sisters, there appeared a perfect inundation of similar and more questionable performances in the person of all sorts of traveling mediums. The popular conception of spiritualism was soon determined by the methods of this class of impostors. Their demonstrations took the form of cabinet séances, materializations, slate-writing performances, and tricks that are easily imitable by the prestidigitator. To this day the general public has no other conception of spiritualism than that which is furnished by the most absurd and most trivial legerdemain. Finally the indifference of the public after discovering the futility of such methods and the influence of the *Report* by the Seybert Commission (see below) caused the interest in such phenomena to decline. The Society for Psychical Research (see PSYCHICAL RESEARCH, SOCIETIES FOR) also had its share of the credit in this depreciation of the movement.

To this period, contemporaneous with Moses and apparently combining the phenomena described by him and the performances of the average trickster, belonged David D. Home, who created an enormous sensation throughout America and Europe. He received the attention of Sir William Crookes, and a group of experiments involving all sorts of physical miracles which still mystify students who have confidence in Crookes.

What the Society for Psychical Research has accomplished tends to show that the methods of physical science which had captivated the last generation are not adequate to cope with the problem of spiritualism. It has been shown to be a psychological problem that must comprehend the whole field of normal and abnormal psychology, including in the latter all the phenomena of automatism, sensory and motor, illusion, hallucination, secondary personality, hysteria, insanity of the functional sort, and the various hyperæsthesias. The consequence of all this has been to suggest that neither fraud nor spirits are always necessary to account for seemingly supernormal phenomena. We are being made acquainted with a vast fund of facts in connection with subliminal consciousness which are well calculated to strike the unwary as of a spiritistic significance, but which are really phenomena of irresponsible secondary personalities. These personalities, like the dream life of normal people, are apparently quite as liable to deception as are the states of consciousness of everyday life. However, the range and capacity of the powers of subliminal states have not yet been exactly determined.

About the same time that the Society for Psychical Research was founded a Mr. Seybert gave a fund to the University of Pennsylvania for the investigation of spiritualism, and the Seybert Commission was appointed for the purpose. The commission exposed many of the ordinary frauds of professional mediums, and its conclusions were adverse to the usual spiritistic claims. After publishing a *Report*, the commission was allowed to lapse.

In Germany and France the movement has had a similar history and outcome. In Germany Reichenbach was the most important investigator, and in France Cahagnet and Du Potet are the principal men of interest. This was in the earlier period. Later we have Karl du Prel, A. N. Aksakoff, a Russian, and Schrenck-Notzing, who manifested interest in the subject and wrote freely upon it.

In recent years the *Proceedings* of the Society for Psychical Research have recorded data, especially in the phenomena of coincidental apparitions and experiments with a Mrs. Piper, a Boston medium, which some of the members have thought favorably confirm the possibility of the spiritistic theory. She has been the subject of experiment for nearly 18 years. This, with two volumes of Mr. F. W. H. Myers, has had the effect of reviving an interest in the general problem. But the subject must still run the gantlet of scientific skepticism and investigation. The early history of the movement has been so infected with charlatanism, fraud, half-baked science, and various forms of radicalism in religious and social matters as to put it under abeyance by the critically intelligent part of the community.

It is not possible to determine with any accuracy the number of adherents to the spiritualistic belief. Spiritualists are certainly very numerous, and have many thriving organizations. These take the form of the ordinary church. It is claimed that they have nearly 350 churches and over 200,000 members. It is probable that the number of believers far exceeds this figure. There is nothing in the belief to suggest the necessity of organization as in the orthodox Christian Church. Their periodicals are quite numerous. *Light*, a weekly, published in London, England, is, perhaps, the best. The *Banner of Light* is published in Boston, Mass.

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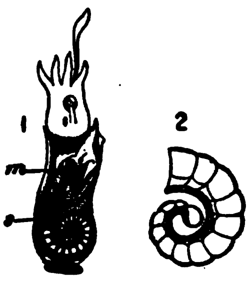
SPIRITUALISTS. See LIBERTINES.

SPI'ROCHÆ'TA PAL'LIDA (Neo-Lat., from Gk. *σπεῖρα*, *speira*, coil + *χαίτη*, *chaitē*, flowing hair, and Lat. *pallidus*, pale). The specific organism of syphilis, a very motile spirillum, discovered by Schaudinn (q.v.) and Hoffmann in 1905. This spirochæta is from four to 10 micromillimeters long and has a pointed, nonretractile, spirally curved body, difficult to stain. The organism is very motile, moving in three ways: rotation on its own axis; whiplike undulation without locomotion; and forward and backward movements. It has been found in almost every tissue of the body of the syphilitic, in the blood in even the smallest capillaries, in saliva, in the brain, in cerebrospinal fluid, in the initial and secondary lesions of acquired syphilis, and in the organs of congenitally syphilitic persons, from the newborn infant to the fully developed man or woman. There exist several other varieties of spirochætæ, all belonging to the genus of flagellated protozoans, such as *Spirochæta carteri*, which causes Indian relapsing fever; *Sp. duttoni*, the cause of African relapsing fever; *Sp. obermeieri*, the specific cause of relapsing fever; *Sp. pertenuis*, which causes yaws (q.v.); etc. See SYPHILIS.

SPIROPH'YTON (Neo-Lat., from Gk. *σπεῖρα*, *speira*, coil, twist, spire + *φυτόν*, *phyton*, plant). A supposed fossil alga found in rocks of Devonian age. It presents a flabellate expansion with a central pit from which radiate curved ribs as from the centre of a vortex. The surfaces of the Esopus grit of Lower Devonian age in eastern New York and Pennsylvania are covered with these fossils. The genus is known also in the Carboniferous rocks, and it has been described from European localities under the name of *Taonurus*. Recent investigations have proven it to be formed by successive packings of sediment along the radial side of a curved burrow which was shifted with each packing, the aperture remaining stationary. The animal which produced these structures was probably a sedentary polychætous annelid. See Sarle, "Preliminary Note on the Nature of *Taonurus*," in *Proceedings of the Rochester Academy of Sciences*, vol. iv (Rochester, 1906).

SPIR'ULA (Lat., dim. of *spira*, coil, spire). A genus of small decapod, dibranchiate cephalopods, comprising two or three species, and constituting the family Spirulidæ, with internal skeleton in the form of a nacreous, discoidal shell, the whorls of which are not in contact with one another, and which are divided into a series of chambers by partitions pierced by a ventral tube or siphuncle. The animal has minute lateral fins, and six rows of small suckers on the arms. The three species constituting the family dwell in deep waters of tropical seas. In internal anatomy *Spirula* is a true dibranchiate, having two branchiæ and an ink bag. It has the peculiar feature that the hinder end of the body acts as a suctorial disk for fastening itself to foreign bodies.



SPIRULA.

1, animal, showing position of shell; *s*, shell; *m*, siphon muscles; 2, shell enlarged.

The genus *Spirula* is not known in a fossil state, but it has ancestors, *Spirulirostra* and *Spirulirostrina*, in the Tertiary deposits of Italy. These latter have remnants of the guard at the apical portion of the shell, which feature seems to indicate the descent of *Spirula* from some form of shell-like Belemnites. See CEPHALOPODA.

SPIT'ALFIELDS. An eastern district of

London, England, in Whitechapel, adjoining Bethnal Green. It is a manufacturing district inhabited chiefly by the poorer class of population, and by silk weavers, descendants of French Huguenots. It is the seat of the Spitalfields market. Spitalfields derives its name from the Hospital of St. Mary, founded in 1197. Pop., 1901, 27,965; 1911, 28,172.

SPIT′HEAD. A roadstead off Portsmouth, England, separating the Isle of Wight from the mainland on the northeast (Map: England, E 6). It is 14 miles long by 4 miles in average breadth, and receives its name from the Spit, a sand bank stretching south from the English shore for three miles. Fortified by circular towers, and, except on the southeast, protected from all winds, it is a favorite anchorage of the British navy, styled by international lawyers the Queen's Chamber, on account of its security.

SPIT′TA, Friederich Adolf Wilhelm (1852–). A German Protestant theologian. He was born at Wittingen, Hanover, and was educated at Göttingen and Erlangen universities. After filling several minor educational and pastoral positions he was pastor at Ober-Kassel (1881–87) and was then appointed university preacher and professor of New Testament exegesis and practical theology at Strassburg. In 1896 he became coeditor of the *Monatsschrift für Gottesdienst und Kirchliche Kunst*. His works include: *Die Apostelgeschichte, ihre Quellen und deren geschichtlicher Wert* (1891); *Zur Reform des evangelischen Kultus* (1891); *Zur Geschichte und Literatur des Urchristentums* (3 vols., 1893–1907); *Jesus und die Heidenmission* (1909); *Das Johannes-Evangelium als Quelle der Geschichte Jesu* (1910).

SPITTA, Karl Johann Philipp (1801–59). A German religious poet, born in Hanover. He was educated at Göttingen and from 1824 to 1828 was a tutor at Lüne, and there wrote the best of his hymns. Afterward he was vicar or pastor in several churches, and in 1859, shortly before his death, was made superintending clergyman at Burgdorf. His hymns, contained in *Psalter und Harfe* (1833; rev. with bibliographical note by his son Ludwig, 1890; Jubilee ed., 1901), and in the *Nachgelassene geistliche Lieder* (1861 and often), rank high in the German spiritual song of the century, and attained great popularity by their freshness of thought, purity of style, depth of sentiment, and finished form. Consult Münkel, *P. Spitta* (Leipzig, 1861; 2d ed., by Majer, Bremen, 1891).

SPITTA, Philip (1841–94). A German musical scholar, born at Wechold in Hanover. He studied philology at the University of Göttingen, and taught at the Gymnasium in Sondershausen (1866–74) and then at Leipzig. The appearance of the first volume of his monumental Bach biography in 1873 won for him international reputation, so that in 1875 he was called to Berlin to be professor of the history of music and secretary of the Royal Academy of Arts. In 1891 he was made Privy Councilor. He died in Berlin. His biography of Bach (2 vols., 1873–80), still the standard work, combines the results of profound scholarly research with a rare æsthetic appreciation. The influence of his method in all fields of musical investigation has been enormous, as is proved by the work of his pupils, among whom was Max Friedländer (q.v.). He contributed to the foremost musical journals, and edited a critical edition of the organ works of Buxtehude (2 vols.) and the complete works of Schütz (16 vols.). From 1885 till his death he was, with Chrysander and Adler, editor of the *Vierteljahrsschrift für Musikwissenschaft*.

SPITTING SNAKE. See Naja.

SPITZBERGEN, spĭts′bĕr-gen *or* -bĕr-gen. An Arctic archipelago lying principally between long. 10° and 28° E. and from lat. 76° 30′ to 80° 30′ N. (Map: Arctic Region, G 4; World, Eastern Hemisphere, B 22). The largest islands are West Spitzbergen (15,000 square miles), Northeast Land (4000 square miles), Edge (2500 square miles), Barents (1000 square miles), and Prince Charles Foreland (900 square miles). Northeast Land is covered with high inland ice, as is the greater part of West Spitzbergen, where ice-free peaks appear, the highest being Diadem, 4150 feet. Discovered by the Dutch (1596) under Barents, Heemskerck and Rijp at its extreme northwestern parts, its area was extended by Hudson, Prince Charles Foreland (1607); Poole, Edge, Edge Island (1614); Marmaduke, Smythe Island (now Northeast Land) and Barents Island (1617). (See Polar Research.) The climate is harsh, the temperature ranging from 40° F. in July to — 10° F. in February.

Through intensive hunting whales, seals, walrus, foxes, and reindeer have practically disappeared. Only 14 species of fish are found in its waters. Flowering plants somewhat exceed 100 in number. While there was a luxuriant Miocene vegetation (cypresses, oaks, etc.) only a tiny willow creeps along favored spots to-day. In recent years the archipelago has become of economic importance. The phosphate discoveries of Nathorst and Wilander (1870) proved temporarily unprofitable. The existence of coal in Spitzbergen has been known for three centuries, but the first full cargo was shipped in 1899. Recently extensive areas of valuable coal have been located and exploited by American, British, and Swedish companies. Forty thousand tons were shipped to Europe by one company in 1912. The main field of operation is on the south side of Ice Fiord, where large forces are engaged in mining, the largest number being at Advent Village, the American settlement. Three wireless stations keep Spitzbergen in touch with the outside world.

International conventions have considered without definite conclusion the important point of the sovereignty of the archipelago, which will probably be governed by a commission. Instances of lawlessness, disputes, conflicting claims, and wanton destruction of game have been of not infrequent occurrence. See Polar Research.

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SPITZ DOG, or Pomeranian Dog. See Sheep Dog.

SPITZKA, Edward Charles (1852–1914). An American psychiatrist, born in New York City. He was educated at New York University (M.D., 1873) and in Leipzig and Vienna. He served as interne in the New York City Asylum for the Insane, was professor of medical jurisprudence and diseases of the nervous system in the New York Post Graduate Medical School and Hospital from 1885 to 1887, and was editor of the *American Journal of Neurology* from 1881 to 1884. In 1890 he held the presidency of the American Neurological Association. Spitzka was well known as an alienist and acted as such in the trial of Guiteau, assassin of President Garfield. His writings include *A Treatise on Insanity* (1883) and many monographs.

SPITZWEG, spĭts′väk, KARL (1808–85). A German genre and landscape painter. Although self-taught in art, he was one of the most original figures in the art world of Munich, his native city, the most genial exponent of the humorous genre. He depicts German life of the forties with realism, humor, poetic fancy, and a delicacy learned from the old masters. In color his paintings are superior to most contemporary German work. Among the best known are "The Poor Poet" (1837), "Two Hermits" and a "Scholar in the Attic" (1882), all in the Pinakothek, Munich: "The Hypochondriac" and five others in the Schack Gallery, Munich; "Going to Church Near Dachau" (1862), in Dresden; "His Reverence" and four others in the National Gallery, Berlin. He also contributed frequently to the *Fliegende Blätter*. Consult: the monograph by Uhde-Bernays (Munich, 1913) and Richard Muther, *History of Modern Painting* (New York, 1907); and for reproductions, *Spitzweg Mappe* (Munich, 1887) and *Spitzweg Album* (ib., 1888).

SPLAY. The sloping or beveled opening in window recesses and other such openings. Also the corner taken off the outer angle of these.

SPLEEN (Lat. *splen*, spleen). The largest and most important of the so-called ductless glands. It is generally oval in form, somewhat concavo-convex, soft, brittle, highly vascular, of a dark bluish-red color, and situated in the left hypochondriac region, its interior concave surface embracing the cardiac end of the stomach and the tail of the pancreas. In the adult it is normally about 5 inches in length, 3 or 4 in breadth, an inch or an inch and a half in thickness, and weighs about 7 ounces. At birth and through most of life, its weight, proportioned to the body, is as 1 to 350; in old age it decreases in weight, the ratio being 1 to 700. The size of the spleen is increased after gastric digestion, and is large in highly fed and small in starved animals. In infectious diseases, such as in typhoid fever, and in chronic malaria, it is much enlarged, weighing occasionally from 18 to 20 pounds, and constituting what is popularly known as the ague cake.

The spleen is invested externally by the peritoneum and inside this by a fibrous capsule giving off from its inner surface numerous small fibrous bands termed *trabeculæ*, which unite at numerous points with one another, and run in all directions. The parenchyma or true substance of the spleen occupies the interspaces of the above-described areolar framework—a soft pulpy mass of a dark reddish-brown color, consisting of colorless and colored elements. The colorless elements are granular matter, of nuclei about the size of the red-blood disks, and a few nucleated vesicles, and constitute one-half or two-thirds of the whole substance of the pulp in well-nourished animals, while they diminish in number and sometimes disappear in starved animals. The colored elements consist of red-blood disks and of colored corpuscles either free or included in cells; sometimes enlarged blood disks are seen included in a cell, but more frequently the inclosed disks are altered in form and color as if undergoing retrograde metamorphosis. Besides these, numerous deep-red, or reddish-yellow, or black corpuscles and crystals, closely allied to the hæmatin of the blood, are seen diffused through the pulp substance.

The venous blood of the spleen is carried away by the splenic vein, which contributes to form the great portal venous system, distributed through the liver; while arterial blood is supplied by the splenic artery, the largest branch of the cœliac axis. The branches of this artery subdivide and ramify like the branches of a tree, with the *Malpighian* or *splenic corpuscles* attached to them like fruit. These splenic corpuscles, originally discovered by Malpighi, are whitish spherical bodies, which are either connected with the smaller arterial branches by short pedicles, or lie upon their sheaths. They vary in size and number, their diameter usually ranging from $\frac{1}{30}$ to $\frac{1}{60}$ of an inch. Each consists of a membranous capsule, homogeneous in structure, formed by a prolongation from the sheath of the artery. The blood capillaries form a delicate plexus within these corpuscles.

The office of the spleen in the human economy is not thoroughly understood, but there is considerable evidence to show that this organ may act as a storehouse of nutritive material; that it is engaged in the formation of blood corpuscles, both red and white, particularly the latter; that in it worn-out and exhausted red corpuscles undergo disintegration; that it has a special nitrogenous metabolic function; and that it acts as a reservoir in connection with the portal circulation. Besides this it is known to have an internal secretion which is believed to have a stimulating influence on the stomach and digestion generally, as well as upon the muscles of the intestines. See SECRETIONS, INTERNAL.

SPLEENWORT. See ASPLENIUM, and Colored Plate of FERNS.

SPLENIC (splĕn′ĭk *or* splē′nĭk) **EXTRACT.** The spleen is believed to have an internal secretion which stimulates the processes of digestion in the intestinal mucosa. An extract of the substance of this organ is given, either alone or in combination with other glandular extracts, to stimulate intestinal digestion and as a general aid to oxidation. It has also been recommended in chronic malaria, tuberculosis, typhoid fever, and various blood disorders. It may be given as an ethereal extract made into an emulsion, or in a form suitable for hypodermic injection. See ORGANOTHERAPY; SPLEEN.

SPLENIC FEVER. See ANTHRAX.

SPLE′NOMEG′ALY, TROPICAL. See KALA AZAR.

SPLICING. See KNOTTING AND SPLICING.

SPLINT (Swed. *splint*, spike, forelock, flat iron peg). In surgery, a mechanical contrivance for keeping a fractured limb in proper position and for preventing any motion of the fractured ends; also employed for securing perfect immobility of the parts to which it is applied in other cases, as in diseased joints, after resection, etc. Many different kinds of splints are used, but wood and plaster of Paris are most common. Wire netting, gutta percha, papier maché, and other materials are also frequently employed, as they can be molded to the shape of the limb. In the same way plaster of Paris can be applied to one side of a limb, carefully molded to it, and held in place by bandages. All movable splints, however, have the disadvantage that they must be readjusted from time to time, and thus the fractured limb is subjected to handling.

The plaster-of-Paris splint is desirable, therefore, in many cases. The limb is carefully protected with a light layer of nonabsorbent cotton, especial care being used to guard bony prominences and to avoid unevenness. Coarse, wide-meshed bandages well rubbed with dry plaster of Paris are immersed for a moment in water and then applied like ordinary bandages, each layer being rubbed into the one beneath so as to make a firm cohesive splint. The plaster should include the joints above and below the seat of injury. This splint may be both strengthened and lightened by the introduction of wooden or metal strips between the layers of plaster. Drying takes place rapidly and gives a firm resisting splint. In compound fractures or in operative cases a fenestrum may be left over the wound proper and opportunity given to attend to required dressings without disturbing the splint.

SPLINT. A bony enlargement on the horse's leg between the knee and the fetlock, usually appearing on the inside of the foreleg, frequently situated between the large and small cannon bones. It is usually caused by concussion, and is most common in young horses that have been driven rapidly along hard roads before their bones have become firm.

SPLIT′MOUTH. See CUTLIPS.

SPLÜGEN, shplụ′gen. An Alpine pass between a tributary of the Hinter Rhein and Val S. Giacomo, a feeder of Lake Como, a few miles east of San Bernardino Pass and at an altitude of 6946 feet (Map: Italy, B 1). The southern or Italian descent has three great galleries built to protect the road from avalanches, and completed by the Austrian government in 1834.

SPOD′UMENE (from Gk. σποδός, *spodos*, ashes). A mineral lithium and aluminium silicate crystallized in the monoclinic system. It has a vitreous lustre and is light green, gray, yellow, or purple in color. The yellow-green to emerald-green crystalline variety found in Alexander Co., N. C., is known as hiddenite, from its discoverer, W. E. Hidden, of New York. A beautiful pink variety, recently discovered in San Diego Co., Cal., is named kunzite, from its discoverer, George F. Kunz. Both of these varieties have been cut for gems, and the latter is still very popular as a semiprecious stone. See HIDDENITE.

SPOELBERCH DE LOVENJOUL, spo͞ol′-bĕrk de lō′ven-zho͞ol, CHARLES, VISCOUNT DE (1836–1907). A Belgian literary collector, born at Brussels. Possessed of a large private fortune he devoted himself to collecting manuscripts, first editions, autographs, reliques, etc., of the French masters in literature, especially Balzac. By his will this collection was left to the Institute of France. The Viscount de Lovenjoul prepared a number of literary monographs, including: *Etude critique et bibliographique des œuvres d'Alfred de Musset* (1867); *Alfred de Musset et ses prétendues attaques contre Victor Hugo* (1878); *Histoire des œuvres d'H. de Balzac* (1879; 3d ed., 1888), crowned by the French Academy; *Un dernier chapitre de l'histoire des œuvres de Balzac* (1880); *Histoire des œuvres de Théophile Gautier* (1887); *Etudes balzaciennes: un roman d'amour* (1896); *Etudes balzaciennes: autour d'Honoré de Balzac* (1897); *Une page perdue d'Honoré de Balzac* (1903).

SPOF′FORD, AINSWORTH RAND (1825–1908). An American librarian, born at Gilmanton, N. H. He was in 1861 assistant librarian of Congress, and from 1864 to 1899 librarian in chief of the Congressional Library. He wrote much for periodicals, on literature, economics, and history, and edited with others a *Library of Choice Literature* (10 vols., 1881–88) and a *Library of Wit and Humor* (5 vols., 1884). He published annually *The American Almanack and Treasury of Facts, Statistical, Financial, and Political* (1878–91), and *A Book for All Readers* (1900), on the collection and preservation of books and the founding of libraries.

SPOFFORD, HARRIET (ELIZABETH) PRESCOTT (1835–). An American novelist, born at Calais, Me. In 1865 she married Richard S. Spofford, a lawyer of Boston. Her writings include: *Sir Rohan's Ghost* (1859); *The Amber Gods and Other Stories* (1863); *Azarian, an Episode* (1864); *New England Legends* (1871); *The Thief in the Night* (1872); *Marquis of Carabas* (1882); *Poems* (1882); *Ballads About Authors* (1888); *Scarlet Poppy and Other Stories* (1894); *A Master Spirit* (1896); *Four Days of God* (1905); *Old Washington* (1906); *The Making of a Fortune* (1911).

SPOHR, shpōr, LOUIS (1784–1859). A German composer and violinist, born at Brunswick. He studied there under Kunisch and Maucourt and in 1802 became a pupil of the celebrated Franz Eck. In 1805 he accepted the appointment of concertmeister at Gotha and in 1812 went to Vienna as leader at the Theater an der Wien, where he remained until 1815. From 1817 to 1819 he filled a similar position at Frankfort and in 1821 received a life appointment as court conductor at Cassel. It was in connection with this last position that he won his greatest successes as a violinist, composer, and conductor; besides which he succeeded in bringing his orchestra to a pitch of perfection that earned it a world-wide reputation. In 1831 he completed his work, *The Violin School*, which has remained one of the standard works of instruction for that instrument. He was a prolific composer and wrote in all nearly 200 works. Most of his operas were little known outside of Germany, but his oratorios formerly were very popular in England and America, particularly *Die letzten Dinge* (The Last Judgment). His works include ten operas, five oratorios, nine symphonies, twelve concertos for violin, and a great quantity of chamber music. He died at Cassel. Consult: *Autobiography* (Cassel, 1860; Eng. trans., London, 1865); H. Schletterer, *Louis Spohr*, in Waldersee, *Sammlung* (Leipzig, 1881); L. Nohl, *Spohr* (ib., 1886).

SPOILS SYSTEM. See CIVIL-SERVICE REFORM.

SPOKAN, spō-kăn′. An Indian tribe of Salishan stock formerly occupying the whole basin of Spokane River in Washington and Idaho and now chiefly gathered upon reservations in the same States. They were visited in 1806 by Lewis and Clark, who call them Liartielo. In language, customs, and alliance they were closely connected with the Sanpoil (q.v.). They number 643. See SALISHAN STOCK.

SPOKANE, spō-kăn′. A city and the county seat of Spokane Co., Wash., in the extreme eastern part of the State, 339 miles by rail east of

Seattle, on the Spokane River, and on the Chicago, Milwaukee, and St. Paul, the Great Northern, the Idaho and Washington Northern, the Northern Pacific, the Oregon-Washington Railroad and Navigation Company, the Spokane and Inland Empire, the Spokane International, and the Spokane, Portland, and Seattle railroads (Map: Washington, H 3). It was formerly known as Spokane Falls. In the valley, half plain and half mountain, through which flows the Spokane River, at a point where the slopes narrow and the hills close in, is the beautiful natural park in which the city has been built. It rises from the river banks to the north and the south, to an elevation of 1900 feet above the sea. Below are the business streets, while on the slopes are the homes. The famous cataract, Spokane Fall, is in the heart of the city's business district. A fine concrete bridge, 1070 feet long, spans Latah Creek, a tributary of the Spokane River. The Monroe Street Bridge, whose arch is 281 feet in length, is also of concrete. Spokane is the seat of Gonzaga University (Roman Catholic), opened in 1887; Whitworth College, Spokane College, Spokane University, and Brunot Hall, an Episcopal school for girls. The city is amply provided with hospitals and charitable institutions, is well laid out, having 68 miles of paved streets, 1933 acres of parks, and owning its water works and sewage system. Notable structures are the Carnegie Library, the Davenport Hotel, erected at a cost of $2,500,000, the Federal, Auditorium Theatre, and Old National Bank buildings, city hall, and courthouse. There are 23 bridges within the city limits. Fort Wright, a large United States army post, is situated on the river, just outside the city. Spokane is the mining centre of the Pacific Northwest, the tributary mines producing more than $35,000,000 annually in gold, silver, copper, zinc, and lead. North, east, and south of the city stand large pine timber forests. The city is also the trade centre of a highly productive cereal belt. In 1915 there were $50,926,273 invested in the city's 225 industrial establishments, employing 10,053 persons, and yielding a product valued at about $50,000,000. Lumbering, mining, wheat raising, fruit growing, and the manufacture of foundry and machine-shop products, cars, flour, brick, brooms, furniture, pottery, marble and granite, and ornamental iron constitute the leading manufactures. Spokane adopted the commission form of government in 1910. It spent for maintenance and operation in 1913 $1,936,000, the chief items of expenditures being: schools, $694,000; highways, $248,000; fire department, $185,000; police department, $131,000; water-supply system, $160,000; sanitation, $153,000. In the same year its total bonded indebtedness amounted to $13,432,000, while the assessed valuation of its property was $89,800,000. The growth of the city dates from 1881, when the Northern Pacific Railway was completed to this point. Pop., 1890, 19,922; 1900, 36,848; 1910, 104,402; 1915 (U. S. est.), 142,990. Consult Edwards, *An Illustrated History of Spokane County* (1900), and Harold Bolce, in L. P. Powell, editor, *Historic Towns of the Western States* (New York, 1901).

SPOLETO, spô-lā′tô. A city in the Province of Perugia, Italy, situated on a hill, 61 miles north-northeast of Rome (Map: Italy, D 3). It is dominated by a citadel, now a prison, in which in 1499 Lucretia Borgia was incarcerated. The town is united with the neighboring height of Monte Luco by a Roman bridge and aqueduct. Beneath the Piazza Vittorio Emanuele are the ruins of a Roman theatre. Several of the churches occupy the sites of Roman temples. The eleventh-century cathedral has a fine Renaissance portico. The gathering of truffles, together with the preservation of meats, fruits, and vegetables, the manufacture of olive oil and silk, and the mining of lignite are the chief industries. Pop. (commune), 1881, 21,507; 1901, 24,642; 1911, 25,996 (town, 9631). The ancient Umbrian town of Spoletium was colonized by the Romans in 241 B.C. It was destroyed by the Goths, but rebuilt by Narses. In 574 it became the capital of the Lombard Duchy of Spoleto, which rose to great power in the ninth century, when two of the dukes, Guido (q.v.), and Lambert, his son, successively received the Imperial crown from the Pope. From 1220 to 1860 it was a papal possession. Consult E. H. and E. W. Blashfield in *Italian Cities* (New York, 1912).

SPOLETO, Duke of. See Guido.

SPO′LIA OPI′MA (Lat., richest spoils). The name given by the Romans to the fairest honor that could be won in battle. The *spolia opima* were gained only when the actual commander in chief of the Roman army slew the commander in chief of the enemy and stripped him of his armor. They were won but thrice: by Romulus, when he killed the King of the Caeninenses; by A. Cornelius Cossus, when he slew Lar Tolumnius, King of the Veientes (426 B.C.); by Marcus Claudius Marcellus, when he killed Viridomarus, King of the Insubrians (222 B.C.). The *spolia opima* were deposited in the temple of Jupiter Feretrius. Consult the article "Spolia" in William Smith, *A Dictionary of Greek and Roman Antiquities*, vol. ii (3d ed., London, 1891).

SPOLIA′TION (Lat. *spoliare*, to plunder, spoil). The destruction of a thing by a person not an owner or interested therein, particularly the erasure of a signature on or alteration of the body of an instrument in writing. The wrongdoer is liable in damages for his act. Such an alteration or destruction of an instrument will not destroy its legal effect if the original contents can be clearly proved. Spoliation differs from alteration in that the former is committed by a stranger and the latter by a person interested in the thing destroyed or altered.

In admiralty law the hasty spoliation or destruction of ship's papers or other documents connected with the voyage by the officers of a vessel suspected of smuggling or blockade running is held to create a presumption of guilt, which, however, may be rebutted.

In ecclesiastical law the term denotes the destruction or waste of church property.

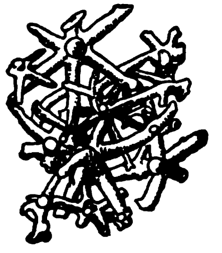
SPON′DEE. See Versification.

SPON′DYLI′TIS (Neo-Lat., from Lat. *spondylus*, vertebra + *-itis*). Inflammation of the spinal column or its segments (vertebræ). It occurs as a form of arthritis deformans, a slow inflammation of the bone usually terminating in ankylosis and rigidity of the spine. For this reason it has been termed "poker back." In the tuberculous form spondylitis occurs as an acute osteomyelitis with rapid destruction of the vertebræ. The affection is comparatively rare.

SPONGE (Lat. *spongia*, sponge). A group of animals representing a distinct branch or phylum, Porifera. The sponges are many-celled animals, with three-cell layers, without a true digestive cavity, supported usually by calcareous or siliceous spicules, the body mass permeated by ciliated passages or containing minute chambers lined by flagellate, collared, monad-like cells. There is no true mouth opening, but usually an irregular system of inhalant pores opening into cell-lined chambers or passages through which food is introduced in currents of sea water, the waste particles passing out by a single but more usually by many cloacal openings (oscula). Sponges are hermaphroditic, multiplying by fertilizing eggs, the germ passing through a cleavage and a gastrula stage.

Sponges are divided, according to the nature of the skeleton or supporting fibres or spicules, into two orders: (1) *Calcispongiæ*, in which the spicules are calcareous, and (2) *Silicispongiæ*, or glass sponges, in which the spicules are siliceous, or horny and fibrous, as in the bath sponges, when spongin instead of silica forms the supporting framework. Examples of the siliceous sponges are the Venus's flower basket (*Euplectella*) and allied deep-sea forms (*Hyalonema*, *Holtenia*, etc.). To the second order also belongs the fresh-water sponge (*Spongilla*), growing in lakes or sluggish streams. These differ from other sponges in producing statoblasts or winter buds, formed by the protoplasm dividing into round bodies as large as a pin's head and enveloped by a dense membrane, thus enabling the species to survive freezing cold or droughts.

Certain sponges bore into shells, causing them to disintegrate. For example, *Cliona sulphurea* has been found boring into various shells—the oyster, mussel, scallop; it also spreads out on all sides, enveloping and dissolving the entire shell. It has even been found to penetrate one or two inches into hard marble. *Cliona* also disintegrates coral. Of the marketable sponges there are six species, with numerous varieties. They are available for use from being simply fibrous, having no siliceous spicules. The Mediterranean sponges are the softest and best; those of the Red Sea are next in quality, while the West Indian species are coarser and less durable. The glove sponge (*Spongia tubulifera*) corresponds to *Spongia adriatica* (the Turkey cup sponge and Levant toilet sponge of the Mediterranean). *Spongia gossypina*, the wool sponge of Florida and the Bahamas, corresponds to *Spongia equina*, horse or bath sponge of the Mediterranean. This wool sponge of Florida attains under favorable circumstances a weight of one-tenth pound, in six months, and reaches a size of commercial value in a year.



A FOSSIL SPONGE.
One of the Brachiospongia
(*Tholiasterella gracilis*).

Fossil sponges are known in rocks of all ages. They appear first in the Cambrian as *Protospongia* and *Archæoscyphia*, representing the hexactinellids and lithistids. They are represented in the Ordovician by the curious *Brachiospongia*, and a number of irregular forms; in the Silurian by *Astræospongia*, *Astylospongia;* in the Devonian by Hindia and the Dictyospongidæ, which latter enjoyed such great expansion in the shallow seas of western New York during Chemung time. Receptaculites is a peculiar sponge that is common in the Ordovician. During the Mesozoic, sponges attained a great development, became especially abundant during the Cretaceous period, and declined during the succeeding Tertiary. Noteworthy Cretaceous genera are *Ventriculites* and *Cœloptychium*.

Bibliography. J. S. Bowerbank, *Monograph of the British Spongidæ* (4 vols., London, 1864–82); Alpheus Hyatt, "Revision of North American Poriferæ," in *Memoirs Boston Society of Natural History*, vol. ii (Boston, 1875); Hinde, *Catalogue of Fossil Sponges of the British Museum* (London, 1883); D. W. Thompson, *Bibliography of Protozoa, Sponges, Cœlenterata, and Worms* (Cambridge, 1885); Rauff, "Palæospongiologia," in *Palæontographica*, vol. xl (Berlin, 1893); I. B. J. Sollas, "Porifera," in *Cambridge Natural History*, vol. i (New York, 1909).

SPONGE, VEGETABLE. See VEGETABLE SPONGE.

SPONGING HOUSES. In the law of England, the private houses of the bailiffs, who may detain there a debtor who has been arrested for debt for 24 hours, to admit him or his friends to arrange to settle the debt. The name is derived from the extortion often practiced on the debtor. The name is not used in the United States.

SPON'GIOZO'A (Neo-Lat. nom. pl., from Gk. *σπογγιά*, *spongia*, sponge + *ζῷον*, *zōon*, animal). One of the branches or phyla of Invertebrates, intermediate between the Protozoans and the Cœlenterata, and represented by a single class, Porifera, which comprises the sponges.

SPONSORS (Lat. *sponsor*, surety). The persons, also called godfathers and godmothers, who present a candidate for baptism, and in the Roman Catholic church for confirmation also, to the minister of those sacraments. In the case of infants they are representatives who make the vows the child is incapable of making, and are regarded as in some measure responsible for developing religious life in their godchildren. The spiritual bond resulting from this relation is held by Roman Catholic theologians to constitute a species of affinity, and hence an impediment of marriage, extending to the parents of the baptized, and even at one time to the sponsors themselves.

SPONTA'NEOUS COMBUSTION (Lat. *spontaneus*, willing). The ignition of substances apparently without any direct cause. The spontaneous combustion of organic materials is sometimes a cause of fires. When large quantities of soot, linen, paper, cotton or woolen stuffs, ship's cables, etc., became soaked with relatively small amounts of oils (especially drying oils) and exposed to a limited access of air, they may take fire sooner or later. The presence of moisture frequently aids spontaneous combustion, and piles of damp hay, freshly mown grass, sometimes take fire spontaneously. The phenomenon is not, however, without a clearly defined cause. Fats and oils can be shown to undergo a slow process of combustion at but slightly elevated temperatures. Combustion of a small amount of oil causes the evolution of a corresponding amount of heat; rise of temperature accelerates the combustion, producing a further degree of heat, until at a given moment the temperature may become so high as to cause the mass to burst into flame. As to the spontaneous combustion of human bodies, it is an impossibility, and all reports of such cases are due to erroneous observation, if they are not intentionally fraudulent. See PYROPHORUS.

SPONTANEOUS GENERATION and **PROTOGENESIS.** The doctrine that different forms of life, especially the lower, have arisen by physicochemical agencies from inorganic substances. This view prevailed from ancient times until after the middle of the seventeenth century, and as late as 1842 Weeks maintained that mites (*Acarus*) were spontaneously generated in "several solutions under electrical influence." In 1859 Pouchet, in his *Hétérogénie*, revived the subject, and in 1871 Bastian maintained that bacteria and torulæ were developed at the present day in certain fluids containing organic matter by laws similar to those by which crystals arise, or by what he calls archebiosis.

In 1660 Redi disproved the prevailing notion that the maggots of flies were generated in putrefying meat, by covering similar pieces of meat with fine gauze, and keeping away the blowflies. He thus demonstrated that the maggots grew from eggs, and that there was "no life without antecedent life." About 1750 Needham experimented by boiling and corking flasks of water containing infusoria, but in every case animalcules appeared after a time. This led Spallanzani (1768) to experiment carefully. He boiled infusions longer, and, instead of corking, fused his flasks. The result was that the infusions remained free from living organisms. Schulze and Schwann in 1836 made further experiments. They carefully boiled their infusions, and then supplied air; but they made it first pass through red-hot tubes, so that germs present would be burned; no infusoria appeared. Then the discovery was made by Cagniard de la Tour that fermentation, like putrefaction, is accompanied by the presence of microscopic organisms. In 1854–59 Schroeder and Dusch invented the screen of cotton wool now used for plugging the openings of tubes, which kept out the germs, and it was thus found that the cause of putrefaction and fermentation, and the origin of the living forms accompanying these processes, must be microscopic particles existing in the air. The next step was taken by Pasteur (*On the Organized Particles Existing in the Air*, 1862). On sowing these particles in suitable sterilized infusions he produced microscopic organisms. Germs like these were afterward shown by Cohn to be low plants to which he gave the name "bacterium." (See BACTERIA.) Finally Tyndall, in 1869, by passing a beam of light through the air in a box, showed that whenever dust was present the putrefaction occurred sooner or later; when it was absent it did not. The result of these experiments is that the view that spontaneous generation takes place at the present day has been entirely discarded.

Spontaneous Generation (Protogenesis) Necessary for the Beginnings of Life. Some who, like Wyman, made observations disproving its occurrence at the present day, yet supposed that the first living organisms probably arose from inorganic matter, through the action of unknown physicochemical processes. In 1868 Herbert Spencer, while rejecting the doctrine of spontaneous generation, stated his belief that the formation of organic matter and the evolution of life in its lowest forms "took place at a time when the heat of the earth's surface was falling through ranges of temperature at which the higher organic compounds are unstable." He conceived that the molding of such organic matter must have begun with portions of protoplasm (q.v.), more minute, more indefinite, and more inconstant in their characters than the lowest rhizopods, or even the Protogenes of Haeckel. With this view biologists now agree.

When the earth had assumed its present shape, with incipient continents, and oceans lying in their basins, the period arrived when the conditions for the appearance of life became favorable, and at this critical moment the protoplasmic substance probably came into being. The chemical compounds giving origin to it were far more abundant, and the physical and chemical conditions more favorable.

The origin of protoplasm was probably the result of a combination of circumstances which certainly never occurred before in the history of our planet, and which has never happened since. The phenomenon of protogenesis, after taking place once for all, could never have again occurred. Such is the nature of cell division, of sexual reproduction, of growth, and of heredity, that it would be contrary to the course of nature to suppose that it was ever afterward necessary for it to again occur.

Early Life. To account for the beginnings of life we have assumed the creation of a primordial microscopic bit of protoplasm. In shape it was droplike, spherical, or oval, its form being due to gravity, as the primary form of all living beings tends by the action of gravity to be round or ovate.

This primordial being had the power of absorbing and digesting food, or the protoplasmic materials round it, and hence of growing; it was contractile and could move automatically, and thus was adapted for moving through the water, sending out from its body rootlike extensions to aid in seizing food and in locomotion. A single chance germ (though in nature there is no such thing as chance) would have been sufficient. Such a primordial cell, by self-division, may have multiplied itself, and in a few hours even become the parent of thousands. These beings were plastic. Already the earth's surface varied in chemi-

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SPONGE STRUCTURE

1. Exterior of a living bath sponge: the arrows show how the water is sucked into the small pores and expelled from the elevated canal mouths (oscules).

2. Diagram of canal system, represented by a young sponge with a single excurrent orifice; such a system is represented in a large sponge by each oscule: *a*, oscule; *b*, inhalant pores.

3. Vertical section of a part of a bath sponge: *b*, inhalant pores; *c*, canals; *d*, *d*, flagellated chambers; *e*, *f*, skeleton fibres; *g*, maturing eggs.

4. Enlarged view of a part of the canal system: *a*, inhalant pores and passages by which water is drawn into the spherical flagellated chambers and their connecting passages (apopyles) conducting it into larger spaces (*b*) whence it flows out through an oscule (*c*). Cf. Fig. 2.

5. Enlarged view of flagellated cells lining the chambers and canals; and a single cell: *n*, nucleus; *c*, contractile vesicle; *m*, collar; *f*, flagellum.

6. Various forms of siliceous spicules.

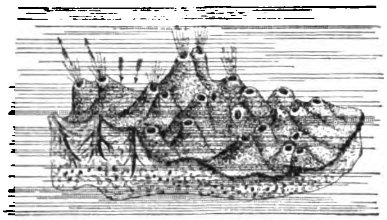
7. One form of siliceous fibrous skeleton.

8. Fresh-water sponge; vertical section of Spongilla; the water enters through the dermal pores (*a*) into the subdermal cavities (*b*), then enters the incurrent pores and passages (*c*, colored black), and passes into flagellated chambers (*d*), thence out through the excurrent canals (*e*), into the main central canal or perigastric cavity (*f*), in which the openings (*g*) of these canals from all sides are indicated by the black dots; and the water is finally discharged through the apical oscule (*h*).

9. A bath sponge (*Spongia*).

10. A branching sponge (*Chalinopsilla oculata*), a "finger" sponge, common on the Atlantic coast of the United States.

SPONGE STRUCTURE



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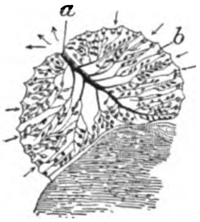

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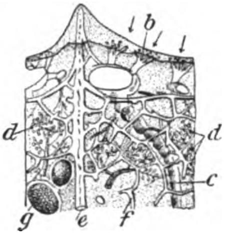

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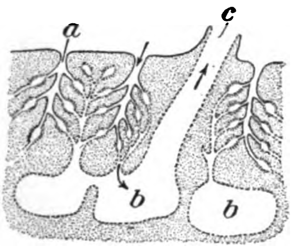

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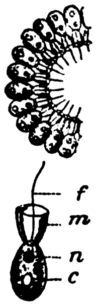

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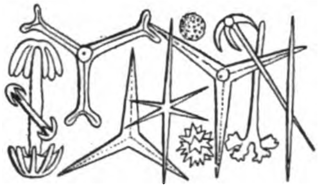

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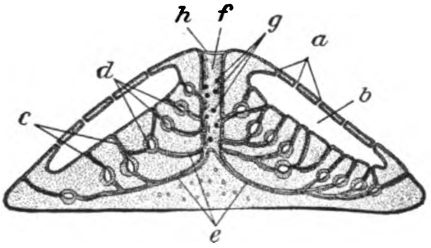

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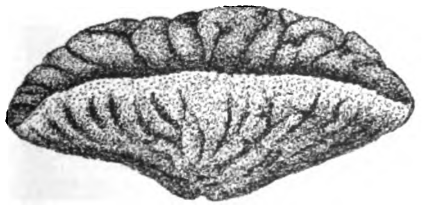

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For Names and Descriptions, see Text.

cal constitution and other physical features. There would follow migrations and the foundation of new colonies in scattered areas. Adaptation to each new environment would take place, and in the course of time variation would set in and the evolution of higher organisms take place. See EVOLUTION and the bibliography cited thereunder. Consult: Herbert Spencer, *Principles of Biology* (rev. ed., 2 vols., New York, 1898–1900); Max Verworn, *General Philosophy* (trans. from 2d Ger. ed. by F. S. Lee, ib., 1899); Ernst Haeckel, *History of Creation* (4th ed. rev. by E. R. Lankester, 2 vols., ib., 1906).

SPONTINI, spôn-tē'nē, GASPARO LUIGI PACIFICO (1774–1851). An Italian dramatic composer, born at Majolati, Ancona. In 1791 he studied at the Conservatory della Pietà de' Turchini at Naples. As early as 1803 he had produced 16 operas in the light Italian style of that time. His opera *La finta filosofa* and two imitations of French opéra comique, *Julie* and *La petite maison*, met with little success. He then began the study of Mozart and showed a marked change in the one-act opera *Milton* (1804). The Empress Josephine, to whom the score was dedicated, had him appointed chamber composer, and she secured the production of *La vestale* (1807). It proved a success. His grand opera *Ferdinand Cortez* (1809) was equally successful. In 1810, as director of the Italian Opera, he staged Mozart's *Don Giovanni* in the original form for the first time in Paris. In 1820 he was appointed general musical director at Berlin. He wrote for Berlin the festival play *Lalla Rukh* (1821), remodeled as the opera *Nurmahal, oder das Rosenfest von Kaschmir* (1822); *Alcidor* (1825); and *Agnes von Hohenstaufen* (1829). In 1842 he resigned and returned to Paris. He died in his birthplace.

SPOONBILL. An ibis-like bird of the family Plataleidæ, distinguished by the flat, dilated, spoonlike form of the bill. The species are five or six, in two genera widely distributed. The spoonbills of the Old World belong to the genus *Platalea*, and have the windpipe curiously convoluted. The spoonbills of the New World lack these convolutions, and are placed in a distinct genus *Ajaja*. The roseate spoonbill (*Ajaja ajaja*), the only American species, is abundant within the tropics. It is nearly three feet in length; a beautiful bird, with plumage rose color, the tint deepest on the wings; the tail coverts are carmine. It was formerly abundant in Florida, but is now rare there, but seen along the coast of Texas. It nests in colonies, and builds a coarse platform of sticks, in trees, on which it lays three eggs, white spotted with brown. The only European species is the white spoonbill (*Platalea leucorodia*), common in marshy districts throughout northern Europe and Asia in summer, and in Mediterranean salt marshes in winter. See Colored Plate of WADERS.

SPOON-BILLED SANDPIPER. A rare reddish, stintlike sandpiper (*Eurynorhynchus pygmæus*) of eastern Asia, remarkable only for its spoon-shaped bill. (See Colored Plate of SHORE BIRDS.) It breeds in Siberia, occasionally crossing to the Alaskan coast, and migrates southward in winter to China and India.

SPOON'ER, JOHN COIT (1843–). An American lawyer and statesman, born at Lawrenceburg, Ind. Having removed with his parents to Wisconsin, he graduated at the university of that State in 1864. He served during the Civil War first as a private in the Fortieth Wisconsin Volunteers and subsequently as a captain in the Fiftieth Wisconsin, and was brevetted major at the close of hostilities. In 1867 he was admitted to the bar, and from 1868 to 1870 was Assistant Attorney-General of the State. He won distinction and success as a railroad and corporation attorney. He was a member of the State Assembly (1872), and served in the United States Sénate (1885–91; 1897 till his resignation in 1907). He was unsuccessful as a candidate for Governor of Wisconsin in 1892. As Senator he took a prominent part in legislation and debates, and became recognized as one of the spokesmen of the McKinley and Roosevelt administrations. Spooner declined the portfolio of the Interior in 1898 and the post of Attorney-General in 1901. He was generally recognized as one of the ablest of the conservative Republican leaders. In 1907 he established himself in law practice in New York City.

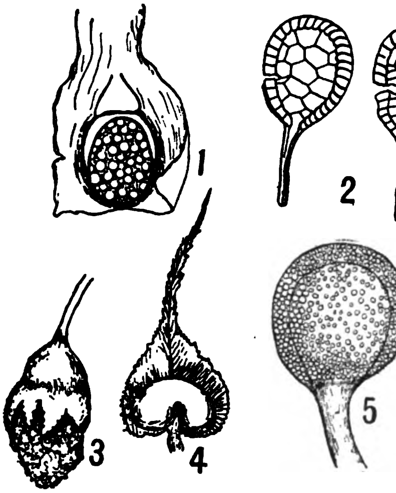
SPORADES, spŏr'ȧ-dēz (Gk., scattered). A group of islands in the southeastern portion of the Ægean Sea between Samos and Rhodes and east of the Cyclades (q.v.) (Map: Greece, H 6, 7). Their principal members are Astropalia, Leros, Patmos, Nicaria, Calimno, Cos, Nisyros, and Scarpanto. Some also include Rhodes, Samos, Chios, and Lesbos with the neighboring islands. In a wider sense the name Sporades is applied to all the islands of the Ægean Sea except the Cyclades proper. The group lying in the western part of the sea, north and east of Eubœa or Negropont, the principal member of which is Scyros, are known as the Northern Sporades, and belong to the Greek Nomarchy of Eubœa. The Sporades proper belonged to Turkey, but during the Turco-Italian War (1911–12) Italy seized 12 of them, and during the Balkan War (1912–13) the Greeks occupied all the islands not held by Italy. For details, see articles on the principal individual islands.

SPORAD'IC (Lat. *sporadicus*, from Gk. *σποραδικός*, *sporadikos*, from *σπείρειν*, *speirein*, to sow). Isolated. In medicine, a disease is sporadic when but few cases, widely separated, appear. In botany, sporadic growths are those which are scattered or widely dispersed.

SPORAN'GIUM (Neŏ-Lat., from Gk. *σπόρος*, *sporos*, seed + *ἀγγεῖον*, *angeion*, vessel). The plant organ within which asexual spores are produced. Among algæ and fungi (qq.v.) the sporangium is usually a single cell (mother cell), which produces few to numerous spores. Among bryophytes there are no distinct sporangia, the spores being produced by a more or less complex capsule which is the essential feature of the characteristic leafless sporophyte (sporogonium) of the group. Among pteridophytes the sporangia are prominent, and their origin is the basis of a fundamental distinction in the group. They are complex, many-celled organs, usually borne on leaves. They originate usually from a single superficial cell, which divides in a plane parallel to the surface, resulting in an outer and inner cell. If the sporogenous tissue is derived from the outer cell, the sporangium is *leptosporangiate;* if it is derived from the inner cell, the sporangium is *eusporangiate*. The ancient ferns, represented to-day by a few tropical forms, were chiefly eusporangiate; while the great host of modern ferns, including the water ferns, are leptosporangiate. It is natural, therefore, to regard the eusporangiate condition as primitive, and the leptosporangiate as derived.

The two other divisions of pteridophytes (horsetails and club mosses) and all the spermatophytes (seed plants) are eusporangiate.

The structure of the ordinary fern sporangium indicates its highly specialized character. It consists of a long slender stalk that bears a spore-containing capsule. The walls of the capsule are thin, except for a single row of thick-walled cells (annulus) which girdles the capsule like a meridian, from the stalk nearly around to the stalk again. At maturity the annulus acts like a bent spring, and when the thin wall of the capsule begins to yield, straightens violently and rebounds, hurling out a spray of spores.



TYPES OF SPORANGIA.

1, quillwort; 2, climbing fern; 3, liverwort; 4, club moss; 5, fungus.

In most ordinary ferns the sporangia are developed in great numbers upon the under surface of foliage leaves, usually in definite groups (sori), popularly called fruit dots, which are generally protected by a flaplike outgrowth (indusium, q.v.) from the epidermis. In some ferns (e.g., sensitive fern), however, foliage work and spore production are separated, and distinct foliage leaves and sporophylls (spore leaves) occur. This distinction persists in the other groups of pteridophytes (horsetails and club mosses) and in the spermatophytes, the sporophyll being a constant organ in them. In the horsetails (see Equisetum) and most of the club mosses (Lycopodiales, q.v.) the small sporophylls are organized into a conelike cluster (strobilus), which also appears as the so-called cones of pines, and as the equivalent in general of the flowers of angiosperms. In plants which exhibit heterospory (q.v.) the sporangia are differentiated, some producing megaspores (megasporangia) and others microspores (microsporangia). This differentiation begins among the pteridophytes, most notably in the club mosses (see Pteridophytes), and is found in all seed plants. Since the two forms of sporangia in seed plants, long called pollen sacs and ovules, are really microsporangia and megasporangia respectively, stamens and carpels are properly sporophylls and not sex organs, as supposed.

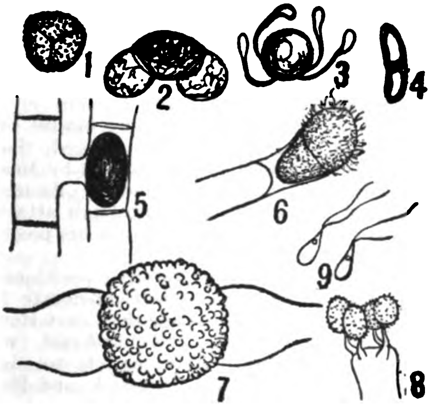
The structure of a complex sporangium, such as occurs among all the vascular plants (fern plants and seed plants), is constant in character though diverse in details. In the early stages of a sporangium, when it consists of a mass of similar cells, there is no distinction of regions. Very early, however, a single cell or group of cells becomes differentiated in connection with spore production, dividing more or less and producing in some cases a considerable mass of tissue. In any event, the cells of the last division are called the spore mother cells, because within each one of them four spores are formed, the group of four being known as a tetrad. In a completely formed sporangium, just outside of the mass of mother cells, there is a more or less distinct nourishing layer called the tapetum, outside of which is the sporangium wall, consisting usually of two to five layers of cells, and variously modified for protection, discharge, etc. This general account applies to all sporangia of the higher plants, excepting the megasporangia or ovules of seed plants, where the ordinary sporangium structure is more or less modified. See Plate of Fungi, Types of.

SPORE (from Gk. *σπόρος*, *sporos*, seed). In general, a single cell separated from the parent plant for reproduction. In the simplest plants spores are not produced, as in the blue-green algæ (Cyanophyceæ, q.v.), but in all other plants they are a prominent method of reproduction. Asexual spores are usually produced by division of one or more cells in a sporangium. Sexual spores are not produced, as in the blue-green algæ spores (zygotes) are produced by the fusion of two sexual cells (gametes), which arise in a simple or complex organ called a gametangium (q.v.).

Asexual Spores. The diverse names given to asexual spores usually indicate some peculiar character of the spore or the group of plants which produce it. Among the green algæ (Chlorophyceæ, q.v.) the characteristic spore is a zoospore or swarm spore, a minute, naked mass of protoplasm, swimming freely by means of one or more cilia at one end (Fig. 9). Among the brown algæ (Phæophyceæ, q.v.) the zoöspores are bean-shaped, with two cilia on the concave side. Among the red algæ (Rhodophyceæ, q.v.) the spores have no cilia and hence cannot swim, and as each sporangium produces four such spores they are called tetraspores.

Among the fungi, asexual spores, which are produced in great profusion and variety, have received many names. Among the alga-like fungi (Phycomycetes, q.v.) they are developed in one-celled sporangia, and in the aërial forms they are mostly light, dry cells, easily scattered by wind. Such are called simply spores, with no designating prefix. Among the sac fungi (Ascomycetes, q.v.), however, two conspicuous forms of asexual spores occur: the one, conidia, which are cut off from the tips of filaments; the other, ascospores (Fig. 4), developed within a delicate sac (ascus). Among the rusts (Uredinales, q.v.) the greatest variety of asexual spores for one plant is reached; e.g., in wheat rust there are four. Among toadstools (Basidiomycetes, q.v.) the characteristic spores are basidiospores, borne two or four together on the tips of pointed branches from a swollen filament, the basidium (Fig. 8). There are several other spores of minor significance among the fungi, each with its distinctive name. Among the bryophytes (liverworts and mosses) and most of the pteridophytes the asexual spores are called simply spores. In heterosporous plants (some pteridophytes and all spermatophytes), however, there are two kinds of asexual spores, megaspores and microspores (qq.v.). Before their character in seed plants was appreciated these two kinds were called respectively embryo sacs and pollen grains. In all of these wind-dispersed asexual spores the spore wall consists of two layers: a delicate inner one (intine or endospore) and a tough outer one (extine or exospore), often variously sculptured, especially in the pollen grains of flowering plants, and sometimes even winged, as in the pollen grains of pines (Fig. 2).

Sexual Spores. The name "zygospore" is used to designate sexual spores which result from the union of similar gametes (Figs. 5, 7). (See ISOGAMY.) Oöspores, produced by all but the lowest plants, are formed by the union of dissimilar gametes (see HETEROGAMY) known as sperms and eggs. The term "zygote" has come into use to designate the sexually formed cell whatever the character of the gametes. See SEX, *In Plants*.



TYPES OF SPORES.

1, megaspore of *Selaginella;* 2, microspore (pollen) of pine; 3, spore of *Equisetum* with elaters; 4, ascospore of lichen; 5, zygospore of *Spirogyra;* 6, zoöspore of *Vaucheria;* 7, zygospore of *Mucor;* 8, basidiospores; 9, zoöspores of a green alga.

Under suitable conditions any spore begins to form a new plant, the process being called germination. In some cases the germination is immediate; in others it is delayed more or less by unfavorable conditions, as in winter. Spores adapted to delayed germination are called resting or dormant spores—recognized by their unusually heavy protecting wall. See REPRODUCTION.

The methods of spore dispersal are as diverse as the various means of seed dispersal. In many lower forms, as in the algæ and some fungi, zoöspores may distribute the species over wide areas. Most aërial spores are light and usually small, and thus readily scattered great distances by wind, a fact evidenced by the usually early appearance of ferns on new tropical islands. Mechanical expulsion and special devices for separating or entangling spores, as the elaters of *Equisetum* (Fig. 3), are common.

SPÖRER, spẽ′rẽr, GUSTAV FRIEDRICH WILHELM (1822–95). A German astronomer, born in Berlin and educated there. He taught in succession at Bromberg, Prenzlau, and Anklam. At the last place he began in 1860 to observe sun spots with the view of determining the law of solar rotation, and with government aid he erected a solar observatory there. Spörer arrived independently at a conclusion similar to that of Carrington concerning the equatorial quickening of the sun's movement on its axis. In 1868 he took part in an expedition to Hindustan for observing a total eclipse of the sun. He also investigated the structure of the chromosphere, and showed it to be of the same nature as the vast protrusions from it. From 1874 to 1894 Spörer was observer at the astrophysical observatory at Potsdam.

SPO′ROPHYLL (from Gk. *σπόρος, sporos*, seed + *φύλλον, phyllon*, leaf). A leaflike organ that occurs only in spermatophytes and in certain pteridophytes and bears sporangia (spore cases). Though generally unlike ordinary foliage leaves in appearance, they are regarded as foliar organs. See SPORANGIUM.

SPO′ROPHYTE (from Gk. *σπόρος, sporos*, seed + *φυτόν, phyton*, plant). The sexless phase in alternation of generations (q.v.).

SPO′ROZO′A (Neo-Lat. nom. pl., from Gk. *σπόρος, sporos*, seed + *ζῷον, zōon*, animal). A class of parasitic protozoa comprising the malaria germs, Texas cattle-fever germs, etc. While the sporozoa differ much in structure, they are similar in parasitic habits and development. As a rule they are more or less oval or elongated, with no organs of locomotion except in the early stages. They are very minute, though *Gregarina gigantea*, which lives in the intestine of the European lobster, is of comparatively colossal size, being a little over half an inch in length. They are nourished by the absorption of the fluid in which they live. The young arise as sporoblasts, which when enveloped with a membrane are called spores, the contents of which break up into several small bodies or sporozoites; the latter to complete their development must leave the first host and enter a second one.

Some of the sporozoa are parasites in the interior of cells, such as those lining the intestine of higher animals. Malaria in man has been proved to be due to the presence of a sporozoan (*Hæmamœba* or *Plasmodium laverani*) which invades and destroys at a certain stage in its life history the red corpuscles of the blood. The sporozoites are developed in a mosquito (*Anopheles*) and are transferred from the salivary glands to man by the sting or proboscis. The bird-malaria germ is communicated by the ordinary mosquito (*Culex*). Another form (*Apiosoma bigeminum*) causes the Texas fever in cattle, the infection being carried by ticks (q.v.). A parasite of the tsetse fly (q.v.), which is a flagellate hæmatozoan, is the cause of the tsetse disease in southern Africa. See INSECT, *Insects and Disease*.

The Myxosporida are generally rather large sporozoa, their hosts being fish and insects. The silkworm disease called pebrine is due to one of the Myxosporida (*Glugea bombycis*), which inhabits all the tissues of the caterpillar.

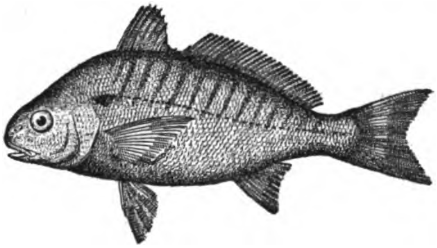
The Sarcosporida, also called Rainey's or Mieschers's corpuscles, take up their abode in the voluntary muscles of mammals. They form oval cysts, which when ripe inclose spores, each of which contains numerous kidney-shaped sporozoites. Thus *Sarcocystis miescheriana* occurs in the muscles of the pig; *Sarcocystis muris* in the mouse; *Sarcocystis lindemanni* (rarely) in human muscle.

SPORT (from OF. *desporter*, to support, banish, amuse, divert). In biology, the appearance at birth of an individual having one or more marked or extraordinary physical or mental characteristics; a sudden aberration from the type. See Evolution; Natural Selection.

SPORTS. See Athletics.

SPORTS, Book of (correctly, the Declaration of Sports). A name popularly given to an edict issued by James I of England in 1617 dictating the games which should or should not be played on Sundays after divine service. According to this, "no lawful recreation shall be barred to my good people which does not tend to the breech of the laws of my kingdom and the canons of the established Church." Sports allowed were dancing, archery, leaping, vaulting, May games, Whitsun ales, Morris dances, and setting up May poles. This proclamation was occasioned by the conduct of Puritan authorities in the County of Lancashire, who, by arbitrary repression of the recreations of the people, had created discontent and (in the estimation of the King and his advisers) "had given much comfort to the Roman Catholics" by giving a repulsive aspect to the reformed religion. The unlawful sports were bear baiting, bull baiting, and bowling. In 1644 the Long Parliament ordered all copies of the Book of Sports to be called in and publicly burned.

SPOT, or Lafayette. A small food fish (*Leiostamus xanthurus*) of the South Atlantic and Gulf coast, locally called Lafayette (q.v.), goody, and oldwife. It is bluish above and silvery below, with about fifteen dark, wavy bands slanting down the sides, and a black spot behind the eye. It appears numerously on northern coasts in September, for spawning in the inlets.


THE SPOT.

SPOTS'WOOD, or **SPOT'TISWOOD,** Alexander (1676–1740). A British soldier and American Colonial Governor. He was born at Tangier, Africa, entered the British army, served with Marlborough, and was wounded at Blenheim. He was appointed Lieutenant Governor of Virginia in 1710, became active in promoting the interests of William and Mary College, and was interested in helping the Indians. To his efforts the improvement in the production of tobacco is attributable, and he favored making tobacco notes a circulating medium. He introduced the manufacture of iron into Virginia, and urged the construction of a line of forts on the western frontier to resist the encroachments of the French. But Spotswood quarreled with Commissary Blair over the right of inducting ministers, and owing to lack of support was superseded in 1722. He remained in America, and in 1730 was appointed Deputy Postmaster-General. Consult *The Official Letters of Alexander Spotswood* in "Collections of the Virginia Historical Society," vol. i.

SPOT'SYLVA'NIA COURT HOUSE, Battle of. A series of battles during the Civil War, between May 7 and May 21, 1864, around Spotsylvania Court House in Virginia, 49 miles north by west of Richmond, between the Federal Army of the Potomac, under General Meade, and the Confederate Army of Northern Virginia, under General Lee. As at the Wilderness (q.v.), the movements of the Federal army were directed by Grant. Both armies paused for breath after the battle of the Wilderness (May 5, 6), and prepared to renew the struggle. The Federal wagon trains were on the 7th drawn to the eastward to clear the direct road to Spotsylvania Court House, upon which a night march had been ordered. This was, however, anticipated by Lee, and Longstreet's corps (under R. H. Anderson) moved towards the same point, which (having a shorter line) they reached early on the 8th in time to oppose the advance of Warren's corps. Anderson had been ordered to begin his march at about the hour when he actually arrived at his destination. Notwithstanding his speed, Watson's division of the Federal cavalry reached the Court House some hours earlier, and had not, as alleged, Sheridan's dispositions been countermanded by Meade, the result might have been different. Anderson immediately intrenched, and, although attacked by Warren, was enabled to maintain his position until heavily reënforced.

By noon of the 9th the relative positions of the opposing forces were—the Confederate line forming a semicircle in front of the Court House, facing north, northwest, and northeast, with Anderson, Ewell, and Hill from left to right. Confronting them, Warren, Sedgwick, and Burnside from right to left, as named; Hancock had not yet arrived, but had been ordered to threaten Lee's left. In the course of these movements the distinguished commander of the Sixth Corps—General Sedgwick—was killed by a sharpshooter, and was succeeded by General Wright. It was discovered that Hancock's movement had caused Lee to draw troops from his right, and Grant thereupon (on the 10th) delivered a blow upon that part of his enemy's line. Combining the fifth, sixth, and part of the Second Corps, all under Hancock, while Burnside was to coöperate (a storming party of 12 regiments under Colonel Upton being a feature of the attacking column), he scaled the enemy's intrenchments and took several guns and hundreds of prisoners. The general attack failed, and was repulsed with loss; it was renewed with success but Upton's men were finally driven back.

A reconnaissance made on the 11th from Hancock's corps discovered a salient, at the right centre of the Confederate intrenchments. At 4 o'clock on the 12th a combined attack of Hancock and Burnside was made, capturing 4000 prisoners, 30 guns, many stands of arms and colors. The captured artillery was turned upon the defenders of the position, who, heavily reënforced, resisted strenuously. Reënforcements hurried to this quarter succeeded in pushing Hancock's men to the outside of the parapet but could drive them no farther. It was 3 o'clock next morning before fighting ceased, after nearly 20 hours of battle. As it was reported that the Confederates were trying to take the offensive in this quarter, at 6 A.M. of the 12th, Wright was ordered by Meade to attack on Hancock's right. This attack against the west angle, lasting all day and well into the night, was one of the fiercest and bloodiest of the whole war; its memory has been perpetuated in the name since given to the place, the "Bloody Angle." Lee retired to a fresh position in rear of the one previously occupied and strongly intrenched. Until the 18th the two armies lay facing each other, engaging in minor conflicts, and Grant then, on May 19–21, transferred his army to the North Anna River. On the 8th Sheridan had been detached with his command and sent on a raid in the direction of Richmond and against Lee's communications. He was followed by the Confederate cavalry, but succeeded in passing entirely around Lee's army. He had four severe engagements with Stuart's cavalry, and that distinguished leader was mortally wounded. He recaptured 400 Federal prisoners, seized large quantities of supplies and war material, destroyed miles of railroad and telegraph, passed within the outer defenses of the enemy's capital, and after a fortnight reached Grant's headquarters. The Federal losses at Spotsylvania are estimated at 16,141 killed and wounded; those of the Confederates cannot be stated, but were probably much less.

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SPOTTED CAVY. See PACA.

SPOTTED FEVER, ROCKY MOUNTAIN; also known as TICK FEVER, BLACK FEVER, BLUE DISEASE. An acute infectious disease, coming on suddenly with chill, fever, headache, and pains in the joints and bones, appearing in the spring months in certain districts in the Rocky Mountains. It is endemic in the Bitter Root valley of Montana, whence it is spread to Idaho, Wyoming, and Nevada. Mortality varies in different epidemics and is given as from one to three, or even as high as seventy per cent. Infection is spread by means of the wood tick, *Dermacentor occidentalis*, which fastens upon roaming animals, domestic and wild, and is principally communicated to lumbermen, cattle and sheep men, and miners. The incubation period is from one to three days. The temperature rises to 103°, 104°, or even 107° F. In fatal cases death occurs usually between 6 to 12 days. Patients surviving the second week generally recover. Preventive treatment consists in guarding against the bite of ticks at certain seasons. During the attack treatment is purely symptomatic. The rash from which the disease gets its name consists of bright-red macules which gradually become darker and reach their fullest development from the seventh to the tenth day. They are seen on the wrists and ankles and gradually spread to the trunk and abdomen. See TYPHUS FEVER.

SPOTTED FEVER. See MENINGITIS.

SPOTTISWOOD, A. See SPOTSWOOD.

SPOT'TISWOODE, SPOT'TISWOOD, SPOT'ISWOOD, or **SPOTS'WOOD,** JOHN (1565–1639). Archbishop of St. Andrews. He was educated at the University of Glasgow and on his father's death in 1583 succeeded him as parson of Calder. For many years an uncompromising Presbyterian, he afterward adopted English Episcopal ideas, and became the chief instrument of James I and Charles I in their attempts to reconstruct the Scottish church after the English model. He was Archbishop of Glasgow in 1603 and member of the Scottish Privy Council in 1605. In 1610 he was moderator of the Assembly which gave its consent to the introduction of Episcopacy into Scotland. In 1615 Spottiswoode was made Archbishop of St. Andrews and Primate of Scotland. In 1618 he persuaded the General Assembly to accept the Five Articles of Perth, ordaining certain ceremonial innovations, and he subsequently enforced the articles as far as he could. He took part in the revision of the Scottish Prayer Book, but was opposed to the introduction of the Laudian system into Scotland. In 1633 he crowned Charles I at Holyrood, and in 1635 he was made Chancellor of Scotland, a dignity which no churchman had held since the Reformation. He tried to introduce the Prayer Book, according to the King's wishes, but in the resulting disorders found it necessary to flee from Scotland. He was excommunicated and deposed by the General Assembly, Dec. 4, 1638, and Charles asked him to resign the chancellorship. Spottiswoode was the author of the *History of the Church and State of Scotland from the Year of Our Lord 203 to the End of the Reign of King James the VI, 1625*, an official compilation for King James, first printed in London in 1655. Consult David Calderwood, *The True History of the Church of Scotland* (n. p., 1674).

SPOTTISWOODE, WILLIAM (1825–83). An English mathematician and physicist, born in London. He was educated at Balliol College, Oxford. His memoirs on the contact of curves and surfaces in the *Philosophical Transactions* and various other scientific journals are important and original. Among his works are: *Meditationes Analyticæ* (1847); *Elementary Theorems Relating to Determinants* (1851; a second edition appeared in *Crelle's Journal*, 1856); *A Tarantasse Journey through Eastern Russia* (1857); *Polarisation of Light* (1874); *A Lecture on the Electrical Discharge, its Form and Functions* (1881).

SPOUT SHELL. See PELICAN'S-FOOT.

S. P. Q. R. The abbreviation of *Senatus Populusque Romanus* (the Senate and the Roman people), the motto surmounting the Roman standards.

SPRAGUE. A town in New London Co., Conn., 22 miles by rail from New London, on the Shetucket River and on the New York, New Haven, and Hartford Railroad. It contains the Academy of the Holy Family. There are cotton, woolen, and paper mills, and a manufactory of hospital supplies. Pop., 1900, 1339; 1910; 2551.

SPRAGUE, FRANK JULIAN (1857–). An American electrical engineer, born at Milford, Conn. He graduated at Annapolis in 1878, resigned from the naval service in 1883, and became an assistant to Thomas A. Edison. He founded in 1884 the Sprague Electric Railway and Motor Company, and later the Sprague Electric Elevator and Sprague Electric companies. Besides having been a pioneer in electric-railway work, he introduced the high-speed electric elevator, and invented the multiple-unit system of electric-train control. He served as consulting engineer to the Sprague and General electric companies after 1902, and in the same capacity for other important corporations. In 1892–93 he was president of the American Institute of Electrical Engineers, and he became president of the American Institute of Consulting Engineers. Sprague was awarded a gold medal at the Paris Exposition in 1889 and the Elliott Cresson gold medal of the Franklin Institute in 1904, a grand prize at the St. Louis Exposition in 1904, and the Edison gold medal in 1911. In 1915 he was appointed a member of the Naval Advisory Board.

SPRAGUE, William (1831–1915). An American manufacturer and politician, born at Cranston, R. I. After studying at the Irving Institute, Tarrytown, N. Y., he entered his father's mills, and afterward became interested in linen weaving and locomotive building. He was elected Governor of Rhode Island, but in the Civil War he offered his services to the United States government, and served with the Rhode Island troops, fighting in the first battle of Bull Run and in the Peninsular campaign. From 1863, when his term as Governor expired, until 1875 he was a member of the United States Senate. He died in Paris.

SPRAGUE, William Buell (1795–1876). An American clergyman and compiler of *Annals of the American Pulpit* (9 vols., 1857–69), a comprehensive biographical dictionary of the leading American ministers of all denominations. He graduated at Yale (1815), studied theology at Princeton (1819), had pastoral charges at West Springfield, Mass. (1819–29), and Albany, N. Y. (1829–69), and afterward devoted himself to literary work at Flushing, L. I. Besides the *Annals* mentioned above he wrote numerous books, of which the chief are *Lives* of Rev. Edward Dorr Griffin, D.D. (1838), Timothy Dwight (1845), and Rev. Jedediah Morse (1875).

SPRAIN (Lat. *ex*, out + *premere*, to press), or Strain. A term employed in surgery to designate a violent stretching of tendinous or ligamentous parts with or without rupture of some of their fibres. Sprains are frequent in the joints of the upper limbs, especially in the wrist and the articulations of the thumb. In the lower extremity the ankle is the joint most frequently affected. In slight ankle sprains the ligaments are only stretched or slightly lacerated; in more severe cases they may be completely torn through or detached from their bony insertions. Sprains are sometimes mistaken for fractures, and vice versa; and the two injuries may coexist. Pain and swelling sometimes make accurate diagnosis difficult, especially if the patient is not quickly seen after the accident; and if any doubt exists the case should be treated as for the more severe injury. An X-ray photograph, however, will clear up the diagnosis. Sprains of the knee are not uncommon, and are characterized by swelling from effusion of fluid within the joint. The treatment of sprains generally must be regulated by their severity. When seen early before swelling has taken place, strapping with adhesive plaster is a most satisfactory procedure. In most cases elevation of the joint, the application of cold, and complete rest in a splint will be sufficient, and as soon as the inflammation subsides massage and pressure movement are necessary to prevent adhesions.

Sprains or strains are common among horses, owing to exertions required of them, often while they are young and unprepared. Various muscles, ligaments, and tendons are affected, but none more frequently than the large tendons at the back of the fore limbs. In slight cases cold water continuously applied for several hours gives relief; but in all serious cases diligent fomentation with hot water is preferable. Perfect rest is essential; in bad cases the horse may be slung. Blisters, hot oils, firing, and all such irritants are not to be used until inflammation abates and the part becomes cool and free from tenderness. Such remedies are then useful for causing the reabsorption of swelling and loosening of adhesions.

SPRAT (from AS. *sprota*, sprout). A small European herring (*Harengula sprattus*), abundant in the northern Atlantic. It is six inches in length when fully grown. Sprats are cured in great quantities, dry salted and in brine, and form a cheap and excellent food. Small and unimportant species have taken the name in America, where the true sprat is not found.

SPRATT, Thomas Abel Brimage (1811–88). An English vice admiral and hydrographer. He was born at East Teignmouth and entered the navy in 1827. For the most part until 1863 he was engaged in making a survey of the Mediterranean. During the Crimean War he commanded the *Spitfire*, and in 1855 was promoted to captain. He made also important geological investigations in the Greek isles and in Asia Minor, and in 1856 was elected a fellow of the Royal Society. His writings include *Travels in Lycia*, with Edward Forbes (2 vols., 1847), and *Travels and Researches in Crete* (2 vols., 1865).

SPREADING ADDER. See Hognose, and the photographic Plate of Snakes.

SPRECK'ELS, Claus (1828–1908). An American sugar refiner, born at Darmstadt in Hanover, Germany. He emigrated to Charleston, S. C., in 1846, worked for a time in New York City, and went to San Francisco in 1856. In 1857 he established the Albany Brewery in San Francisco, and in 1863 organized the Bay Sugar Refining Company. Two years afterward he sold his interests and went to Europe, where he studied the manufacture of sugar in all its aspects. Returning to California, he engaged more extensively in business, gaining large interests in manufactures and shipping both in California and in the Hawaiian Islands. He acquired large sugar interests in Hawaii, built large refineries with improved processes, engaged in beet-sugar farming in California, and by the control he exercised over the sugar industry gained for himself the name of the sugar king.

SPRECKELS, Rudolph (1872–). An American sugar refiner and financier, born in San Francisco. At an early age he entered his father's sugar refinery at Philadelphia to aid in the unsuccessful fight against the sugar trust. At 22 he purchased his father's holdings in the Hawaiian Commercial and Sugar Company, became its president and made it profitable. After making a fortune he sold his interest and returned, in 1898, to San Francisco to become a banker and head of a gas company. Again he fought a trust, but was successful. He was president of the First National Bank after 1906. In that year he was a member of the committee of 50 organized after the earthquake, and also at that time he organized the graft prosecution against city officials. In 1912, although a Republican in politics, he supported Wilson and effected an organization of Republicans to that end.

SPREE, shprā. A river of Prussia (Brandenburg) which rises in the eastern part of the Kingdom of Saxony, on the borders of Bohemia (Map: Germany, F 3). It flows in a winding northwest course of 226 miles past Berlin, and falls into the Havel at Spandau. Its valley, low, marshy, and dotted with lakes, was formerly, probably, the course of a much larger stream. It becomes navigable for small vessels at Liebsch, and has recently been deepened below Berlin so as to admit large ships to that city. It is connected with the Oder by two canals.

SPREMBERG, shprĕm'bĕrĸ. A town of Prussia, on the Spree, 77 miles southeast of Berlin (Map: Germany, F 3). Its chief industry is cloth manufacture. There are oil mills and mines of lignite. Pop., 1910, 11,706.

SPRENGEL, sprĕng'el, Kurt (1766–1833). A German physician and botanist, born at Boldekow, near Anklam, and educated at Halle. In 1789 he was made professor of medicine there, and in 1797 he was appointed professor of botany as well. He published: *Versuch einer pragmatischen Geschichte der Arzneikunde* (1792–1803; 4th ed., 1846); *Handbuch der Pathologie* (1795–97; 4th ed., 1815); *Historia Rei Herbariæ* (1807–08); *Geschichte der Botanik* (1817–18); *Neue Entdeckungen im ganzen Umfange der Pflanzenkunde* (1819–22).

SPRENGEL EXPLOSIVES. See Explosives.

SPRENGER, sprĕng'ĕr, Aloys (1813–93). An Orientalist, born at Nassereit, Tirol, and educated at Innsbruck and at the University of Vienna. In 1836 he went to Paris, and thence to London, where he became a naturalized British subject in 1838. In 1843 he proceeded to Calcutta under an appointment to the medical service of the East India Company. From 1844 to 1848 he was principal of the Mohammedan College at Delhi. In December, 1847, he became assistant resident at Lucknow, and was employed for some time in cataloguing the manuscripts in the royal library of the King of Oudh. From 1851 to 1854 he was official Persian translator at Calcutta and principal of the Mohammedan College at Hoogli. During these years he traveled extensively through the Orient, gathering materials for his projected *Life of Mohammed*, the first portion of which was published at Allahabad in 1851. In 1857 he returned to Europe and settled at Heidelberg. From 1858 to 1881 he was professor at the University of Bern. The remainder of his life he spent in retirement at Heidelberg. His works include: *Technical Terms of the Suffees* (1844); *English-Hindustani Grammar* (1845); *Selections from Arabic Authors* (1845); *History of Mahmud Ghaznah* (1847); *The Gulistan of Saadi* (1851), a translation from the Persian; *Leben und Lehre des Mohammed* (3 vols., 1861–65); *Die alte Geographie Arabiens* (1875).

SPRENGTPORTEN, sprĕngt'pōr'ten, Göran Magnus, Count (1740–1819). A Swedish-Russian politician. He assisted his half brother, J. M. Sprengtporten, in the revolution of 1772, and became colonel and brigadier in Finland (1775). Like his brother, suspicious of the King of Sweden, he was welcomed at the Russian court. After service in France he planned to separate Finland from Sweden and to make it an independent state under the protection of Russia. He openly opposed the Swedish King, engaged in treasonable correspondence with Russia, and on invitation of Catharine II he entered Russian service (1787). In the Russo-Swedish War (1788–90) he commanded a Russian army corps against Finland. The High Court of Finland condemned him to death as a traitor, and Catharine considered him an impostor, but Emperor Paul reëmployed him in diplomatic service. In 1808 he was appointed first Russian Governor-General of Finland, with title of Count, but unpopularity compelled him to resign the next year.

SPRIGG, Sir John Gordon (1830–1913). A South African statesman, born at Ipswich, England. In 1858, for the sake of his health, he settled on a farm near King William's Town in Cape Colony. Entering the Cape House of Assembly in 1869 he served there until 1904 and again after 1907. He won distinction by his attacks upon the immoral conduct of the Molteno government, and succeeded Molteno in 1878 as Prime Minister and Colonial Secretary. Subsequently he served as Treasurer (1884–86; 1893–96), and as Prime Minister and Treasurer (1886–90; 1896–98; 1900–04). Sprigg was an ardent Imperialist, and influenced his government to contribute £50,000 a year to the British treasury.

SPRING (AS. *spring*, spring). A natural outflow of water from the ground at a single point within a restricted area. If this outflow has no visible current it is called a seepage. Springs may emerge at different points on dry land, or in the beds of streams, ponds, or lakes. They will also show variable volume of flow. Cold spring waters are usually of meteorologic character, rain having soaked into the ground and emerged again as a spring at some other point on a lower level. Hot spring waters may be of igneous origin, or they may represent surface waters heated by contact underground with uncooled igneous rock, as the Yellowstone Park hot springs.

Classified according to their mode of origin, we recognize gravity springs, or those not confined by impervious beds, and artesian springs, in which the water is under pressure because it is confined to a pervious bed or a fissure. Grouped according to the nature of the water-conducting passages springs are: (1) seepage, in which the water seeps out from sand and gravel; (2) tubular, or those formed by tubular passages in glacial drift or easily soluble rocks; (3) fissure, in which the water issues along bedding, joints, fault, or cleavage planes. Where the water follows an underground channel way of somewhat open character, pollution can be carried a distance.

The composition of spring water varies with the character of the surrounding soil or rocks. Volume of flow of any given spring may vary with the season and amount of rainfall. Seepage springs often fail in periods of drought or little rainfall. Nevertheless some springs have a fairly constant and even large volume of flow, and may serve as sources of domestic or municipal water supply. Some are also of medicinal value on account of the dissolved mineral substances which they contain. Consult: Schlichter, "Motion of Underground Water," in *United States Geological Survey, Water Supply and Irrigation Papers, No. 67* (Washington, 1902); M. L. Fuller, *Domestic Water Supplies for the*

Farm (New York, 1912); Ries and Watson, *Engineering Geology* (ib., 1914). See ARTESIAN WELLS; GEOLOGY; GEYSER; MINERAL WATERS.

SPRING. A term used in mechanics to designate variously constructed devices of metal or other elastic material adapted to resist concussion, to store up and give out motive power, or to register stress through their property of uniform deformation under stress and their tendency to return to their original form when deforming stress is released. A spiral spring is one which is wound around a fixed point or centre in constantly receding coils, like the mainspring of a watch or clock. Spiral springs are usually made of flat strips or ribbons of steel, but may be made of round or other shaped wire. A helical spring is one which is wound around a cylindrical arbor in advancing spirals like the thread of a screw. Helical springs are usually made from round bars or from square rods of steel, and are perhaps more extensively used than any other form. An elliptical or laminated spring is made of flat bars, plates, or leaves of regularly varying lengths superposed one upon the other. For formulas for calculating the strength and energy of springs of various forms and sizes, consult William Kent, *Mechanical Engineers' Pocket Book* (8th ed., New York, 1913).

SPRING, GARDINER (1785–1873). An American Presbyterian clergyman, son of Samuel Spring. He was born at Newburyport, Mass., and was graduated at Yale in 1805. He taught for two years in Bermuda, and was admitted to the bar at New Haven, Conn., in 1808. The next year he entered Andover Theological Seminary. In 1810 he became pastor of the Brick Presbyterian Church, New York City, where he remained until his death. He was one of the founders of the American Bible Society in 1816, the American Tract Society in 1825, and the American Home Missionary Society in 1826. He published many books of a religious character besides his *Personal Reminiscences of his Life and Times* (1866).

SPRING, SAMUEL (1746–1819). An American Congregational clergyman. He was born at Northbridge, Mass., and graduated at the College of New Jersey in 1771. In 1775 he joined the Continental army, and accompanied Benedict Arnold as chaplain of the invading army into Canada. In 1776 he was installed pastor at Newburyport, Mass., where he continued until his death. He was one of the founders of Andover Theological Seminary and of the Massachusetts Missionary Society, and to him is attributed the idea of forming the American Board of Commissioners for Foreign Missions. Many of his occasional sermons have been printed, the most notable being *A Sermon on the Death of Washington* (1799) and *A Discourse in Consequence of the Late Duel* (1804)—that between Burr and Hamilton. Consult Gardiner Spring, *Personal Reminiscences of his Life and Times* (2 vols., New York, 1866).

SPRING BALANCE. An instrument used to determine the weight of a body by the extension or compression of a spring. In its usual form a spring of coiled wire is contained in a metal case and incloses a central rod to which is attached at one end a hook, and at the other a projection which extends through a slit in the case and moves over a graduated scale. The central rod can also be connected by means of a rack and toothed wheel with an axle on which is fastened a pointer moving over a circular scale or dial. The spring balance measures the amount of attraction of the earth at any particular place; consequently, readings at the equator would be different from those at the poles or other places on the earth's surface. The ordinary balance, on the other hand, would give the weight for a body irrespective of its position. The force of the spring varies with temperature, which alters the length and elasticity of the wire and renders impossible precise measurements. In practice many spring balances are inaccurate, due to faulty design and construction, and in some communities weights and measures officials prescribe standards for their construction.

SPRING BEAUTY. See CLAYTONIA.

SPRING'BOK' (Dutch, springing goat). A South African gazelle (*Gazella euchore*). It is larger than the common deer, and its neck and limbs much longer and more delicate. The general color is fulvous brown on the upper parts, pure white beneath, the colors separated on the flanks by a broad band of deep vinous red. The head is white, except a broad brown band on each side from the eye to the mouth, and a brown spot in the centre of the face. The springbok derives its name from the prodigious leaps which it takes either when alarmed or in play, often to the height of seven feet, and sometimes of 12 or 13 feet. It is one of the most sought-after game animals of South Africa, yet remains numerous. Consult authorities cited under ANTELOPES, and see Plate of GAZELLES.

SPRING EEL. A fish of the small order Opisthomi and family Mastacembelidæ, several species of which occur in the fresh waters of the East Indies; they are eel-like in form, with the dorsal fin very long and the forepart of it composed of low free spines. Allied to this is a small curious eel (*Derichthys serpentinus*) dredged from the depths of the North Pacific. See Plate of EELS.

SPRING'ER, ALFRED (1854–). An American chemist, born in Cincinnati, Ohio. He took degrees of A.M. and Ph.D. at Heidelberg and after 1873 was a member of a firm of manufacturing chemists in Cincinnati. He published studies on *Glycocholic Ether* (1879), *Pentachloramyl Formate* (1881), and *Reduction of Nitrates by Ferments* (1883), in which he announced his discovery of denitrifying ferments among the microörganisms of the soil, and forming a sort of link between the plants and their nitrogenous constituents; also, *A Latent Characteristic of Aluminum* (1891) and *Increase of Segmental Vibrations* (1897). He was one of the inventors of the torsion balance.

SPRINGER, ANTON (1825–91). A German art critic and historian. He was born at Prague and studied philosophy and the history of art at the universities of Prague, Munich, and Berlin. As a historian and politician at Prague he took a prominent part in the struggles following the revolution of 1848, advocating liberal views and Prussian supremacy in Germany. In disfavor with the government, he left Prague to study art in the Netherlands, France, and England. From 1852 he taught the history of art at Bonn, where he was appointed professor in 1859; then at Strassburg and (from 1873) at Leipzig. He wrote a number of historical works, important for their day, but no longer standard; but his contributions to art history, particularly during the Renaissance, are of permanent value. They are characterized by scholarly historical research and sound, appreciative criticism. The most important are: *Bilder aus der neueren Kunstgeschichte* (1867); *Raffael und Michelangelo* (1877); *Grundzüge der Kunstgeschichte* (1887–88; 8th ed., as *Handbuch der Kunstgeschichte*, 5 vols., 1907); *Albrecht Dürer* (1892). Consult the posthumous *Aus meinem Leben* (Berlin, 1892).

SPRINGER, WILLIAM MCKENDREE (1836–1903). An American jurist and political leader, born at New Lebanon, Ind. He graduated at the Indiana State University in 1858, and for four years was a newspaper correspondent and editor. He was admitted to the bar in 1859, and in 1872, having become a resident of Illinois, was elected a member of the Illinois Legislature. He was a member of Congress (1875–95), where he introduced a resolution, carried by a large majority, declaring that it would be unwise for one man to serve more than two terms in the presidency. He was United States Judge of the Northern District of Indian Territory and Chief Justice of the United States Court of Appeals there (1895–99).

SPRINGFIELD. The capital of Illinois and the county seat of Sangamon County, 185 miles southwest of Chicago, on the Illinois Central, the Chicago and Alton, the Chicago, Peoria, and St. Louis, the Baltimore and Ohio Southwestern, the Cincinnati, Hamilton, and Dayton, the Wabash and the Illinois Traction railroads (Map: Illinois, E 6). It is regularly laid out with wide streets. The most prominent edifice is the State capitol, a handsome building begun in 1867, and completed twenty years later. It is 399 feet long and 286 feet wide, and has a massive dome 364 feet high. Other interesting structures are the old capitol, now used as the county courthouse, and the Lincoln residence, now under State supervision. The Lincoln Monument and Mausoleum of gray granite, the cost of which was borne by several States, is situated a little more than a mile from the heart of the city. There are the Bettie Stuart Institute (female), Concordia Seminary, St. Agatha's School, and the Academy of Our Lady of the Sacred Heart. The State Library has 50,000 volumes, and the Public more than 42,000 volumes. There are also the State Historical Library, that of the Illinois State Museum of Natural History, the Lincoln Library, and the Supreme Court Library. Other noteworthy features are the State armory, the Supreme Court Building, the city hall, post office, Governor's mansion, the high-school and the Odd Fellows' buildings, the Orphanage of the Holy Child, the Springfield and St. John's hospitals, and the David Prince Sanitarium.

Springfield is the centre of a rich farming and coal-mining region, which also has important horse-breeding interests. The census of manufactures in 1914 showed an invested capital of $9,078,000 and an output of $11,753,000. The Illinois Watch Company maintains a large establishment here, and there are also engine works, boiler works, car shops, foundries and machine shops, lumber, woolen, and flour mills, breweries, and manufactories of soap, saddlery, mattresses, brick, clothing, automobile tires, electric meters, etc. The commission form of government has been adopted. For maintenance and operation the city spent in 1913, $733,000, the principal items being: schools, $295,000; highways, $44,000; fire department, $77,000; police department, $52,000; and water works, $60,000. The water works are owned by the municipality. Pop., 1890, 24,963; 1900, 34,159; 1910, including annexed suburbs, 51,678; 1915 (U. S. est.), 59,468. First settled in 1819 and laid out in 1823, Springfield was incorporated as a town in 1832, and was chartered as a city in 1840. In 1837 it was chosen as the State capital, and the State Legislature assembled here for the first time in 1839. For many years it was the home of Abraham Lincoln. Consult Power, *History of Springfield* (Springfield, 1871).

SPRINGFIELD. A city and the county seat of Hampden Co., Mass., 99 miles by rail west-southwest of Boston, on the Connecticut River and on the Boston and Albany, the Boston and Maine, the Central New England, and the New York, New Haven, and Hartford railroads (Map: Massachusetts, B 4). Several bridges here span the river. There are 1605 acres in the public park system. In Court Square are the Soldiers' and Sailors' Monument and a statue of Miles Morgan. "The Puritan," by Saint-Gaudens, near the library, is a work of great merit. Among prominent buildings of Springfield are some designed by H. H. Richardson, the most notable of which, perhaps, are the county courthouse and the Church of the Unity. The new municipal group consists of three fine edifices—the Administration Building, the Auditorium, and Campanile Tower. The United States arsenal is conspicuously situated within extensive grounds, where small arms are made for the United States government. (See SMALL ARMS.) Other prominent structures are the Springfield Science Museum, Art Museum (containing the George Walter Vincent Smith collection, one of the best in the country), the Federal Government Building, the Public Library, containing 190,000 volumes, and the buildings of the Springfield Fire and Marine Insurance Company, the Massachusetts Mutual Life Insurance Company, the Union Trust Company, and the Third National Bank. Springfield is the seat of the American International College, and of the International Y. M. C. A. College. The most important charitable institutions and hospitals include the City Almshouse, the Union Relief Association, the Home for Friendless Women and Children, the Good Will Home, the Rescue Mission, Industrial Charities, Springfield Hospital, Wesson Memorial Hospital, Mercy Hospital, and the Hampden Homœopathic Hospital.

The Federal census of 1909 gave the capitalization of the industrial establishments as $28,658,000 and the value of the output as $31,773,000. The leading manufactures are motor cycles, steam and electric cars, skates, revolvers, confectionery machinery, foundry and machine-shop products, paper and envelopes, tobacco, cigars and cigarettes, brass castings, lumber and lumber products, buttons, electrical apparatus and supplies, confectionery, automobiles, rubber and elastic goods, cotton and woolen goods, tools, etc. Springfield is a port of entry, and it has some foreign trade. The government is vested in a mayor, annually elected, and a bicameral council. The city spent in 1915, $3,808,000, the principal items being: schools, $894,000; police department, $272,000; fire department, $283,000; health and sanitation, $292,000. The water works are owned and operated by the municipality. The system comprises 213 miles of mains.

The net debt of the city in 1914 was $7,549,328, the assessed valuation of real and personal property, $180,129,051. Pop., 1800, 2250; 1850, 11,330; 1870, 26,703; 1880, 33,340; 1890, 44,179; 1900, 62,059; 1910, 88,926; 1915 (State census), 102,941.

Springfield was first settled in 1636 by a party from Roxbury headed by William Pynchon. Until 1640, when it received its present name, it was known as Agawam. On Oct. 4, 1675, during King Philip's War, it was attacked by Indians and burned. During Shays's Rebellion it was the scene (September, 1786) of a riot headed by Shays. Later (Jan. 25, 1787) occurred a sharp skirmish between a small body of State militia and about 2000 insurgents led by Shays, the latter being easily defeated. Consult: Green, *Springfield, 1636–1886* (Springfield, 1888); Burt, *The First Century of the History of Springfield, The Official Records from 1636–1736* (Springfield, 1898–99); Charles H. Barrows, *The History of Springfield for the Young* (ib., 1909); James E. Tower (ed.), *Springfield Past and Prospective* (Springfield, Mass., 1906).

SPRINGFIELD. A city and the county seat of Greene Co., Mo., 200 miles southeast of Kansas City, on the St. Louis and San Francisco and the St. Louis, Iron Mountain, and Southern railroads (Map: Missouri, C 4). The city is in the Ozark Mountains (altitude 1300 feet), and is surrounded by beautiful forest and prairie scenery. It is the seat of Drury College (nonsectarian), opened in 1873, and of Loretto Academy. Other features include the United States government building, Carnegie Library, the high school, courthouse, city hall, and Federal building, St. John's Hospital, Burge-Deaconess and Springfield hospitals, U. S. Weather Bureau Station, U. S. Land Office, Doling Park, and the State Normal School. The national cemetery here has 1703 graves, of which 737 are of unknown dead. Situated in the mineral belt of southwest Missouri, Springfield has also important agricultural, lumbering, and stock-raising interests. The leading establishments are carriage and wagon factories, ironworks, lumber mills, flouring mills, furniture factories, foundries, and shops of the St. Louis and San Francisco Railroad. The commission form of government was adopted in 1916. Pop., 1900, 23,267; 1910, 35,201; 1915 (U. S. est.), 39,513.

SPRINGFIELD. A city and the county seat of Clark Co., Ohio, 45 miles west of Columbus, at the confluence of Lagonda Creek and Mad River, and on the Erie, the Cleveland, Cincinnati, Chicago, and St. Louis, the Ohio Electric, and the Detroit, Toledo, and Ironton railroads (Map: Ohio, C 6). It is the seat of Wittenberg College (Lutheran), opened in 1845, and has the Warder Public Library, with more than 31,000 volumes. Noteworthy also are the city hall, the United States government building, the buildings of four State fraternal homes, Masonic, Pythian (two), and Independent Order of Odd Fellows, Clark Memorial Home for Aged Women, city hospital, Memorial Hall, Babies' Fresh-Air Camp, and 250 acres of parks, the largest reserve being Snyder Park. Excellent water power has aided in making an important industrial city.

The census of 1914 showed that there was invested in the various industries capital to the amount of $29,082,000. Their output was valued at $27,722,000. More than five-sevenths of the capital and nearly two-thirds of the output were represented by the manufactures of agricultural implements, and foundry and machine-shop products. Other manufactured articles include electric motors, motor trucks, caskets and vaults, piano plates, emery wheels, gas and gasoline engines, automobile tires and tubes, incubators, railway frogs, etc. The commission-manager form of government has been adopted. The water works, which represent an investment of $2,000,000, are owned by the municipality. Springfield was first settled in 1799. Pop., 1900, 38,253; 1910, 46,921; 1915 (U. S. est.), 50,804.

SPRINGFIELD. A city in Bon Homme Co., S. Dak., 30 miles west of Yankton, on the Missouri River and on the Chicago, Milwaukee, and St. Paul Railroad (Map: South Dakota, F 5). It is the seat of the Southern State Normal School. Pop., 1900, 525; 1910, 675.

SPRINGFIELD. A town and a village in Windsor Co., Vt., 14 miles north of Bellows Falls, on the Black River and on the Springfield Electric Railway (Map: Vermont, D 7). It has machine shops, a brass foundry, large shoddy mills, etc. Pop. (town), 1900, 3432; 1910, 4784.

SPRING FROG. See GREEN FROG.

SPRINGHILL. A town in Cumberland County, Nova Scotia, Canada, on the Cumberland Railway and Coal Company Railway, about 75 miles north-northwest (direct) of Halifax (Map: Nova Scotia, G 5). It has manufactures and important coal mines. Pop., 1901, 5178; 1911, 5713.

SPRING HILL COLLEGE. A Roman Catholic institution for higher education founded in 1830 under the direction of the Society of Jesus and located at Spring Hill, Ala. Its courses are preparatory (two years), commercial (five years), and classical (seven years). The students in 1914–15 numbered 225, and the faculty 26. The buildings and grounds were valued at about $250,000. The annual income is about $42,000. The library contains about 19,000 volumes. The president in 1915 was E. Cummings, S. J.

SPRINGING USE. A use which is limited to take effect on the happening of a future event and not depending upon any preceding use or estate. This is a peculiar form of future estate and differs from a shifting use, which operates in derogation of some other estate, and from a remainder which must be limited upon some particular or preceding estate. It may be limited to rise either upon a certain or uncertain and contingent event. See REAL PROPERTY; LIMITATION OF ACTIONS; SHIFTING USE; ESTATE. Consult Gilbert, *On Uses*.

SPRING LAKE. A borough in Monmouth Co., N. J., 11 miles south of Long Branch, on the Atlantic Ocean and on the Pennsylvania and the Central of New Jersey railroads (Map: New Jersey, D 3). Spring Lake is a popular summer resort, having a fine beach and several excellent hotels and beautiful residences. It contains also the Ann May Hospital and the Maloney Memorial. Pop. (summer), 20,000; (resident), 1915 (State census), 1492.

SPRING-RICE, SIR CECIL ARTHUR (1859–). A British diplomat. He was born in England and was educated at Eton and at Balliol College, Oxford. After being private secretary to Earl Granville and précis writer to the Earl of Rosebery, he was successively

Secretary of the British legations at Brussels, Washington, Tokyo, Berlin, and Constantinople. He was appointed chargé d'affaires at Teheran, Persia (1900), and British Commissioner of the Public Debt at Cairo (1901); was First Secretary of the British Embassy at St. Petersburg (1903–05); Minister and Consul General at Teheran (1906–08); Minister to Sweden (1908–12); and in 1912 became British Ambassador to the United States, in succession to James Bryce (q.v.). He was knighted (K.C.M.G.) in 1906 and was given the Grand Cross of the Victorian Order in 1908.

SPRING SWIFT. Any lizard of the iguanid genus *Sceloporus*, which contains a great number of small species whose heads are not spiny and which have flat scales and no gular fold. They vary in color, but are generally dull above, with one or two light lines along each side and black cross lines or blotches on the back. The inferior surfaces, however, are likely to be brilliantly colored. These lizards are conspicuous objects everywhere in the southwestern United States and Mexico. One small species, variable in color, *Sceloporus undulatus*, is the common "fence lizard" of the Eastern and Central States. They are swift and spry, but harmless, and increase by means of eggs laid in the sand and left to hatch by the sun's warmth. In captivity they do not become tame, but in a dry cage with an abundance of sunlight and a diet of mealworms they will thrive for years.

SPRINGTAIL. Any one of the minute insects of the families Poduridæ, Smynthuridæ, Entomobryidæ, and Papiriidæ, of the thysanuran suborder Collembola. These insects leap by the tail-like organ arising from the under side of the penultimate or antepenultimate segment of the abdomen, reaching forward horizontally when at rest, nearly to the head. This organ when suddenly drawn towards the perpendicular throws the insect high in air and sometimes several feet away. The springtails are found in great numbers on the surface of the ground or just beneath in boreal and even Arctic regions. In the northern United States on bright sunny days in spring when the snow is melting, they occur in great numbers on the surface of the snow. One species (*Achoreutes nivicola*) is commonly known as the snow flea.

SPRINGTAIL DUCK. See PINTAIL.

SPRING VALLEY. A city in Bureau Co., Ill., 5 miles east of La Salle, on the Illinois River and on the Chicago, Rock Island, and Pacific, the Chicago and Northwestern, and the Chicago, Burlington, and Quincy railroads (Map: Illinois, F 3). Noteworthy features are the high and vocational school, Carnegie library, and St. Margaret's Hospital. Pop., 1900, 6214; 1910, 7035.

SPRINGVILLE. A city in Utah Co., Utah, 6 miles south of Provo, on the Denver and Rio Grande, and the San Pedro, Los Angeles, and Salt Lake railroads (Map: Utah, C 2). Fruit and stock raising, dairying, and canning are the chief industries. Pop., 1900, 3422; 1910, 3356.

SPRING WHEAT. See FLOUR; WHEAT.

SPRIT (AS. *sprēot*, pole). A light spar extending from the peak (see SAIL) to a sliding becket on the mast. In the early days of square-rigged ships, square sails set on yards under or over the head booms were called the spritsail, sprit topsail, and sprit topgallant sail. When the square spritsails of the head booms were replaced by fore-and-aft jibs and staysails, the various spritsail yards were no longer used, but as a spreader was needed for the jib guys, whisker booms (see SHIP AND SHIPPING) were devised, and these are occasionally called spritsail yards, though they are in two parts, one on each side of the bowsprit cap.

SPROULE, sproul, THOMAS SIMPSON (1843–). A Canadian physician and legislator. He was born in York County, Ontario, and was educated at the University of Michigan and in medicine at Victoria University, Cobourg. He practiced his profession for a brief period in Michigan, but returned to Canada, entered political life, and represented East Grey as a Conservative in the Dominion Parliament in 1878–1911, being appointed in the latter year Speaker of the House of Commons. In December, 1915, he was appointed a member of the Senate. He held decided views in favor of Protestant supremacy in Canada, took a prominent part in the Equal Rights agitation (see PARTY NAMES), and supported the unsuccessful attempt of the Dominion government to give Manitoba separate schools. He was grand master of the Loyal Orange Association of British North America in 1901–11, and in 1911 was elected president of the Imperial Grand Orange Council of the World.

SPRUCE (from ML. *Prussia*, Prussia), *Picea*. A genus of about 30 species of coniferous trees, indigenous to the Northern Hemisphere, nearly half being natives of North America. The genus was formerly combined with *Abies* (see FIR), from which it differs in having pendulous cones, leaves jointed on the twigs, keeled on both sides and not arranged in ranks, but scattered and pointing in every direction. They occur farther north than most trees, forming forests within the Arctic circle, and extending south, especially in the mountains, as far as the Pyrenees in Europe, the Himalaya in Asia, and North Carolina and Arizona in the United States. The white spruce and also the black cover extensive areas in Canada almost totally excluding other trees. In Europe the Norway spruce is similarly distributed. The species are pyramidal in habit, the lower branches drooping when old. The Norway spruce (*Picea excelsa* or *Picea abies*), the principal European species, is of rapid growth, attains a height of 150 feet or more, and is extensively planted both for forests and for ornament. The timber is valuable for fuel and for housebuilding, and is largely exported from Norway and Sweden for masts and spars of sailing vessels. The tree yields resin and turpentine; its bark is used in tanning and for basket making, etc. The wood is also used for wood pulp and paper manufacture. In North America the prevailing species over the greatest extent of territory are the white and the black spruce (*Picea canadensis* and *Picea mariana*), although in lumbering the two species are seldom distinguished. The former is found from New York to British Columbia and northward to Newfoundland, Hudson Bay, and Alaska—a handsome tree 50 to 150 feet high. The wood is light, soft, compact, nearly odorless, light yellow, and with scarcely distinguishable sap wood. It is largely used for general building, spars, flooring, etc., and also yields some of the spruce gum of commerce. The black spruce has a distribution somewhat similar to the white except that it descends along the mountains to Virginia—a somewhat smaller tree, but otherwise very similar to the white spruce. It forms immense forests in Maine, New York, Canada, and elsewhere, and is largely used for wood pulp and paper. A third species, the red spruce (*Picea rubra*), a valuable timber tree, has much the same distribution as the others except it is found along the mountains as far south as Georgia. These species are the chief and best source for wood-paper making. The gum of the black spruce is used for chewing. The branches are used in the preparation of essence of spruce. The bark contains tannin and is used to some extent in tanning leather. The roots are often split into narrow strips and made into baskets, coarse mats, ropes, etc. The Sitka or tideland spruce (*Picea sitchensis*) is a larger tree occurring abundantly from northern California to Alaska, following the coast as far as the island of Kodiak. It is one of the largest trees of North America, attaining in low regions a height of more than 300 feet and a diameter of 7 or 8 feet at 100 feet from the base. Specimens upon the islands in southeastern Alaska measured more than 200 feet in height and 25 feet in circumference 4 feet from the ground. The timber is very valuable, entering into all kinds of building operations. In the tree-planting operations in the West the spruces, especially the white and the Norway, have proved among the most adaptable of evergreens. The black, being slow growing, less ornamental, and not well adapted to dry soils, is less frequently planted. For ornamental planting none excels the blue spruce, which is of rather slow growth. A tree known as Douglas spruce or Douglas fir (*Pseudotsuga douglassi*) is one of the important timber trees from the Rocky Mountain region to the Pacific and north to British Columbia. Upon the Pacific coast it attains a height of more than 300 feet and a diameter of 10 to 12 feet. The timber is fine, straight-grained, heavy, and very strong, and is useful for all kinds of building, masts, etc. It has been very successfully planted in Minnesota, where it is believed it will supersede the other species.

SPRUE, or PSILO′SIS. This is a chronic catarrhal inflammation of the gastrointestinal mucous membrane and is characterized by anæmia, wasting, uncontrollable diarrhœa, and profound weakness. The mouth is inflamed and spotted with aphthæ; as the disease progresses erosions and ulcerations appear on the mucous surfaces of the whole gastrointestinal tract; and still later atrophic changes take place. Sprue is a disease of the tropics, particularly of the Orient, although it is also found in the West Indies. It is equally frequent in women and men, and is prone to attack Europeans who have resided for some time in hot climates. The essential cause of sprue was, until recently, obscure. It has been variously assigned to a protozoön and to yeast fungi, but in 1915 Maj. B. K. Ashford of the Medical Corps of the U. S. army, in Porto Rico, ascribed the disease to a species of Monilia, a yeastlike body producing mycelial threads in its vegetative state, in contradistinction to the true yeasts—saccharomyces—which reproduce by ascospores. Ashford says: "The organism is a typical Monilia. Its biologic characteristics are that it ferments glucose, levulose, and maltose; that it causes an acid reaction in these three, and in saccharose and galactose; that it does not liquefy gelatin or serum; does not coagulate or render milk acid, but, on the contrary, renders it alkaline; and that all other sugar mediums lose rapidly in acidity." Ashford followed the usual treatment, consisting of a dietary in which Monilia does not flourish and in which it cannot ferment. Three types of diet are employed: (1) a strict milk diet, to which may be added lactic acid bacilli; (2) a strict meat diet; (3) a simple fruit diet in which bananas may form the principal feature. As the patient improves, vegetables, fruits, and eggs are cautiously added to these. Under this treatment, of 69 cases of sprue 12 were cured, 32 greatly improved, 19 were not improved, 2 became worse, and 4 died. In the Orient the disease, although sometimes undergoing remissions, is generally fatal.

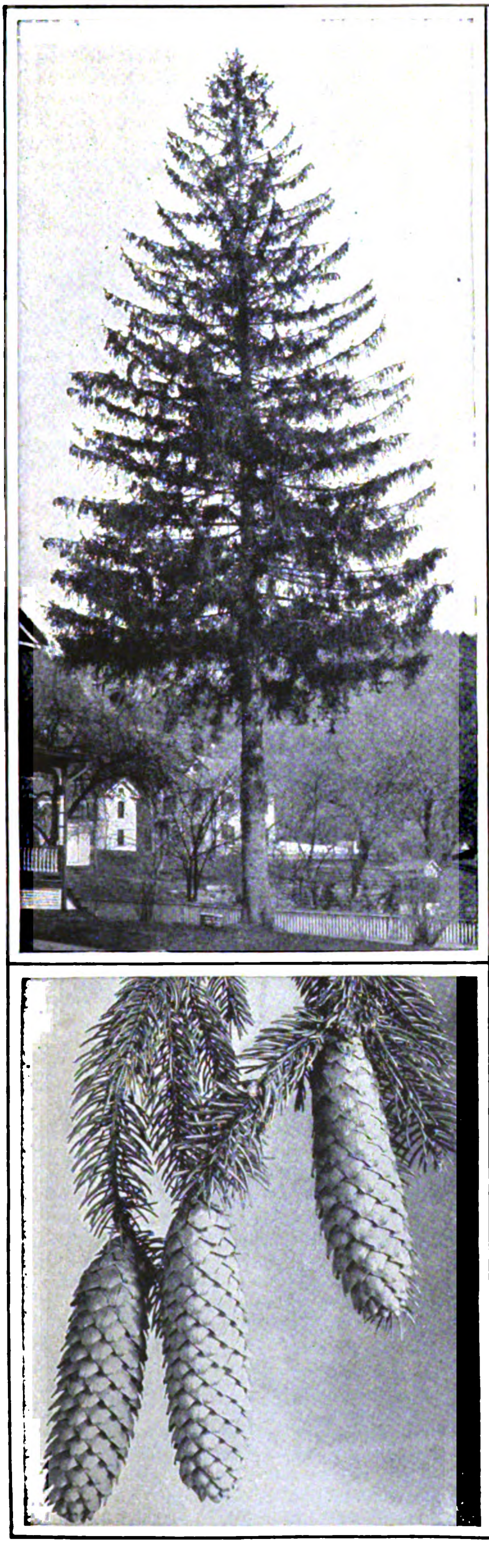
SPRUE. See THRUSH.

SPRUNER VON MERZ, shprōō′nĕr fŏn mĕrts, KARL (1803–92). A German cartographer, historian, and poet, born at Stuttgart. He entered the corps of cadets at Munich in 1814, became lieutenant in 1825 and lieutenant colonel in 1855, when King Maximilian II appointed him his aid-de-camp. Favored with that monarch's special confidence, he was a steadfast advocate of Pan-German and liberal principles at the Bavarian court. In 1864 King Ludwig II appointed him his adjutant general and in 1883 general of infantry. He retired from service in 1886 and died in Munich. His principal work is the great *Historisch-geographischer Handatlas* (118 maps, 1837–52; 4th ed. by Sieglin, 1893 et seq.); besides which he published a model *Atlas zur Geschichte von Bayern* (1838); *Handatlas für die Geschichte des Mittelalters und der neueren Zeit* (90 maps: new ed. by Menke, 1879); *Historisch-geographischer Schulatlas* (10th ed., 1880); and others. He wrote a *Leitfaden zur Geschichte von Bayern* (1853); *Pfalzgraf Rupert der Kavalier* (1854); *Charakterbilder aus der bayrischen Geschichte* (1878); several historical dramas and anonymously, *Jamben eines greisen Ghibellinen* (1876), and *Aus der Mappe des greisen Ghibellinen* (1882), both strictly Christian, but antipapal.

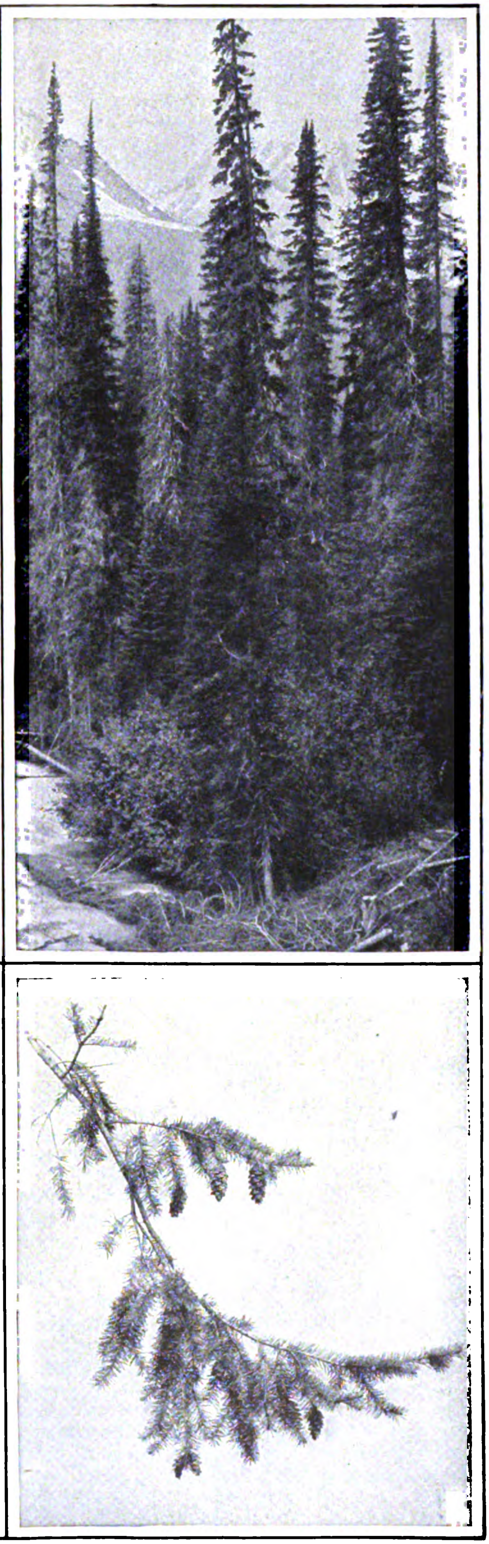
SPULLER, spụ′lâr′, EUGÈNE (1835–96). A French publicist and political leader, born at Seurre (Côte d'Or). After the proclamation of the Republic in 1870 he became Gambetta's secretary and one of his most trusted supporters, and with him escaped from Paris in a balloon on Oct. 7, 1870, in order to assist him in reorganizing the provincial governments. He was elected by a Paris constituency to the Chamber in 1876, and became one of the most influential leaders of the Union Republic group. Upon the formation of Gambetta's short-lived cabinet, in November, 1881, Spuller was made Undersecretary of State for Foreign Affairs. He returned to the Chamber in the following year, and in 1884 was chosen one of the vice presidents of the body. He was Minister of Public Instruction in the Rouvier cabinet in 1887, and Minister of Foreign Affairs in the Tirard cabinet in 1889–90. In 1892 he was elected Senator, and in 1893–94 held the portfolio of Public Instruction in the cabinet of Casimir-Périer. He published: *Petite histoire du second empire* (1870); *Ignace de Loyola et la compagnie de Jésus* (1876); *Michelet, sa vie et ses œuvres* (1876).

SPUNKIE. See IGNIS FATUUS.

SPRUCE



NORWAY SPRUCE AND CONES



DOUGLAS SPRUCE AND CONES

SPUR (AS. *spora*, spur). Originally spurs were made with a single point or prick and were known as the prick-spur or goad-spur, but they soon developed into the rowel. In some instances the spur proper consisted of a ball from which projected a sharp point. Although the rowel is first met with in the thirteenth century, it was not common until the middle of the fifteenth century. In the Middle Ages the use of the spur was limited entirely to knights, who were granted their spurs as a symbol that they had won their right to knighthood. Similarly, the hacking off of his spurs denoted the public disgrace and degradation of the knight. Throughout modern European armies generally, the gilt spur denotes an officer of field rank, and the steel spur a mounted officer of regimental rank. In the United States army the spurs of mounted officers are of noncorrosive metal without ornamentation and without rowels. The rank and file wear a similar spur made of steel. The spur is used to train and control the horse, not to punish him.

SPURGE (Lat. *expurgare*, to purge), *Euphorbia*. A genus of about 600 species, mostly tropical shrubs or trees or temperate climate herbaceous species of the family Euphorbiaceæ, characterized by a resinous, milky, usually acrid juice. There are two large classes, those having normal leaves, and those with abortive leaves which fall early. To the first class belong most of the species found in temperate climates, the others abound in Africa. Some of the green-stemmed, fleshy, and spiny African species so resemble certain cacti in their habit of growth as to render their identification more or less uncertain when not in flower. The leaves are either wanting or fall off early, and the functions of assimilation are performed by the stems. The flowers of many species, especially of Poinsettia, have bright-colored bracts that make them very ornamental. About forty species are indigenous or introduced in the eastern United States, all being herbaceous plants, mostly weeds.

CYPRESS SPURGE
(*Euphorbia cyparissias*).

SPURGE LAUREL. See DAPHNE.

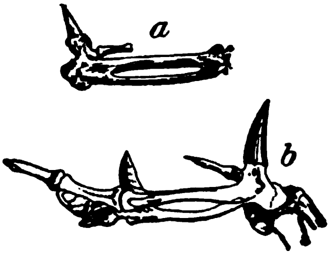
SPUR′GEON, CHARLES HADDON (1834–92). A celebrated English preacher. He was born at Kelvedon, Essex, attended school at Colchester, and spent a few months at an agricultural college at Maidstone. His family intended him for an Independent minister, but his own sympathies drew him towards the Baptists, whom he joined in 1851. Removing to Cambridge, he began to deliver lay sermons in the neighborhood. At 18 he had charge of a small Baptist congregation at Waterbeach, Cambridgeshire. In 1854 he entered upon the pastorate of the New Park Street Chapel, London. The Surrey Music Hall was for some time engaged for his use, and finally his followers built for him the well-known Metropolitan Tabernacle, opened in 1861. Many evangelistic and philanthropic agencies grew up in connection with this great institution, such as the Stockwell Orphanage; a pastor's college, where hundreds of young men were trained for the ministry under Spurgeon's direction; the Golden Lane Mission, etc. He died at Mentone, France, where he had gone for his health. His sermons were published weekly from 1854, and yearly volumes were issued from 1856. They had an enormous circulation, and many of them were translated into various languages. Spurgeon also published many volumes, including: *The Saint and his Saviour* (1857); *Morning by Morning, and Evening by Evening* (1866–68); *John Ploughman's Talks* (1869); *The Treasury of David* (a commentary on the Psalms, largely from Puritan writers, 1870–85); *Lectures to my Students* (1875–77); *Commenting and Commentaries* (1876); *John Ploughman's Pictures* (1880); and after 1865 he edited a monthly magazine, *Sword and Trowel.*

In theology he was a pronounced Calvinist, in biblical science an extreme conservative, in policy an open-communion Baptist, in politics a Liberal Unionist, in all things independent. He attacked the Low Church party in the Church of England because it countenanced, he asserted, the Prayer Book teaching of baptismal regeneration, and in 1864 withdrew from the Evangelical Alliance because this doctrine was supported by it. He attacked his own coreligionists for their alleged rationalism and sympathy with modern views of the Bible, and withdrew in 1887 from the Baptist Union. Consult: *Autobiography, Compiled from his Diary, Letters, and Records by his Wife* (4 vols., London, 1897–1900); R. H. Conwell, *Life of Charles Haddon Spurgeon* (Philadelphia, 1892); C. H. Lorimer, *Charles H. Spurgeon, the Puritan Preacher of the Nineteenth Century: A Monograph* (Boston, 1892); J. J. Ellis, *Charles Haddon Spurgeon* (new ed., London, 1902); W. M. Higgs, *The Spurgeon Family* (ib., 1906).

SPURRY (Dutch *spurrie*, spurrey). Plants belonging to the genera *Spergula* and *Spergularia* of the family Caryophyllaceæ. Spurry is a weed sometimes cultivated as a forage crop. Corn spurry or common spurry (*Spergula arvensis*) is an annual from 6 to 12 inches high, producing a tangled mass of succulent stems with numerous whorled linear leaves. It prefers sandy soil, upon which it is often planted as a green manure and as a soiling crop for sheep and cattle. The plant readily reseeds, but need not become a pest; it is sometimes a catch crop. Giant spurry (*Spergula maxima*), by many botanists not regarded as distinct from the above, is larger than common spurry. The species of *Spergularia* are called sand spurry.

SPURS, BATTLE OF THE. See COURTRAI; GUINEGATE.

SPUR-WINGED GOOSE, PLOVER, ETC. Many terrestrial birds have the bend of the wing armed with one or more spurs or bony knobs, which they use for attack and defense. This armament is conspicuous in the geese of the African family Plectropteridæ, of which there are four species, and here it is based upon one of the wrist bones, instead of on the metacarpus, as is usual elsewhere. The spur-winged plover (*Hoplopterus spinosus*), one of the commonest birds of the Nile valley, is only one of many tropical plovers so armed, the largest and finest spurs being those of a Chilean plover (*Belonopterus chilensis*); its spur is situated just at the base of the thumb, and, as in other cases, is sheathed with horn, and sharp at the end. Some of the jaçanas have wing spurs, and others a peculiar bladelike enlargement of the forearm. Lastly, the large, turkey-like South American screamers (q.v.) have two wing spurs, the larger of which is an inch and a quarter long. Consult F. A. Lucas, "Weapons of Birds," in *Bird Lore*, vol. iv (New York, 1902). For illustration of Egyptian Spur-winged Plover, see Plate of PLOVERS.



ANATOMY OF WING SPURS.

a, spur of the spur-winged plover; *b*, relative positions of the two wing spurs of the screamer (q.v.).

SPURZHEIM, spōōrts'hīm, JOHANN KASPAR (1776–1832). A German phrenologist, born near Treves. After studying medicine at Vienna he became the pupil and later the colleague of the phrenologist Franz Gall (q.v.). He lived and lectured in France and England alternately, and in 1832 went to the United States on a lecturing tour, but died suddenly in Boston. His works as translated into English include: *Education* (1821; in print, 1912); *Phrenology* (1825; rev. ed., 1911). Consult N. Capen, *Reminiscences of Dr. Spurzheim and George Combe* (q.v.) (New York, 1881). See PHRENOLOGY.

SPUTUM. See EXPECTORATION.

SPUYTEN DUYVIL (spī'ten dī'vĭl) **CREEK.** A channel connecting the Hudson with the Harlem River, at the north end of Manhattan Island (q.v.) (Map: New York City and Vicinity, E 2).

SPY (OF. *espie*, to spy). A person employed to obtain information regarding an enemy in a clandestine manner and by deception by entering the latter's territory, lines, or camp, his naval yards and other depots, and employing any possible means or methods by which to attain his ends. The status of the spy while generally recognized was not defined explicitly until formulated in "The Rules of Land Warfare," contained in the Annex to The Hague Convention, No. IV, Oct. 18, 1907, which give the international definition of the word *spy* and the regulations governing such a person as follows: "Art. 29. A person can only be considered a spy when, acting clandestinely or on false pretenses, he obtains or endeavors to obtain information in the zone of operations of a belligerent, with the intention of communicating it to the hostile party.

"Thus, soldiers not wearing a disguise who have penetrated into the zone of operations of the hostile army, for the purpose of obtaining information, are not considered spies. Similarly, the following are not considered spies: soldiers and civilians, carrying out their mission openly, intrusted with the delivery of dispatches intended either for their own army or for the enemy's army. To this class belong likewise persons sent in balloons for the purpose of carrying dispatches, and, generally, of maintaining communications between the different parts of an army or a territory."

"Art. 30. A spy taken in the act shall not be punished without previous trial."

"Art. 31. A spy who, after rejoining the army to which he belongs, is subsequently captured by the enemy, is treated as a prisoner of war, and incurs no responsibility for his previous acts of espionage."

Spies, war traitors, and war rebels are not exchanged according to the common law of war. The spy is punishable with death, whether or not he succeed in obtaining the information or in conveying it to the enemy. The condition that determines the offense is dissimulation; there must be a violation of good faith. Consult Edmonds and Oppenheim, *Land Warfare* (London, 1912); *Rules of Land Warfare, United States Army, 1914*. See INTERNATIONAL LAW, *Land Warfare*.

SPY, spē. One of the most important archæological sites in Europe. See MAN, SCIENCE OF.

SPY, THE. A novel by James Fenimore Cooper (1821), giving the story of Harvey Birch, a spy employed by Washington in 1780 in Westchester Co., N. Y.

SPY SLANGE. See NAJA.

SPY WEDNESDAY. See HOLY WEEK.

SQUADRON (from It. *squadra*, squad). The basis of all European cavalry organization is the squadron, usually commanded by a captain, sometimes by a major assisted by a captain. The European squadron numbers, on a war footing, from 120 to 150 sabres. Regiments contain from three to six squadrons. In the United States cavalry, the squadron, commanded by a major, is composed of four troops each commanded by a captain. At war strength the squadron consists of 15 officers and 401 enlisted men. The regiment, commanded by a colonel, consists of three squadrons (12 troops), and, at war strength, numbers 51 officers and 1236 enlisted men. Consult *Tables of Organization, U. S. Army* (Washington, 1914). See ARMY ORGANIZATION. For the application of the word in the navy, see TACTICS, NAVAL.

SQUA'LODON (Neo-Lat., from Lat. *squalus*, sort of sea fish + Gk. *ὀδούς*, *odous*, tooth). An extinct genus of whale based on fossil skulls and teeth found in Miocene and Pliocene deposits. See CETACEA; MAMMALIA, *Fossil Mammalia*.

SQUA'LORAJA (Neo-Lat., from Lat. *squalus*, sort of sea fish + *raja*, ray, skate). A fossil shark of the Lower Lias of England, ancestral to the modern chimæra (q.v.).

SQUARCIONE, skwär-chō'nā, FRANCESCO (1394–1474). An Italian painter of the early Renaissance, founder of the school of Padua. He developed under the influence of the antique and was a teacher rather than a painter. From the large number of his pupils he has been styled the "Father of Painting," and the influence of his school was dominant throughout northern Italy. His method of teaching differed from that of other masters in that he had his pupils copy antique statues rather than his own works. The chief characteristics of their art are the statuesque character of the figures and the wealth of antique ornamentation, combined, however, with a trenchant realism. It is impossible to distinguish the works ascribed to him at Padua and elsewhere from those of his pupils, only one, the "Madonna of the Lazzaro Family" (Berlin Museum), being signed.

SQUARE, in Geometry. See Parallelogram.

SQUARE, Magic. See Magic Square.

SQUARE KNOT. See Knotting and Splicing.

SQUAREMOUTH. See Chiselmouth.

SQUARE ROOT. See Involution and Evolution.

SQUARES, Method of Least. See Least Squares, Method of.

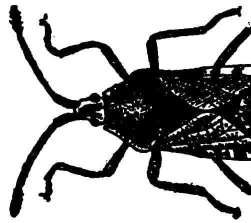
SQUARING THE CIRCLE. See Circle; Quadrature.

SQUASH (from North American Indian *askutasquash*, pl. of *asq*, green, unripe). The common name for the fruits and plants of various varieties of *Cucurbita maxima*, *Cucurbita pepo*, and *Cucurbita moschata*. The term is frequently applied in America to what are known in Europe as pumpkins. Squashes are cooked as a vegetable and also used for making pies. They are of divers forms, with early, late, and midseason varieties of each. Squashes like a warm fertile soil. They are planted about the same time as corn in hills from six feet apart each way for early varieties to 12 feet apart each way for late varieties. Bush varieties may be planted as close as four by four feet. From four to six seeds are put in each hill, which should be made rich with a few shovels of well-rotted manure placed in the bottom. The winter varieties are gathered upon the approach of frosty weather and left in the sun to cure for a while, being covered at night with hay or like material. Before cold weather sets in the fruits should be stored on shelves one deep in a dry, cool, not cold, room. For diseases and pests of the squash, see Cucumber Diseases and Melon Insects. See Plate of Cucumber Allies.

SQUASH. A ball game belonging to the family of tennis, which it is considered to have preceded in origin. It is played with a racquet and ball in an inclosed court of varying size without any affixed standard, but generally less than 40 feet by 20 feet, divided by a central line on the floor and a cross line into four spaces. The underlying principle of squash is that two players try alternately to hit the ball up against the front wall above a "tell-tale" line. Whichever first fails to do so before the ball's second bounce from the floor loses the point. There are various rules governing the placing of the ball and of scoring. Consult Eustace Miles, *The Game of Squash* (New York, 1901), and Toombs (ed.), "Court Games," in *R. Spalding's Athletic Handbooks, No. 50* (ib., 1914).

SQUASH BUG. See Squash Insects.

SQUASH INSECTS. The insect fauna of the squash and the pumpkin are practically identical; several insects which feed upon these plants also attack melons, cucumbers, etc. (See Melon Insects.) The most important in the United States are the squash bug (*Anasa tristis*) and its closely similar relative, the horned squash bug (*Anasa armigera*), the squash-vine borer (*Melittia satyriniformis*), and the squash ladybird (*Epilachna borealis*). The squash bug is a dull-grayish-brown musky-smelling bug of the family Coreidæ, a little over half an inch long, hibernating in the adult stage. Its large golden-brown eggs are laid in the spring on foliage. The young bugs grow rapidly and molt five times, and suck the plant juices. Hand-picking the bugs before eggs are laid, kerosene sprayed upon vines started early to act as decoys, and destruction of bugs on vines and fruits after the crop has been gathered, are the only feasible remedies. The squash-vine borer, a clear-winged moth of the family Sesiidæ, has an orange or red and black and bronze abdomen and hairy hind legs, red or orange on the outer surface, and black inside. Young caterpillars hatched from eggs laid on the stems in late spring bore into the stem, which wilts and dies. In midsummer they pupate in a tough cocoon beneath the ground, whence the adult emerges in spring. In the South a second generation appears in August. The best preventive measures consist in late fall harrowing and deep spring plowing. The squash ladybird, belonging to the genus *Epilachna*, which contains the only plant-feeding species of the family Coccinellidæ (see Ladybird), is a black-spotted, yellow, hemispherical species of wide distribution. The adult beetles hibernate and lay their eggs upon the leaves in May or June. The yellow, spiny larvæ chew circular holes in the leaves, reach full growth in from two to four weeks, and transform to pupæ, attaching themselves by the tip of the body to a leaf or stem. There are two or more generations each year; the insect is readily controlled by an arsenical spray.



COMMON SQUASH BUG (*Anasa tristis*).

The pickle worm, melon caterpillar, certain plant bugs, and flea beetles (qq.v.) are also troublesome. Consult: G. B. Smith, *Manual of Economic Entomology* (Philadelphia, 1896); Chittenden, in *Department of Agriculture, Division of Entomology, Bulletin 19* (Washington, 1899).

SQUATTER SOVEREIGNTY. See Popular Sovereignty.

SQUAWFISH. A fresh-water fish (*Ptyochelus oregonensis*) of California, where it is locally known as Sacramento pike. It is the largest American species of the carp family (see Cyprinidæ) and reaches a length of from 3 to 5 feet. Another local name is Chappaul. See Plate of Dace and Minnows.

SQUAW VINE. See Partridge Berry.

SQUAXON. See Salishan Stock.

SQUEAKER. See Ground Beetle.

SQUEERS, Wackford. In Dickens's *Nicholas Nickleby*, the heartless, ignorant Yorkshire schoolmaster of Dotheboys Hall.

SQUETEAGUE, skwē-tēg′, or Deep-Water Trout. A fish (*Cynoscion regalis*) latterly far more widely known as weakfish (q.v.).

SQUID (of uncertain etymology). A cephalopod mollusk, differing from the nautilus in having no outer shell, the body being supported by an inner, pen-shaped, horny structure, or, in the cuttle of the Mediterranean, by a calcareous bone, flattened oval in shape. The body of the squid is somewhat fishlike, pointed behind, with two fins, while the head is large and armed with ten long arms, bearing cup-shaped suckers, two of the arms being longer than the others. The eyes are large and perfect. The mouth is armed with two powerful black teeth, shaped like the jaws of a parrot. At the base of the smaller jaw is the lingual ribbon (radula). With this they divide their food. The squid is provided with an ink sac, and when attacked it will discharge the water in its mantle through its siphon, the ink passing out with the water as if from a syringe; thus the water is colored, and under cover of the inky cloud the squid darts backward. Squids are active and powerful; they will enter a school of fish, dart to the right or left, seize a fish, biting it in the nape of the neck, and kill it instantly. The body is beautifully tinted and spotted with many colors, and the animal rapidly changes hue, this being due to the contraction and dilatation of the pigment cells or chromatophores. (See Metachrosis.) Flying squids (see Squid) are oceanic decapods of the genus *Ommastrephes*.

Ordinary squids are from 1 to 2 feet in length. The largest squid known is *Architeuthis princeps*, nearly 19 feet long in body; the longer arms measure about 29 feet, the entire animal, with extended arms, reaching a length of 40 feet. Another species (*Architeuthis monachus*) has a body about 7 feet long, with the two longer arms 24 feet in length. (For fossil squids, see Belemnites.) Consult Verrill, "The Cephalopods of the Northeastern Coast of America," in *Transactions of the Connecticut Academy*, vol. v (New Haven, 1879-80). Compare Cephalopoda and Decapoda.

SQUIER, skwīr, Ephraim George (1821-88). An American archæologist and traveler, born at Bethlehem, N. Y. After varied experience he became known to science through his study of the antiquities of the Mississippi valley. In 1849 he went on a diplomatic mission to Central America, which he revisited in 1853 in the interest of an interoceanic railway and of archæology. In 1863 he was appointed United States Commissioner to Peru, where he investigated Inca remains. He was first president of the Anthropological Institute (1871). He published: *Serpent Symbols* (1852); *Nicaragua: its People, Scenery, and Monuments* (1852); *The States of Central America* (1857 and 1870); *Tropical Fibres and their Economic Extraction* (1861); and *Peru: Incidents and Explorations in the Land of the Incas* (1877).

SQUILL (Lat. *squilla*, squill), *Scilla*. A genus of bulbous-rooted plants of the family Liliaceæ, with a spreading perianth, a three-parted ovary, and a three-cornered capsule with three many-seeded cells. Many of the species are plants of humble growth, with scapes like those of hyacinths and beautiful flowers. The American species formerly classed in this genus are now referred to *Quamasia*. The squill used in medicine as an expectorant, diuretic and emetic is prepared from the bulbs of *Urginea scilla*.

SQUILLA. A mantis shrimp (q.v.).

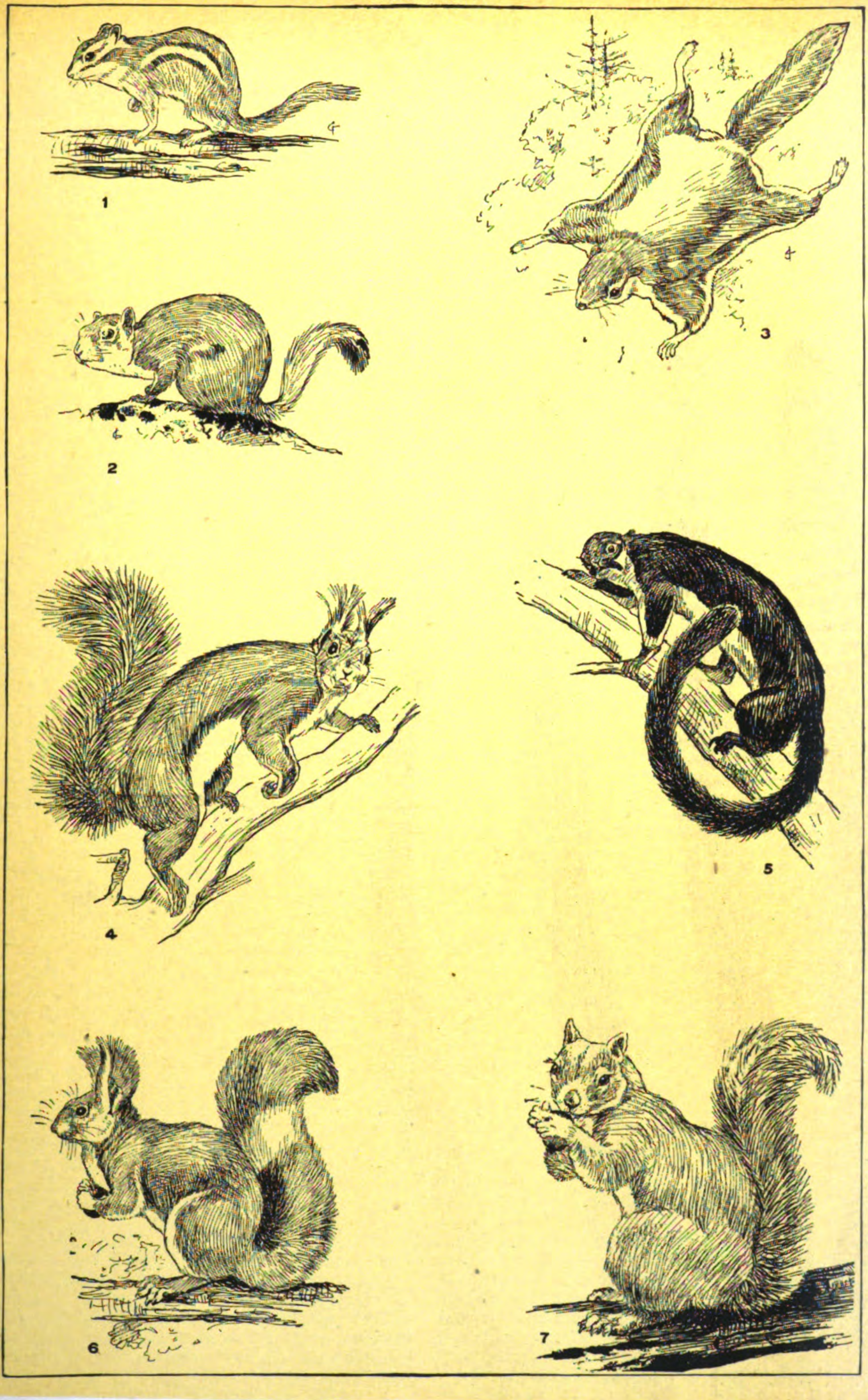
SQUINT. See Strabismus.

SQUIRREL (Gk. *σκίουρος*, *σκιά*, *skia*, shadow + *οὐρά*, *oura*, tail). A rodent mammal of the family Sciuridæ, subfamily Sciurinæ. The Sciurinæ are a group of seven genera with compressed incisors, rather slender bodies, and long, hairy tails. The number of species is still a matter of doubt, owing to the remarkable range of color variation among the individuals. Squirrels are found in all parts of the world except Australia, and are most abundant in India and southern Asia. They range from the size of a mouse to that of a cat. In color squirrels tend towards gray, reddish brown, or black, though many species are white underneath, and the Oriental species are often handsomely variegated. The pelages differ locally in texture, being affected apparently by the climate. Some of the northern species have a fine, dense fur, and their skins have considerable commercial value, while some of the tropical species have the hair scanty and rather stiff, and in one genus spines are present comparable to those of a porcupine. The genus *Sciurus* includes nearly three-fourths of all known squirrels, and all but five of the American species.

The commonest and most widely distributed of these is the red squirrel or chickaree (*Sciurus hudsonius*), which ranges from the northern and the mountainous parts of the United States to the limit of trees in British America. It is a small species only eight inches long, not including the tail. Its upper surface is bright ferruginous or chestnut red; the lower surface is pure white, and there is a black stripe along the sides. The ears are commonly tipped with a little tuft of hairs. In its habits the chickaree is a typical squirrel, very active, almost exclusively arboreal, and very fond of nuts, which are one of the most important items in its bill of fare. The diet is, however, diversified, as is true of most squirrels, for while nuts and grains are doubtless the staple articles, birds and their eggs and young, insects, young twigs, and fruit are often eaten. Many ornithologists, indeed, consider this squirrel one of the most deadly enemies of the common song birds, and this enmity is frequently expressed by the birds themselves. The home of the chickaree is usually in some hollow tree, though frequently a special nest is constructed out of branches, twigs, and leaves. The young are born in the spring, three or four in a litter. The chickaree is a rather noisy little animal, and, though not gregarious, several are usually found within calling distance of each other. The sounds uttered are rapidly repeated notes, making a shrill, scolding chatter.

East of the great plains and south of the chickaree's range occur the fox squirrels, the largest and handsomest of the American Sciuridæ. They are a foot or more in length, besides the beautiful bushy tail, which is somewhat longer than the head and body. The color ranges from gray with a reddish tinge to jet black. The largest form is the black squirrel (*Sciurus niger*) of the South Atlantic and Gulf States, which is usually very dark colored, but always has the nose and ears white. The fox squirrel of the Middle States (*Sciurus cinereus*) is usually reddish, with the tips of the hairs whitish, giving it a grizzled appearance, but black specimens are common. The fox squirrel of the Mississippi valley (*Sciurus ludovicianus*) is more strongly and constantly reddish and is rarely, if ever, black. These large squirrels all agree in their habits, which are not essentially different from those of the chickaree, except that fox squirrels seem to do less harm to the birds.

SQUIRRELS



1. GROUND SQUIRREL: CHIPMUNK (*Tamias striatus*).
2. RED SQUIRREL (*Sciurus Hudsonius*).
3. FLYING SQUIRREL (*Sciuropterus volans*).
4. NEW MEXICAN SQUIRREL (*Otoxiurus Aberti*).
5. BLACK-MUSTACHED EAST INDIAN SQUIRREL.
6. COMMON EUROPEAN SQUIRREL (*Sciurus vulgaris*).
7. AMERICAN GRAY SQUIRREL (*Sciurus Carolinensis*).

They are intelligent and in captivity make interesting pets. They have a considerable antipathy to the chickaree.

The gray squirrels are a third group of common American species, somewhat smaller than the fox squirrels and more widely distributed, ranging as far west as California. They have a considerable tendency towards melanism in certain regions. They are white or whitish underneath. The common Eastern species (*Sciurus carolinensis*) is about 10 inches long, besides the somewhat longer tail. It is one of the popular game animals of New England, where the fox squirrel is very rare, and not only is it prized for food, but the skin has some commercial value. It is also often kept as a pet, and, like the fox squirrel, can be taught simple tricks. Two or three other species of gray squirrel occur in the southwestern United States and California, of which the chestnut-backed gray squirrel (*Sciurus aberti*) is notable for having the ears tufted as in the chickaree. This is a very handsome species, with a broad band of chestnut on the back and a black stripe on each side; melanistic specimens are common. The California gray squirrel (*Sciurus fossor*) is remarkable for its large size and black tail.

Of the remaining sixty or seventy members of the genus *Sciurus* the most important is the common squirrel of Europe (*Sciurus vulgaris*), which ranges from Ireland to Japan and from northern Italy to Lapland. It is a little larger than the chickaree, and, like that species, it is brownish red above and white beneath. In winter it undergoes some change of pelage, becoming gray or even almost white. The ears are tufted with little pencils of hair. A handsome Oriental squirrel (*Sciurus caniceps*) is remarkable as the only known instance among mammals of the temporary assumption during the breeding season of a distinctly ornamental pelage. During most of the year this squirrel is gray, but in December the black becomes a beautiful orange yellow, which becomes gray again late in March, after the breeding season is over. Of the remaining genera one contains only a single species, a large and very handsome Bornean species (*Phithrosciurus macrotis*), which is very remarkable for certain peculiarities of the skull and particularly for the vertical grooves on the front surface of the incisors. The tail is also unusually long, the ears have long tufts, and the coloration is peculiar, the sides being banded with black and white. The genus *Xerus* includes four species known as "spiny squirrels," on account of the pelage, which is coarse and prickly, the hairs being intermingled with spines. They are ground-loving species, and live in burrows which they themselves dig. They are somewhat larger than the chickaree and are all natives of Africa. The genus *Tamias* includes the small ground squirrels, chiefly American, which connect the tree squirrels with the spermophiles. They are all similar in size and habits to the common chipmunk (q.v.). The remaining genera, mainly Old World species, are remarkable for their powers of sailing from one tree to another. They are described in the article Flying Squirrel.

Consult: Coues and Allen, *Monograph of North American Rodentia* (Washington, 1877); E. T. Seton, *Life Histories of Northern Animals* (New York, 1909); Stone and Cram, *American Animals* (new ed., ib., 1914); W. T. Hornaday, *The American Natural History* (ib., 1915).

SQUIRREL CORN. See Dicentra.

SQUIRREL FISH (so called from the sound made by the fish when taken from the water, which resembles the bark of a squirrel). Any of several brilliantly colored tropical fishes. One group is the family Holocentridæ, allied to the mullets, many species of which abound about coral reefs and are numerous in American tropical waters. The best-known species (*Holocentrus ascensionis*) is about two feet long and bright red, with shining streaks along the rows of scales. Another group is the genus *Diplectrum* of the sea-bass family, among which one very handsome species (*Diplectrum formosum*) is common from Charleston to Montevideo, and is also called sewano and sandfish. It is about a foot long, brownish, with blue markings.

SQUIRREL MONKEY. One of the names applied to certain small, active, bushy-tailed tropical American monkeys of the marmoset group, and especially of the golden-haired genus formerly called *Chrysothrix*, because of their squirrel-like size, manners, and appearance. A well-known species is one of the titis (*Chrysothrix* or *Saimiri sciureus*), whose crown, muzzle, and rings about the eyes are black, giving a likeness to a human skull, so that it is known as the death's-head squirrel monkey.

SQUIRTING FUNGUS. See Mucoraceæ; Pilobolus.

ŚRĀDDHA, shrăd′hȧ (Skt., faith, related to Lat. *credere*, to believe). The funeral ceremony of the Hindus, in which offerings of water are made to deceased ancestors or to the pitris (q.v.) collectively. This ceremony was usually accompanied by the offering of the *piṇḍa* or ball of meal. The *śrāddha* is especially performed for a parent recently deceased, or for three paternal ancestors, and secures the residence of the souls of the dead in the heaven of the pitris at the end of a year. This term is also applied to the daily offerings to the manes in general, and to other domestic offerings, as at the birth of a son. In case of the offering to the deceased, the performance of the sacrifice devolved upon the nearest male relative, unless the patrimony was divided contrary to the parent's wishes, when this right was sometimes lost. The śrāddha is still offered in certain parts of India, as at Gaya in Behar. The entire ceremony is based on the fear of malignant ghosts, since the dead man might return to seek revenge for any neglect shown him. See Ghosts. Consult: *Altindischer Ahnenkult* (Leyden, 1893); Hillebrandt, *Ritual-Litteratur* (ib., 1897); E. W. Hopkins, *Religions of India* (Boston, 1895); L. D. Barnett, *Antiquities of India* (London, 1913).

ṠRĀVAKA, shrā′vȧ-kȧ (Skt., Pali *sāvaka*, disciple, from *śru*, to hear). Originally any true disciple of Buddha. The term was later applied to those who were on the fourfold road to Nirvana (q.v.). The four classes of śrāvakas are usually the *śrōtāpannas* (Pali *sōtāpanna*), neophytes or converts; the *sakaṛāgāminas* (Pali *sakadāgāmin*), who are so purified that they need be reborn on earth only once; the *anāgāminas* (Pali *anāgāmin*), who will be reborn in heaven; and the arhats (Pali *arahā*), perfected saints. The general name among the Northern Buddhists for the Southern sect is śrāvakas. See Buddhism; Jainism.

SRĪ-HARSHA-DEVA, srē-här′shȧ-dā′vȧ. See Harsha.

SRINAGAR, srē'nȧ-gŭr', or **SERINAGUR**, se-rē'nȧ-gŭr'. The capital of the native State of Kashmir, India, on the Jhelam River, 195 miles by rail northeast of Rawal Pindi (Map: India, C 1). It is in the Vale of Kashmir, a region noted for its picturesque lakes, lofty mountain peaks, and interesting ruins. The Jhelam River flows through the city, and canals extend in all directions. Within the wall-girt citadel are the city fort and a summer residence of the Maharaja. Dal Lake, a beautiful sheet of water on the east of the city, was formerly a favorite resort of the Mogul rulers. Srinagar is surrounded by a rich agricultural section, and manufactures paper, papier maché, silver and copper ware, and leather. The city was founded in the sixth century, and came under British protection in 1846. Pop., 1901, 122,618; 1911, 126,344.

SRIRANGAM, srē-rŭng'ăm, or **SERINGHAM**, sē-rĭng'hăm. A town in the Province of Madras, India, two miles north of Trichinopoli, on an island of the same name in the Kaveri River. It is connected with the mainland by a bridge of 32 arches and is noted for its temple to Vishnu. (See INDIAN ART.) The temple of Jambukeshwar, about a mile distant, and the neighboring anikuts or dams of the Kaveri River are noteworthy. Pop., 1901, 23,039; 1911, 24,973.

SRIRANGAPATAM, srē-rŭng'ȧ-pȧ-tăm'. A town of Mysore, India. See SERINGAPATAM.

ŚRUTI, shrōō'tē (Skt., hearing). In Sanskrit literature, the technical term for works which are regarded as divine revelation. It originally applied only to the texts of the Vedas (q.v.) and to the Brahamanas (see BRAHMANA), but later it included also the Upanishads (q.v.). The term *śruti* is therefore contrasted with *smṛti* (see SMRITI), or tradition. Consult A. A. Macdonell, *History of Sanscrit Literature* (London, 1913).

SS, COLLAR OF. A collar composed of a series of the letter S, either linked together or set in close order, on a blue and white ribbon, with the ends connected by two buckles and a trefoil-shaped link, from which hangs a jewel. Such collars have been much worn in England by persons holding great offices in the state, as well as by gentlemen of various ranks. The origin of the device is not known. Among conjectures regarding its meaning, one is that the letter S stands for "Souveraigne," the favorite motto of Henry IV; others have suggested "Seneschal." Collars of SS are still worn with certain recognized distinctions by the Lords Chief Justices, the Lord Chief Baron of the Exchequer, the Lord Mayor of London, heralds, and the sergeant at arms.

SSU-MA KUANG AND TS'IEN. See SZE-MA KWANG AND TS'IEN.

STAAL, stäl, MARGUERITE JEANNE [CORDIER] DELAUNAY, BARONESS DE (1684–1750). A French writer of memoirs and letters of much historic value, born in Paris. Her father was an artist. Having studied in a convent at Rouen, she became maid to the Duchess of Maine (1711), took part in Cellamare's plot to deprive the Duke of Orléans of the regency, and was imprisoned (1718–20) in the Bastille. She attained prominence in court circles and finally a leading rôle in Paris society. She afterward married (1735) Baron de Staal, captain in the guard of the Duke of Maine. She spent the rest of her life at the ducal court at Sceaux and died in Paris. Consult her letters and two comedies in her *Œuvres* (Paris, 1821); *Mémoires*, edited by Adolphe de Lescure (2 vols., Paris, 1877; Eng. trans. by S. Bathurst, London, 1877), remarkable for keen observation, sincerity, and irony, and for their style; also C. A. Sainte-Beuve, *Portraits littéraires*, vol. iii (2d ed., Paris, 1864).

STA'BAT MA'TER. A famous mediæval hymn, describing the sufferings of the Virgin Mary as she stood by the cross of Jesus. It is generally spoken of by the above name, from the first words:

Stabat mater dolorosa
Juxta crucem lacrymosa,
Dum pendebat Filius.

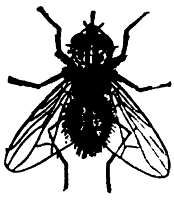
It was formerly attributed to various authors, including Pope Innocent III, St. Bonaventura, and St. Bernard; but it is now generally ascribed to Jacopone da Todi (q.v.).

STABIÆ, stā'byȧ. See CASTELLAMARE DI STABIA.

STABILI, stä'bē-lē, FRANCESCO DEGLI. See CECCO D'ASCOLI.

STABIL'ITY (from Lat. *stare*, to stand). The property of a body by virtue of which it tends to return to a position of equilibrium if it receives an impulse acting to displace it from this position. In the case of a body in equilibrium under the action of gravity, this is therefore stable if work must be done to alter the position of its centre of gravity. Thus a pendulum would be said to be in stable equilibrium, as also would be a well-ballasted ship. To satisfy this condition the centre of gravity must occupy such a position that when it is displaced it is raised with respect to its original position. If under the action of a force the centre of gravity is moved to a lower position the body is said to be in unstable equilibrium. Stability of floating bodies is an important consideration in shipbuilding (q.v.). See BUOYANCY; EQUILIBRIUM; HYDROSTATICS; MECHANICS; METACENTRE.

STABLE FLY. A biting fly (*Stomoxys calcitrans*) of the family Muscidæ, probably introduced into the United States from Europe long ago. It resembles the common house fly so closely as to deceive most untrained observers. It frequents dwellings late in autumn only, and on the approach of rain; this gives rise to the common expression that flies begin to bite before a rain. The larvæ feed in fresh horse manure, and the flies live chiefly on the blood of vertebrates, frequently causing annoyance to horses and cattle and biting human beings. The stable fly has been indicted on the ground that it carries the germs which cause infantile paralysis. Another cosmopolitan muscid fly (*Muscina stabulans*) is sometimes known as stable fly.



STABLE FLY.

STACCATO, stȧ-kä'tō (It., detached). In music, a term implying a detached, abrupt mode of performance. A certain amount of time is subtracted from the proper value of any note played staccato, and a slight rest substituted. A dot placed over a note indicates that it is to be played staccato. A dash implies a greater degree of staccato; a very light degree of staccato is expressed by uniting the dot with the slur.

STACHAU, HANS KARL GEORG VON KALTENBORN-. See KALTENBORN-STACHAU, H. K. G. VON.

STACHYS, stā'kis (Lat., from Gk. στάχυς, ear of corn, spike). A genus of plants of the family Labiatæ, containing numerous species widely distributed in temperate and tropical climates except Australia and New Zealand. *Stachys sylvatica*, hedge nettle, common in Europe in shady places, is a coarse herb 2 to 3 feet tall with ovate, heart-shaped leaves on long stalks and whorls of purple malodorous flowers. *Stachys palustris*, common to moist places in Europe, Asia, and North America, proves troublesome in meadows. It was formerly used as a vulnerary, hence the name "woundwort." Several species are cultivated. To this genus some botanists refer the common betony or wood betony (*Stachys betonica*), plentiful in woods and thickets in Europe. It is a hairy-stemmed plant one or two feet high, has oblong heart-shaped leaves, whorls of purple or white flowers, and a fetid smell. A Japanese species (*Stachys sieboldi*, often called *Stachys tuberifera*) has small edible tubers an inch or two long, used as a vegetable in China and Japan; in the latter country they are known as chorogi, under which name they have been introduced into America. There are a dozen or more species introduced or native to the United States.

STADE, shtä′de. A town in the Province of Hanover, Prussia, on the Schwinge, an affluent of the Elbe, about 4 miles from its mouth (Map: Germany, C 2). It manufactures machinery, ships, trimmed lumber, salt, bricks, wine, and cigars. Stade became a city as early as the tenth century. Pop., 1900, 10,575; 1910, 11,078.

STADE, Bernhard (1848–1906). A German theologian, born at Arnstadt and educated at Leipzig and Berlin. In 1875 he was appointed professor of theology at Giessen. He wrote *De Isaiæ Vaticiniis Æthiopicis Diatribe* (1873), *Ueber die alttestamentlichen Vorstellungen vom Zustand nach dem Tode* (1877), *Lehrbuch der hebräischen Grammatik* (1879), and *Geschichte des Volkes Israel* (vol. i, 1881–84; vol. ii, with O. Holtzmann, 1888). In collaboration with Karl Siegfried (q.v.) he published (1893) a *Hebräisches Wörterbuch zum alten Testament*. In 1871 he became the editor of the *Zeitschrift für alttestamentliche Wissenschaft*.

STA′DIA (Lat. *stadium*, standard of length, furlong). An attachment fitted to the telescope of a transit and used in surveying to measure distances. Stadia surveying is a modification of transit surveying, and is effected by the use of the stadia or gradienter attachment. The telescope of the ordinary transit (see Surveying Instruments) contains a vertical and a horizontal wire dividing the field of vision into four quadrants; but the stadia telescope contains extra horizontal wires mounted on an independent diaphragm, so that the distances between the respective wires are adjustable. The principle of its operation is simple. If the space between two auxiliary wires, one on each side of the horizontal wire of the telescope, is so adjusted as to subtend 1 foot on a rod 100 feet away, the space will subtend 2 feet on a rod at 200 feet, and so on. Thus by proper adjustment approximate distances to near-by points can be calculated by reading the rod. If from any point in a field the corners are all visible and the stadia instrument is set at this point, the distance to each corner can at once be read and also the angles between these lines. Thus with two sides and the included angle of each triangle, areas of the different parts and that of the whole field can be calculated. This plan is known as the method of radiation. The gradienter attachment is a micrometer screw which takes the place of the tangent screw to the axis of the telescope. A mounted scale registers the number of turns of a micrometer screw. The value of the thread is usually such that one revolution of the screw moves the horizontal wire of the telescope over a space of 1 foot on a rod at the distance of 100 feet. If the micrometer screw is divided into 100 spaces it is clear that when the screw is turned through 25, 50, or 75 spaces, or ¼, ½, or ¾ of a space on the scale, the wire of the telescope will pass over ¼, ½, or ¾ of a foot on the rod, etc. See Surveying.

STADIM′ETER (from Gk. *στάδιον*, *stadion*, standard of length + *μέτρον*, *metron*, measure). A nautical instrument invented by Lieutenant (later Admiral) Bradley A. Fiske, United States navy, and designed for measuring the distance of objects when their height is known. It is somewhat similar to the sextant, but its readings are in yards instead of angular measure. See Range Finder.

STA′DIUM (Lat., from Gk. *στάδιον*, *stadion*, standard of length, furlong). The name for the Greek race course, for foot races, within which also other athletic contests took place. It was used only for contests, not apparently as a place for exercise. The spectators stood or sat on high banks of earth at the sides and across the ends. In some cases one end was curved like a horseshoe, and at times one end was open. At Olympia (q.v.) there seem to have been no permanent seats at the sides, but we hear that at Athens Herodes Atticus (see Atticus Herodes, 2) fitted the stadium with Pentelic marble seats. The floor of the stadium was sand or loose earth. The course was straight away, and at each end was usually a long strip of marble serving to mark the start and the finish. The length of the course was always 600 Greek feet, but as the foot varied in different localities the stadium was not of uniform length. (See Ex Pede Herculem.) At Athens the standard foot seems to have been 0.2957 meter, like the Roman foot, and the stadium was 177.42 meters. This seems to be the length of the stadium used commonly as a measure of distance, of which 8⅓ made a Roman mile, and a little more than 9 an English mile. The antique stadium, modified by features derived from the Roman circus, has been revived in modern times as a place for athletic contests. That at Athens, built for the first revival of Olympic sports in 1896, is said to accommodate 80,000 spectators. Other open-air edifices for a like purpose have been built for various colleges and universities in the United States and for international exhibitions, and called "stadia," but the term is in most cases not strictly correct, as many are elliptical amphitheatres, some are open on one side, and none conforms to the classic measure of the *stadion*. Consult: Friedrich Hultsch, *Griechische und römische Metrologie* (2d ed., Berlin, 1882); Dörpfeld, in Deutsches Archäologisches Institut, *Mittheilungen: Athenische Abtheilung* (Athens, 1882); E. N. Gardiner, *Greek Athletic Sports and Festivals* (London, 1910).

STADHOLDER, stăt′hōl′dẽr (Dutch *stadthouder*, stead holder). The title bestowed on William of Orange (q.v.) by the Dutch provinces which rose in revolt against the tyranny of Alva in the sixteenth century. (See Netherlands.) On the assassination of William in 1584 his son Maurice of Nassau was appointed to the office. The stadholderate was considered to be at an end on the death of William III in 1702, but in 1747 William IV, descended from a collateral branch of the house of Nassau, was proclaimed stadholder, captain general, and admiral in chief of the United Provinces. His son, William V, the seventh stadholder, was driven from the country by the French in 1795 and resigned his office in 1802.

STAËL-HOLSTEIN, stä′ĕl hôl′stīn, *Fr. pron.* stäl ôl′stăN′, ANNE LOUISE GERMAINE, BARONNE DE, commonly called MADAME DE STAËL (1766–1817). A French authoress, born in Paris, April 22, 1766. She was the daughter of the Genevese banker and distinguished French Minister of Finance, Jacques Necker (q.v.), and of his wife, Suzanne Churchod, Gibbon's youthful beloved. She passed her childhood in one of the most brilliant literary salons of Paris, where her active mind was stimulated by association with the wits and critics of the pre-Revolutionary decade, chief among them F. M. Grimm, Thomas, Marmontel, and Raynal. In this vortex of disintegrating ideas she assimilated the intellectual spirit of that age. She married in 1786 the Swedish Minister, Baron de Staël-Holstein, by whom she had three children. She was independent, positive, self-assertive, and rather vain, writing much, but publishing nothing until the appearance of her *Lettres sur Jean Jacques Rousseau* (1788), whose social ideas she admired. She had fallen also under the spell of Goethe's *Werther*, and thus sympathized with the Revolution till the King's imprisonment caused a revulsion to an equally indiscreet incivism. She abused her ambassadorial right of asylum, and, fearing the consequences, left Paris before the massacres of September, 1792, going to Coppet, near Geneva, where she gathered some political sympathizers. In 1793 she tried to make herself the centre of a more important group in England, not without some personal scandal. For nine years (1794–1803) she played at politics in Paris, with brief visits to Coppet. She was amicably separated from Baron de Staël in 1788, and irritated Napoleon by her epigrams till the consular police banished her from Paris (1803). She went to Germany, and in her unwearying search for noted people to talk to she came in the winter of 1803–04 to Weimar. Goethe, at first excusing himself on the score of ill health, saw her, and later in his *Annalen* spoke of "her brilliant way of showing her readiness of thought and repartee." Schiller found her "with little ideality or poetry and no feminine reserve." The Romanticists were more attracted, and A. W. Schlegel (q.v.) became her companion and counselor. Thus the German ideas that she introduced into France were seen through Schlegel's eyes, far from impartially, as is constantly obvious in her *De l'Allemagne*, written in 1809–10 and printed in England in 1813. Before her exile Madame de Staël had written three essays, *De l'influence des passions* (1796); *De la littérature considérée dans ses rapports avec les institutions sociales* (1800), and *Des circonstances actuelles qui peuvent terminer la révolution et des principes qui doivent fonder la république en France*, written in 1799, but not printed until 1806. Her literary power was first revealed in the novel *Delphine* (1802), a half autobiography of the "misunderstood woman," to be exploited later by George Sand. Much finer is a second story, *Corinne* (1807), wherewith she made the novel carry artistic discussion, as Goethe and Richter had done in Germany.

In 1810 she published her *De l'Allemagne* in Paris, but Napoleon condemned the entire edition and expelled her from France. She retired to Coppet, and in 1811 married secretly a young officer, De Rocca, over twenty years her junior. In that year she traveled in Russia, Sweden, and England, and after Napoleon's fall returned to France, though spending some time abroad, for her health was failing, as her last book, *Considérations sur la révolution française* (1818), witnesses. Of her three children by her first husband, Auguste (1790–1827) became known as the author of *Lettres sur l'Angleterre;* Albertine (died 1838) married the Duke Archille de Broglie, and Albert became a Swedish officer and fell in a duel. By her second husband (Rocca) she had one child.

In person Madame de Staël was not attractive. In conversation she often repelled. If one considers only language and style she was not a great writer, but she had great enthusiasms, faith in human progress and in democracy. Studiously cosmopolitan, she compelled France to contrast and compare her ideals of letters and art with those of Germany and England. Thus the French Romantic movement, one of the greatest literary regenerations in history, is in large measure the work of Madame de Staël.

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STAFF (AS. *stæf*, staff). In military and naval usage, the aids or assistants of a commanding officer. The staff of an army comprises the assistants of the general in chief and of his generals, and their duties are to relieve the chief of the details to which he cannot personally attend.

In the United States this body is divided into the military staff and the administrative staff. The former is charged with the more purely military duties, and comprises the chiefs of staff (the assistants and executive officers of the generals in the office and in the field), the adjutants general (who attend to the correspondence, orders, etc.), the inspectors general (who are charged with the inspection of the troops), the chief of artillery (the assistant and adviser in all matters relating to the artillery and responsible for the artillery material and personnel), the chief of cavalry, the chief of engineers, the chief signal officer (responsible for the military telegraph, signal stations, balloons, and aëroplanes), the provost marshal general (who has charge of the police, prisoners, deserters, secret service, and post office), and the aids-de-camp (attached more directly to the person of a general, assisting him by carrying orders, studying and reporting on portions of the field, and attending to a part of the correspondence). The administrative staff is charged with the service of administration and supply and comprises the judge advocate (who supervises the proceedings of military courts and boards), the chief mustering officer (who supervises the muster and pay rolls, and makes musters into and out of the service), the chief ordnance officers (who are charged with the supply of ordnance material), the chief quartermasters (providing transportation, forage, clothing, camp and garrison equipage and commissary stores, and who pay the troops), and the medical directors and their respective assistants.

The foregoing relates especially to a state of war. In peace the staff service is represented at Washington by various officers, such as the adjutant general, the quartermaster-general, the inspector general, etc., representatives of whose departments and corps are attached to the various great headquarters both in the United States and abroad, such as the Eastern Department and the Philippine Department. In time of peace there is no provost marshal general, nor is there as yet a chief of cavalry.

General Staff Corps. Since the passing of the General Staff Bill, which was approved on Feb. 14, 1903, and which entered into legal effect August 15 of the same year, a general staff organization has been instituted as follows: The general staff corps establishment consists of officers detailed from the army at large under such rules as may be prescribed by the President. The duties of the general staff corps are to prepare plans for national defense and mobilization of troops in time of war; to investigate and report on questions relating to the efficiency of the army and its preparation for war; to aid and assist the Secretary of War or other general officers and commanders, and to act as their agents in informing and coördinating other officers who are subject to the supervision of the chief of the staff; and to perform such other military duties as may be prescribed by the President.

The general staff corps consists of two general officers, one of whom shall be the chief of staff, four colonels, six lieutenant colonels, and 12 majors from corresponding grades, 12 captains from grades of captain and first lieutenant. The chief of coast artillery and the chief of the division of militia affairs are additional members of the general staff corps. Time of detail four years, unless otherwise relieved. When relieved these officers return to their former branch of the army, and are not eligible for service in the general staff corps until they have served two years in that branch of the army in which they hold their commission, except in case of war or emergency.

The chief of staff supervises all troops of the line, and the adjutant general's, inspector general's, judge advocate's, quartermaster's, medical and ordnance departments, corps of engineers and signal corps, and performs such other military duties as may be assigned by the President. All duties previously prescribed by statute for the commanding general, as member of the Board of Ordnance and Fortification and of the Board of Commissioners or of the Soldiers' Home, are performed by the chief of staff or other officers designated by the President. Acts or sections of acts authorizing aids-de-camp and military secretaries do not apply to officers of the general staff corps.

In Great Britain the army is administered primarily by the Army Council, composed of the Secretary of State for War, the chief of the Imperial general staff, the adjutant general to the forces, the quartermaster-general to the forces, and the master general of the ordnance, with three secretaries, the civil and the finance members, who are civilians, and the secretary proper. Each of these members is, in turn, the head of a department; the officers assisting the chief of the general staff are denominated general staff officers, and are of three grades, according to rank. They are assistants respectively of the director of military operation, of the director of staff duties, and of the director of military training. The civilian members have duties chiefly administrative and are assisted mostly by civilian functionaries. The other departments are likewise divided into directorates, each with its own staff, who, however, are not called general staff officers. There are two "inspections," one for the Home, the other for the Oversea Forces. The various commands, regiments, and corps of the British army naturally have their respective staffs, on the nature of which it is not necessary to dwell. The Army of India has a headquarters staff, with general staff, adjutant general's, quartermaster-general's, medical, ordnance, and military works branches.

The staff in Germany comprises three principal classes: first, the general staff proper; second, the *Adjutantur;* third, orderly officers. The Prussian general staff is composed of: first, the great general staff, second, the general staff serving at corps and at division headquarters, and third, in fortress commands. This great general staff is charged with the preparation in peace of all questions bearing upon the conduct of war, such as armament, tactics, plans of campaign, etc. It studies possible theatres of war, estimates the worth of foreign armies, and takes note of the political situation in foreign lands. It is responsible for the proper development of military sciences in the army. In conjunction with the war ministry it has charge of the mobilization of the army and the consequent use of railroads. The chief of the general staff reports on these matters to the Emperor, and is charged with the preparation of plans for setting the army in motion, upon a declaration of war, and for the conduct of eventual operations. He is assisted by four so-called *oberquartiermeister* (general officers). The work of the great general staff is done by various sections as follows: central section, personnel, organization and administration; under the first *oberquartiermeister*, railroad section; second section; German army organization and a special railroad section; under the second, France, England, and the remainder of west Europe, America, Africa, Australia (third section); fortresses (fourth section); under the third, Russia and Scandinavia, Austria, Rumania, the

Balkans, Italy, Switzerland, Persia, China, Japan (fifth section); under the fourth, the survey and map section. The sixth section, directly under the orders of the chief, has charge of manœuvres, the War Academy, staff rides, history, archives, and library. Under the chief stand the War Academy, the railway brigade, the administration of military railways, and the military railway superintendents.

Officers of the general staff fall into two classes: the *Haupt Etat*, or military staff proper, and the *Neben Etat*, which has charge of learned or scientific matters, and does not wear the uniform of the staff. It is composed chiefly of line officers detailed. The general staff officers serving at corps and division headquarters are charged with duties relating to marches, mobilization, quarters, staff rides, manœuvres, etc., within their troop units. Those at fortress headquarters have to do with the proper equipment and defense of the fortresses.

Württemberg and Saxony have no general staff. Bavaria has its own, formed somewhat on the lines of the Prussian. As a rule, general staff officers must be graduates of the War Academies of Berlin and Munich. To the *Adjutantur* are assigned graduates of the war academies who have not gone into the general staff; but this rule is not absolute. The duties of the *Adjutantur* include the publication of orders, interior economy, reports, recruiting, in short, matters of an administrative character. Orderly officers are selected by the generals from the troops under their orders. Usually they are appointed only for campaigns or manœuvres. Only armies and army corps may have a chief of staff.

In France the general staff is not a permanent organization, but is composed of officers temporarily assigned from the line. The staff of the army is under the direction of a general officer chosen from the Supreme Council of War. This officer has the title of chief of the general staff. He is assisted by a general of division (lieutenant general) taken from the division commanders who have commanded a division for at least one year. The staff of the army comprises three groups. The first, under the orders of a general officer, is divided into three bureaus: military operations and general training; organization and tactics of foreign armies; railroads and marches. The second group, under a general of brigade (major general) or colonel, deals with: the organization and mobilization of the army; African matters; history. The third group, under a general of brigade or a colonel, deals with: the personnel of the staff service; current affairs of the staff of the army; administration. The chief of the general staff investigates personally all questions bearing on the organization of the army for war, its mobilization, and concentration; he directs military studies, and the war school. To the staff of the army is joined the so-called *comité d'état-major*, which investigates among other things all questions touching the technical staff service, referred by the Minister of War, as well as those brought up by its members during their annual inspections, and thought to be necessary to the welfare of the army. Although it forms no part of the staff properly so called, mention must nevertheless be made of the *Conseil Supérieur de la Guerre* (supreme war board), whose president is the Minister of War, and of which the chief of the general staff, the chief of staff of the army, and 10 generals of division are the members. These 10 must have commanded an army corps for at least one year. This council must of necessity be consulted upon all matters affecting the constitution of the army and its state of preparation for war. Fundamental questions are treated by the *Centre de Hautes Etudes Militaires*, at the War School, under the direction of the chief of staff of the army. Troop units in general, the artillery and engineers, the military governments of Paris and Lyons, etc., have their staffs, whose functions, military and administrative, call for no special mention here.

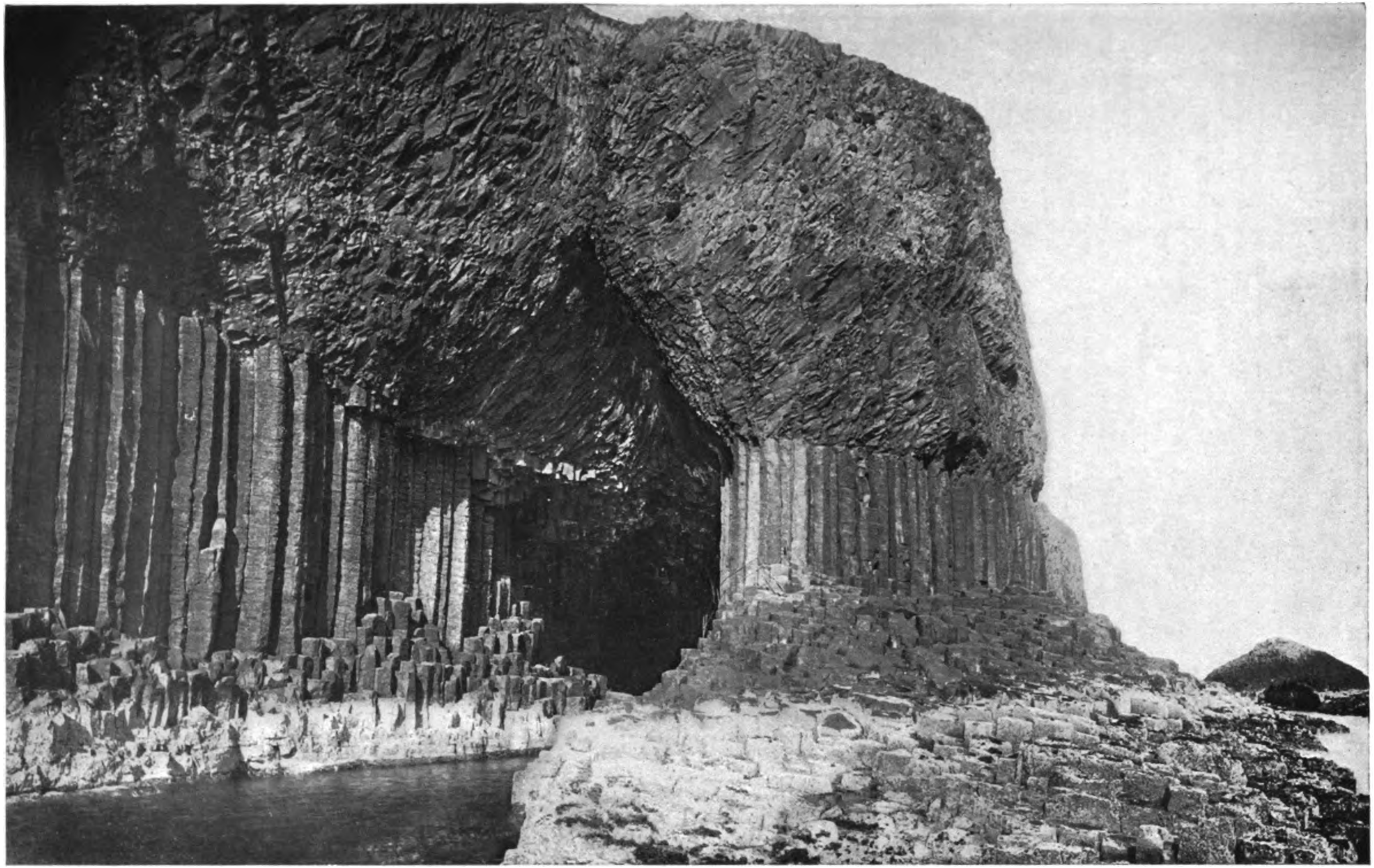
In Italy military affairs are first of all under the direction of the Supreme Defense Board, comprising admirals as well as generals and various ministers. An army council composed of ministers and officers of the very highest rank passes upon questions of interest to the army. The staff corps, whose functions are analogous to those of the great German general staff, is formed of officers who have passed the War School with credit. It has charge of organization and equipment, mobilization, concentration, railways, and in general the defensive organization of the state. The chief of staff, in addition to his duties as such, has the direction of the War School, and of the Geographic Institute. He is assisted by two generals, and a number of other officers of lower grade, including the *applicati*, who are captains of cavalry and of infantry detailed to the staff.

In Russia staff officers must be graduates of the Nikolas General Staff Academy. Topographical duties in Russia do not fall to the general staff, but belong to the military topographers. The number of officers of the staff is not fixed; various classes of officers are considered as forming part of the staff, e.g., the chief of staff of the various military districts, military attachés, the professors of the three military academies, etc. The general staff has to do principally with army organization, manœuvres, camps, fortifications, promotions, rewards, equipment, remounts, geography and topography, home and foreign transport, literature, etc.

The Austrian general staff is a closed corps, composed, as a rule, of graduates of the War School. Its functions are exceedingly broad, including military missions, education, archives, the war ministry, military history, technical committees. Its officers are charged further with the usual and normal duties of the general staff, such as service with troops, and the general subject of preparation for war. The chief is especially responsible for the railway and telegraph regiment, the War School, the archives of the War Department, and the Geographic Institute, whose duties are to map and survey.

Regimental Staff. The commissioned staff of a regimental commanding officer would consist of such officers as are not duty officers in the battalion, squadron, or regiment, as the regimental adjutant, quartermaster, commissary, etc.

The Noncommissioned Staff consists of noncommissioned officers not forming part of the company establishment proper and who have relationship only to the battalion, squadron, or regiment, as sergeant major (battalion or regimental), quartermaster sergeant (regimental), commissary sergeant (regimental), chief musician, chief trumpeters, and principal musician. In the United States army noncommissioned officers doing duty as part of the permanent establishment of an army post or fort are termed the



FINGAL'S CAVE, ISLAND OF STAFFA

post noncommissioned staff, which ordinarily consists of an ordnance sergeant, post quartermaster sergeant, electrician sergeant, etc. Throughout the armies of Europe battalion, regimental, and post (depot or fortress) staffs, commissioned or noncommissioned, include practically the same descriptions of officers. See Staff Colleges and School; Army Organization; and sections on *Army* in articles on the different countries.

The aids-de-camp of a general officer constitute his staff, together with such departmental and technical officers as may be temporarily detailed to assist the general in some specific undertaking.

Naval Staffs. In navies the scope and organization of the general staff is different; and its character, duties, and control are not even similar in any two great navies. In most of them even the word "staff" is not used in this connection. In the United States service staff officers are those who do not belong to the executive or combative branch, such as surgeons, paymasters, chaplains, etc. The centralized functions of the general staff are divided between the Naval War College (see Naval Schools of Instruction), the General Board, and the Chief of Operations, assisted by the Office of Naval Intelligence. The General Board is composed of officers of high rank, and its duties are to pass upon plans presented to the Department through the War College, the fleet, or from other sources; to prepare plans for all probable contingencies in conjunction with the Naval War College; and to advise the Secretary of the Navy upon all matters of naval policy. The Chief of Operations, the executive of all plans involving control of the fleet and allied matters, is a member of the General Board.

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STAFF, in Music. See Musical Notation, *The Stave;* Neumes.

STAFFA, stăf'fȧ. A celebrated but uninhabited Scottish islet, one of the Inner Hebrides (q.v.), 7 miles west of Mull (Map: Scotland, B 3). It rises to a height of 144 feet, is 1½ miles in circumference, and oval in shape. Except on the northeast its cliffs hollowed by caverns rise from the water 84 to 112 feet high. There are seven caves, of which the most remarkable is Fingal's or Great Cave. The entrance, formed by regular basaltic columnar ranges on each side, supporting a lofty arch, is 33 feet wide and 65 feet high. The length of the cave is 230 feet. As a fine specimen of natural architecture it is much frequented by tourists.

STAFF COLLEGES AND SCHOOLS. Military training schools for officers candidates for staff appointments. To prepare officers for duty on the staff of an army special colleges or schools have been instituted by all the leading military nations. The United States staff colleges are the War College at Washington and the Staff College at Fort Leavenworth, Kans. In England officers, to qualify for staff appointment, must have had five years' service in the army, undergo the two years' course at the Staff College at Sandhurst, and serve at least four months at Aldershot in some arm of the service other than the one to which they belong. The rule in Germany is to select officers for the general staff from among the graduates of the war academies of Berlin and Munich having the best qualifications and the highest rank. In France staff officers are educated at the Higher War School at Paris, which was first organized as a staff college at the beginning of the nineteenth century, and reorganized in 1875 as the permanent college for general staff candidates. Austria-Hungary sets apart the Kriegsschule at Vienna for instruction in staff work. The Italian general staff school is at Milan, where about 24 officers graduate each year. The Nicholas Academy at St. Petersburg is the staff school of Russia, entrance to which is competitive to all officers of three years' service and upward. See Staff.

STAFFORD. The county town of Staffordshire, England, on the Sow, 29 miles northwest of Birmingham (Map: England, D 4). Tanning and the manufacture of cutlery and of shoes are the chief branches of industry. Pop., 1901, 20,900; 1911, 23,383. Stafford was of importance before the Conquest, is mentioned in Domesday, and King John confirmed and enlarged the privileges of an old charter.

STAFFORD. A town, including the borough of Stafford Springs, in Tolland Co., Conn., 20 miles north by west of Willimantic, on the Willimantic River, and on the Central Vermont Railroad (Map: Connecticut, F 2). It is a summer resort, with mineral springs, and contains the Johnson Memorial Hospital. It manufactures woolens. There is a public library. Pop., 1900, 4297; 1910, 5233.

STAFFORD, Henry, second Duke of Buckingham (c.1454–83). An English nobleman and political intriguer, the grandson of the first duke succeeding to the title in 1460. He was a prominent adherent of the Duke of Gloucester, afterward Richard III, while the latter, then Protector, was conspiring to seize the throne, and assisted him in his efforts against Earl Rivers and Lord Grey. After their downfall he received the office of Chief Justice and constable of the royal castles in Wales, and later that of Lord High Constable of England. Afterward he joined the Lancastrians to overthrow Richard, but his projects were frustrated, and he was tried and beheaded at Salisbury in 1483.

STAFFORD, William Howard, Viscount (1614–80). An English statesman, the fifth son of Thomas, Earl of Arundel and Surrey. He was educated as a Roman Catholic. In 1634 he married a sister of the thirteenth Baron Stafford, and on the latter's death assumed the title. This marital claim was disputed, but finally decided in his favor, and a new creation was made by the King, declaring him Baron and afterward Viscount Stafford. During the Civil War he was an adherent of the King, but after the Restoration (q.v.) frequently opposed the royal will from the House of Peers. In 1678 Stafford was denounced by the infamous Titus Oates (q.v.) as a conspirator in the pretended popish plot. He was impeached for high treason, and, despite a spirited defense against suborned testimony, was found guilty and publicly executed on Tower Hill. In 1824 the Act of Attainder was reversed by Parliament.

STAF′FORDSHIRE. An inland county of England (Map: England, D 4). Area, 1128 square miles; pop., 1901, 671,490; 1911, 738,991. In the north wild moorlands in long ridges, separated by deeply cut valleys, extend from northwest to southeast. The surface is low and undulating in the midland regions, but becomes hilly again in the south. The Pottery coal field occupies the north, and the Black Country coal field, remarkable also for its abundant and rich iron ores, occupies the south, while in the centre are the extensive Cannock Chase collieries. The Black Country, lying between Birmingham and Wolverhampton, some 15 miles in length, is one of the chief iron and steel manufacturing districts in England and is practically one continuous town. The Trent, flowing first southeast through the county, then northeast along its eastern border, is the chief river. The climate is humid, much of the soil is clayey, and agriculture is in a backward condition. The manufactures, however, are extensive and varied, including iron and steel in every form, chemicals, bricks, pottery, shoes, and glass, and cotton, silk, and leather goods. Stoke-on-Trent is the chief seat of the pottery industry, while Burton-on-Trent is famous for its breweries. Consult *Victoria History of the County of Stafford*, vol. i (London, 1908).

STAFF TREE. See WAXWORK.

STAG, or RED DEER. See ANTLERS; DEER.

STAG BEETLE. Any member of the Lucanidæ, a family of beetles including about 750 species. The common name is derived from the shape of the mandibles of the males, which are developed in some species so as to equal in length nearly that of the entire body, and are armed with spines or teeth. The males are of varying size and exhibit remarkable differences in the development of the head and mandibles. *Lucanus cervus* is the common English species. *Lucanus dama* is the commonest North American species. In the Southern States *Lucanus elaphus*, the giant stag beetle, occurs. See Colored Plate of BEETLES.

STAGE, THE. A term frequently employed to designate the theatre (q.v.), the drama (q.v.), or the profession of the actor.

STAGGERBUSH. See ANDROMEDA.

STAGGERS. Various affections of animals. In horses, mad or sleepy staggers is attributed to inflammation of the brain and is considered fatal. Grass or stomach staggers is said to result from indigestion. In sheep the gid tapeworm in the brain cavity is held accountable for the phenomenon.

STAGGERS, BLIND. See MEGRIMS; MENINGITIS, *Cerebro-Spinal*.

STAGHOUND. See HOUND.

STAGING. Staging and scaffolding are interchangeable terms for the temporary frameworks of timber erected about a building under construction or repair, to furnish platforms for the workmen and for the materials and implements of construction in immediate use. For exterior work the staging may be built up in one of three ways: by series of movable trestles or horses supporting planks in successive tiers or stages; by putlogs projecting horizontally through temporary holes in the masonry, to support the platforms; or by rows of lofty poles or posts standing on or in the ground, to which are nailed, bolted, or lashed with ropes the necessary girts and crosspieces, with braces to prevent the sidewise racking of the frame. In cities a strong staging is built of heavy timbers over the sidewalk for the protection of passers-by. Materials are hoisted by derricks or construction elevators. Stagings erected to support the trusses of bridges while building are called falsework.

STAGIRA, stȧ-jī′rȧ, or **STAGIRUS,** -rŭs. An ancient town in southeast Macedonia, on the Strymonic Gulf, celebrated as the birthplace of Aristotle. It was founded in 655 B.C. by a colony from Andros, but declined after its capture by Brasidas during the Peloponnesian War. The modern village of Stavro is on its site.

STAGIRITE, stăj′ĭ-rīt, THE. A name frequently given to Aristotle (q.v.) from his birthplace, Stagira.

STAGNELIUS, stăg-nā′lē-ụs, ERIK JOHAN (1793–1823). A Swedish poet, born on the island of Oland, and educated at Upsala and Lund. He was deeply interested in Gnosticism and treated all sides of this question in his books. He is considered a master of form. He published the epic poem *Vladimir den store* (1817), the philosophico-religious *Liljor i Saron* (1821), *Martyrerna*, his best drama (1821), and the tragedy *Bacchanterna* (1822). C. Eichhorn edited his complete works (1868), and F. Böök a standard edition in 1912 et seq.; German translation by K. F. L. Kannegieser (6 vols., 1851). Most of his works are translated into French, Finnish, and Latin.

STAHL, shtäl, ERNST (1848–). A German botanist, born at Schiltigheim, Alsace, and educated at Strassburg, Halle, and Würzburg. He became professor in Strassburg in 1880 and professor and director of the botanical gardens at Jena the following year. He visited Ceylon and Java in the winter of 1889–90. Among his books are *Entwickelung und Anatomie der Lentizellen* (1873); *Einfluss des Lichtes auf den Geotropismus einiger Pflanzenorgane* (1884); *Regenfall und Blattgestalt* (1893); *Sinn der Mykorhizenbildung* (1900); *Die Blitzgefahr der verschiedenen Baumarten* (1912).

STAHL, FRIEDRICH JULIUS (1802–61). A German politician and political philosopher. Born in Munich of Jewish parents, he turned Protestant in 1819, studied at Würzburg, Heidelberg, and Erlangen, and in course of time became professor of law at Erlangen, Würzburg, and Berlin. In 1849 he became a member of the Upper House of the Prussian Legislature, and in 1850 a member of the Erfurt Parliament. Stahl was a leader in the Lutheran church, and a most powerful influence for reaction in Germany. He stood for an absolute monarch and an absolute church that should control the monarch. The basis of his political philosophy was the conception of the subserviency of all things lay and clerical to the will of God as expounded by the clergy. In 1858 he was forced to retire from the Upper Church Council. His most important work is the *Philosophie des Rechts nach geschichtlicher Ansicht* (1830; 5th ed., 1878). Others are: *Ueber Kirchenzucht* (1845); *Das monarchische Prinzip* (1845); *Der christliche Staat* (1847); *Die Revolution und die konstitutionelle Monarchie* (1848); *Die lutherische Kirche und die Union* (1859); and, posthumous, *Die gegenwärtigen Parteien in Staat und Kirche* (2d ed., 1868).

STAHL, GEORG ERNEST (1660–1734). A

German physician and chemist, born at Ansbach. He became court physican at Weimar in 1687, and in 1694 was called to the chair of medicine, anatomy, and chemistry in the newly founded University of Halle, whence he removed to Berlin in 1716, and was appointed physician to the King of Prussia. Stahl was one of the ablest chemists of his time. He destroyed numberless absurd opinions then in science, and propounded the first general theory of chemical transformations (see Chemistry), universally accepted till the time of Lavoisier. His works, according to Haller, number 250, the most important being *Theoria Medica Vera* (1707, and 1831–33), containing his medical theory, and *Experimenta, Observationes et Animadversiones Chymico-Physicæ* (1731), in which his chemical opinions are set forth. Consult Charles Lasègue, *De Stahl et sa doctrine médicale* (Paris, 1846), and Albert Lemoine, *Le vitalisme et l'animisme de Stahl* (ib., 1864).

STAHL, Rose (?–). An American actress, born in Chicago. She made her début in Philadelphia in 1870, toured with Daniel Brandmann in 1888, and appeared in New York in 1897. In 1902–03 she starred as Janice Meredith in the play of that name. She first appeared in her rôle of Patricia O'Brien in 1904 in the sketch called *The Chorus Girl*, which she carried to London in 1906, and she reappeared in New York in the revised four-act play, *The Chorus Lady*, in which she made a sensation and which continued to be her vehicle till 1911. Afterward she played in *Maggie Pepper* (1911), *Moonlight Mary* (1916), etc. She was married to William Bonelli, an actor.

STAHL EAR. See Stigma.

STAHR, shtär, Adolf Wilhelm Theodor (1805–76). A German author and art critic, born in Prenzlau, Prussia. After study at the University of Halle he went to the Gymnasium at Oldenberg, and in 1836 became professor there. While on a tour through Italy in 1845, which was afterward described in *Ein Jahr in Italien* (1847–50), he met the author Fanny Lewald, whom he married in 1855, after separating from his first wife. Perhaps the most noteworthy of his writings are his classical studies, which include translations from Aristotle, Suetonius, and Tacitus, and also *Bilder aus dem Altertum* (1863–66) and *Torso: Kunst, Künstler, und Kunstwerke der Alten* (2 vols., Brunswick, 1854–55; 2d ed., 1878). His miscellaneous works, some of which have been translated into English, include: *Charakteristik Immermanns* (1842); *Die Republikaner in Neapel* (1849); *Die preussische Revolution* (1850); *G. E. Lessing, sein Leben und seine Schriften* (1858); and several works of travel.

STAINED GLASS. The term used technically as well as popularly to designate windows made of colored glass, whether the color be produced: (1) by metallic oxides in the melting pot; (2) by coating the surface with a film of colored glass, thus making flashed glass, which is ground or etched away where the color is not desired; (3) by applying under fire a solution of silver (yellow stain) which turns yellow the surface of crystal (colorless) glass, and of the ground-away portions of flashed glass, and by which light-blue glass is turned green; (4) by painting the surface with colored enamels that are afterward fused into the substance.

Frequent mention of stained-glass windows is found in Greek and Latin writers of the fourth century A.D. In the fifth century Sidonius Apollinaris, in a poem for the dedication of a church in Lyons, describes the stained-glass windows. In the ninth century Anastasius says that Pope Leo III decorated windows of St. Peter's with glass of different colors; and the pontificals assert that Benedict XIII adorned the windows of St. Mary's in Trastevere with colored glass. The glass of early windows, especially of those constructed in Mohammedan countries, of which there are several small examples in the Metropolitan Museum of Art, New York, was sometimes set in plaster, instead of being held together with ribbons of lead. A sixth-century writer speaks of "sheets of glass to-day being set in lead which formerly were set in plaster."

Whether any of these windows were picture windows is uncertain. They may have been made in decorative designs only, without the introduction of human figures and subject interest. But we do know that by the twelfth century the art of story representation in glass was well developed. This is proved by windows that remain, and also by the *Diversarum Artium Schedula* of the monk Theophilus, who in great detail describes all the processes of making this glass, leads, etc.

The most ancient stained-glass window that bears the name and portrait of the donor is in the church of the abbey of St. Denis, near Paris, installed in the twelfth century by Suger (born 1081), famous as churchman, statesman, and historian. In 1122 he was elected abbot of St. Denis, and in 1142 he dedicated the new church, built to take the place of the smaller one that dated from the reign of Charlemagne. In the book that gives the history of the administration of Suger as abbot, he says: "We have had painted by the skilled hands of many masters of different nations an extensive series of splendid new windows."

Of especial interest to English-speaking people is the late twelfth-century window in the cathedral of Sens that tells in detail the story of the life of Thomas à Becket (q.v.). It was at Sens that St. Thomas sought refuge before he became reconciled to Henry II and returned to Canterbury to be assassinated. The pontifical garments of St. Thomas that are still carefully preserved in the cathedral of Sens differ in many important points from those worn by archbishops now, but are exactly reproduced in the window that commemorates his life.

The development of Gothic architecture in northern France vastly increased the size of windows, made stained glass the important color factor in the decoration of churches, and caused it to supplant fresco painting. The cathedral of Chartres has no less than 146 important windows, in which appear 1359 pictures, containing about 5000 human figures. It is a perfect example of how a church should be lighted. Through ancient thirteenth-century glass the whole interior is bathed in a sea of living colors marvelously grouped for composite effect. The cathedral of Bourges has 183 stained-glass windows, but many of them are of later date. Twenty-eight of the windows at Chartres were given by the local trades guilds. Consequently we see the different trades pictured in the windows: the tanners at the bottom of the window that tells the story of St. Thomas in 22 picture medallions; the shoemakers beneath the window of St. Martin of Tours; the masons beneath St.

Sylvester. Also at Le Mans and to a less degree at Rheims and Rouen were preserved whole series of the windows that in the thirteenth century set the style for other countries.

The characteristics of the earliest Gothic windows are: multiplication of small figures in many separate compositions grouped in tiers or rows of framed medallions; rich and dark coloring; wide decorative borders; heavy leads bent so as to outline the figures or cut them in the deep shadows; brown enamel used to produce outlines, and shadows and modeling.

The development during the fourteenth century was towards lighter coloring, larger figures, narrow borders, more ornamentation, more delicate gradations of color, and increase of modeling, loss of simplicity, and tendency to mannerisms, while in the fifteenth century much clear glass was introduced into the backgrounds, and inscribed ribbons and architectural accessories became conspicuous. The designers of the Gothic age did not, to any great extent, give the details of their pictures on glass as their successors—Renaissance and modern—mistakenly attempted to do, but obtained their superb effects by a clear knowledge of the interaction of colors, by juxtaposition of complementary colors, and the effect of distances; the technique being that of glass colored not on the surface, but in the mass either by stain or incorporation. This branch of art was, therefore, governed by totally different artistic principles from those governing opaque painting (fresco, oil, tempera, tapestry, etc.), and these principles were thoroughly understood.

During the latter part of the thirteenth century the art was carried to England, Germany, and Italy, where it did not really flourish before the following century. In Italy the imperfect understanding of Gothic methods did not allow of the use of such immense windows, and the art never became thoroughly carried out. At Arezzo Cathedral are some windows by a French artist, Guillaume de Marcillati, proving the transmission from France. Other interesting examples are in San Francesco at Assisi, San Petronio in Bologna, and the cathedral and Santa Croce in Florence. Many of the best Italian examples belong rather to the early Renaissance than to the late Gothic. England would still possess some very fine series, as is shown by the examples at York and Canterbury, had it not been for the vandalism of the Reformation. In Spain there are fine windows at Toledo and León, very close to French models. Germany, however, ranks next to France in the importance of its remaining windows, beginning in the fourteenth century with those of the choir of Cologne Cathedral, those of the cathedrals of Freiburg, Strassburg, and Regensburg, and the churches at Oppenheim, Esslingen, and Nuremberg. German works, however, do not approach the French in quality either of technique or art.

In the fourteenth century the introduction of yellow stain gradually led to the less frequent use of the rich reds and blues that had previously been dominant. The glass, more perfectly fused, became constantly more transparent and was used in larger pieces. About the middle of the sixteenth century the movement towards transparent crystal glass and paint culminated in the invention of colored enamels that could be used on glass as freely as oil paints on canvas. To be sure they were fused in, not merely varnished over. But the principle was the same, and windows made in this way lack what is the most important part of stained glass—the rich polychrome jeweled effect. In recent years a serious attempt has been made, particularly in England, to return to ancient methods.

The so-called American glass is an entirely different product. From cast sheets of opalescent glass, with enamels for the modeling of faces and hands only, John La Farge and Louis B. Tiffany developed an art that is absolutely and completely original. The iridescent effects are extraordinary, and the colors are rich but apt to be too opaque. Drapery effects are very skillfully produced with so-called drapery glass, large sheets of which, partly by design and partly by accident, give the required lines and shadows. Especially important in the process is the artificial selection of natural variations that come about in the making of the sheets of glass.

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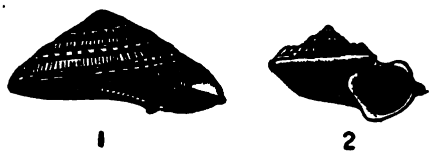
STAINER, shtīn′ẽr, JAKOB (1621–83). A German violin maker, born at Absam, Tirol. He was the son of poor peasants, but at an early age began to make violins and subsequently studied at Cremona under the best makers of his time. His extravagances kept him in continual poverty and he died in an insane asylum in Absam. Stainer violins are rare and command high prices, though they do not rank with the instruments of Guarnerius, Stradivarius, or the Amati (qq.v.). Consult F. Lentner, *Jakob Stainer's Lebenslauf im Lichte archivarischer Forschung* (Leipzig, 1898).

STAINER, stān′ẽr, SIR JOHN (1840–1901). An English composer and organist, born in London. In 1854 he became organist and choirmaster of St. Benedict and St. Peter's Church, but continued to study composition with Bayley and Steggal and organ with George Cooper. He held this appointment for three years. In 1863 he was appointed organist of Magdalen College, Oxford, and conductor of the two musical societies. In 1865 he was made doctor of music, and in 1866 became one of the examiners for musical degrees. He succeeded Sir John Goss as organist of St. Paul's, London, from 1872 to 1888, when he was knighted by Queen Victoria, and the following year was appointed to the chair of music at Oxford University. He was also professor in the Royal College of Music. In 1878 he was made Chevalier of the Legion of Honor. His compositions are nearly all for the Church and include the oratorio *Gideon* and the cantatas *The Daughter of Jairus* (1878), *St. Mary Magdalene* (1883), and *The Crucifixion* (1887). Other compositions include numerous anthems, services, canticles, and songs. In conjunction with W. A. Barrett he wrote a dictionary of musical terms (1876; 3d ed., 1880). His textbooks, including a number of primers, are among the best in English.

STAINVILLE, Duc de Choiseul. See Choiseul-Stainville.

STAIR, Viscount and Earls of. See Dalrymple.

STAIRCASE SHELL. A collector's name for the low, conical, handsomely colored tropical shells of the mollusks of the family Solariidæ, and especially of the genus *Solarium*. In this genus the umbilicus is widely open, and the sculptured edges of the whorl seen within it are comparable to a spiral staircase. These mollusks are related to the wentletrap (q.v.).



STAIRCASE SHELLS.

1, the common existing species (*Solarium perspectivum*). 2, a fossil form (*Solarium leyerici*) from the Upper Cretaceous of Belgium.

STAIRS, Moving. See Elevator.

***STAIRS AND STAIRWAYS.** Stairways became necessary whenever buildings were first erected of more than one story, but they do not appear to have attained architectural importance until the Middle Ages. Previous to the Roman Empire nearly all classes of buildings were of one story only. While ordinary stairways of utilitarian character are known to have been used in Crete, 2000 B.C., and in Greek temples and Roman basilicas, theatres and amphitheatres, to give access to galleries, the only monumental stairways of ancient times known to us are that to the terrace of Persepolis and those leading up to the podia (see Podium) of Roman temples. In the Middle Ages they appear in churches having high choirs above crypts, to connect the nave with the two levels thus created; while the multiplication of towers led to the building of winding stairs. It was the Renaissance that gave the stairway architectural dignity and even splendor, first in Italian palaces and later in France, where both the spiral type (as at Blois and Chambord) and the rectangular type were treated with great magnificence. Italy then took up and imitated the French practice (Braschi Palace, Rome; Caserta; palaces at Naples and Turin). In modern architecture the most splendid example is that of the Paris Opera House. Very fine stairways in America are those of the State Capitol at Albany, N. Y., and of the Congressional Library, Washington, D. C.

In modern practice stairs are built of wood, stone, iron, or concrete or combinations of these. Each step has a riser or face, from 5 to 8 inches high; a tread or top, from 9 to 15 inches wide, and an end. The projecting molding in front and across the end is the nosing. If the stairs are supported on inclined beams, these are called carriages or strings. In an open-string stairway the steps are set above the string; in a closed-string stairway the outer ends abut against the outer string. A balustrade or parapet with a hand rail protects the outer ends. The stairs between two successive landings, or between a landing and a floor, constitute a run. Building laws in cities prescribe the limits of width for stairways of certain classes of buildings and the manner in which they should be safeguarded against fire. Consult: Julien Guadet, *Eléments et théorie de l'architecture* (new ed., 4 vols., Paris, 1905); Morris Williams, *Stair Builders' Guide* (New York, 1914); W. H. Wood, *Practical Stair Building and Hand Railing* (ib., 1915).

STALAC′TITE (from Gk. *σταλακτός, stalaktos*, oozing, and Stalagmite (from Gk. *σταλαγμός, stalagmos*, dripping). Elongated masses of lime, chalcedony, or other mineral substances that depend from the roof or rise from the floor of caves. Water impregnated with carbonic acid will dissolve lime, and as rain and surface water contain more or less carbonic acid, they take in passing through the earth to the roofs of caves a certain amount of lime. When the water is exposed on the roof or floor of the cave, evaporation follows; both the bulk of the water and its solvent power are reduced, and a thin pellicle of solid carbonate of lime is deposited. When this occurs at the roof of the cave, long icicle-like pendants are formed, called stalactites; when the water drops upon the floor a stalagmitic layer is formed, building up at points where the largest supply of material exists as pillars to meet the overhanging stalactites. See Calcareous Tufa; Cave.

STALACTITE, STALACTITE WORK. A form of architectural ornament in nearly all Mohammedan styles, composed of an assemblage of minute brackets and niches so combined as to form systems of corbeling, niche caps, cornices, pendentives, and even capitals.

STA′LEY, Cady (1840–). An American civil engineer and educator, born at Minaville, N. Y. He graduated at Union College in 1865, prospected for gold in the foothills of the Rockies, became a civil engineer on the Central Pacific Railway, in 1867 became assistant in civil engineering at Union College, and in 1868 professor of that subject, and from 1876 to 1886 was dean. Thenceforth until 1902 he was president of the Case School of Applied Science at Cleveland, Ohio. Besides an edition of Gillespie's *Roads and Railroads, Notes on Bridge Engineering* (1875), his publications include *Strength of Materials and Stability of Structures* (1876) and *The Separate System of Sewage* (1882; 3d ed., 1899), with G. S. Pierson.

STALK BORER. A caterpillar which bores commonly into the stems of potatoes, geraniums, spinach, cauliflower, dahlias, corn, and many other plants. It is the larva of a brown noctuid moth (*Papaipema nitela*) commonly found throughout the eastern United States. The whitish-brown striped larva bores longitudinally within the stalks, which wilt. When full grown they burrow in the ground, where they pupate until fall, when the moths emerge and hibernate. Many other insects bore in the stalks of the plants mentioned.

STALKER, stąk′ĕr, James (1848–). A minister of the Free church of Scotland, born at Crieff, in Perthshire. He was educated at the university and at New College, Edinburgh, and studied also at Halle and Berlin. In 1902 he accepted the chair of Church history in the United Free Church College, Aberdeen. He delivered the Lyman Beecher lectures at Yale in 1891, and lectured on other foundations in Britain and the United States. His works were widely read by English-speaking people, and some of them were translated into several languages. Among them are: *The Life of Jesus Christ* (1879); *The Life of Saint Paul* (1884); *Imago Christi* (1889); *The Preacher and his Models*, lectures delivered at Yale (1891); *Men and Morals* (1892); *The Two Saint Johns* (1895); *The Four Men and Other Chapters* (1892); *The Christology of Jesus* (1899); *The Ethics of Jesus* (1909); *Know Thyself* (1914); *Christian Psychology* (1915).

STALLBAUM, shtäl'boum, Johann Gottfried (1793–1861). A German classical scholar, born at Zaasch, in Saxony. He studied at the University of Leipzig. From 1820 to his death he taught at the Thomasschule in Leipzig; from 1835 he was rector there. From 1840 also he was extraordinary professor at the University of Leipzig. He published a complete text of Plato (1821–25), and an edition, with full prolegomena and notes, in Latin (1827–60). The latter work is of great importance in the history of Platonic study.

STALWARTS. The name applied to those members of the Republican party in New York State in 1881 and afterward who adhered to Senators Conkling and Platt and were opposed to the half-breeds (q.v.), who favored the administration of Garfield. See Conkling, Roscoe.

STALYBRIDGE, stā'li-brij. A municipal borough, partly in Lancashire and partly in Cheshire, England, on the Tame, 8 miles east of Manchester (Map: England, E 3). It has fine municipal buildings and is noted for its cotton manufactures, which date from 1776; print works, iron and brass foundries, and machine shops are numerous and important. Pop., 1901, 27,700; 1911, 26,513. Consult Butterworth, *Historical Account of Stalybridge* (Ashton, 1842).

STAMBUL, stäm-bōōl'. The Turkish name of Constantinople (q.v.) proper.

STAMBULOFF, stàm-bōō'lôf, Stephen (1855–95). A Bulgarian statesman, born at Tirnova of poor parentage. He studied for the priesthood at Odessa, but was expelled from Russia for complicity in the revolutionary propaganda of the Nihilists. Upon his return to Bulgaria he engaged in several conspiracies looking towards the liberation of his country from the Turks. In 1879 he was elected to the Sobranje, or national assembly, of which he became president in 1884. Stambuloff combated Russian influence in Bulgaria (q.v.) and lent support to the annexation of eastern Rumelia in 1885. He was in the regency after the abduction of Prince Alexander in August, 1886, until the election of Prince Ferdinand, in July, 1887, then became Premier, and for nearly seven years ruled autocratically, establishing amicable relations with the Porte, but antagonizing Russia. His course gained him bitter enemies and aroused the dissatisfaction of Ferdinand. In May, 1894, the Minister resigned. On July 15, 1895, Stambuloff was set upon by three assassins in the streets of Sofia and was left for dead, expiring three days later. The murderers had only nominal terms of imprisonment. A confession made by one of them in 1902 implicated men then in power, and tended to cast suspicion on Prince Ferdinand. Consult A. H. Beaman, *M. Stambuloff* (London, 1895), and id., *Twenty Years in the Near East* (ib., 1898).

STAMEN (Lat., warp, thread, fibre, stamen). The organ in flowers which produces pollen (q.v.). It is usually differentiated into two regions: (1) a stalklike portion, called the filament, and (2) the terminal anther which bears the pollen sacs. See Flower.

STAMFORD. A market town in Lincolnshire, England, on the Welland, 16 miles by rail northwest of Peterborough (Map: England, F 4). It is remarkable for its history and its antiquities, of which four fine churches, two old gateways, and the ruins of a priory remain. Its charter dates from 982. Pop., 1901, 8300; 1911, 9647. Consult Neirnson, *History of Stamford* (London, 1879).

STAMFORD. A city in Fairfield Co., Conn., 33 miles northeast of New York City, on Long Island Sound and on the New York, New Haven, and Hartford Railroad (Map: Connecticut, A 5). It is attractively situated, and contains the homes of many New York business men. It has the Ferguson Library, the public library, Halloween, Central, West, and St. John's parks, and the Stamford Hospital. Its manufacturing industries are many and important. They include hardware, locks, dyestuffs, pianos, typewriters, insulated wire, chocolate, paints, wood-working machinery, and foundry and machine-shop products. In 1915 the city's 78 industrial establishments represented an invested capital of approximately $16,000,000, gave employment to 5585 persons, and yielded products valued at $12,000,000. Pop., 1900, 15,997; 1910, 25,138; 1915 (U. S. est.), 29,958. Stamford was settled in 1641 by a company from Wethersfield, some of whom were natives of Stamford, England. Until 1662, when the Connecticut and New Haven colonies united, it was under the jurisdiction of the latter. Consult: Huntington, *History of Stamford* (Stamford, 1868); Gillespie, *Historical Sketch* (ib., 1892); and article, "Stamford—1641–1900," in *Connecticut Magazine*, vol. vi (Hartford, 1900).

STAMITZ, shtä'mits, Johann Wenzel Anton (1717–57). A Bohemian composer, the creator of the modern instrumental style. He was born in Deutsch-Brod, June 19, 1717. At the coronation festivities of Emperor Charles VII at Frankfurt in 1742 the young man attracted the attention of Prince Karl Theodor, who engaged him as his chamber musician. After the Prince had become Elector Palatine he appointed Stamitz his musical director in 1745, a position which the latter retained till his death. Under his direction the Electoral Orchestra of Mannheim won the reputation of being the finest body of instrumentalists in the world, while his style of composition was immediately adopted by many of his contemporaries, notably Johann Christian Bach, Boccherini (q.v.), Dittersdorf, and Gossec. Stamitz died in Mannheim, March 26 or 27, 1757. Dr. Hugo Riemann published a number of his works in *Denkmäler der Tonkunst in Bayern* (III, 1; VII, 2; VIII, 2). Stamitz wrote 50 symphonies, 10 trios for orchestra, 12 violin concertos, a number of sonatas for violin solo and for violin and piano. See Music, History of, *XIX;* Orchestra; Sonata; Symphony.

STAMMERING (from Ger. *stammern*, to stammer). Imperfect enunciation of words, due to irregular or spasmodic action of the muscles of articulation. The trouble is sometimes a form of chorea (q.v.), sometimes entirely an emotional incoördination. In the ordinary classification of speech defects stammering is known as dyslalia; in this form there is difficulty of utterance. Pseudolalia embraces slight deviations from normal speech, e.g., slurring or omitting certain elements or the substitution of one element for another. Stammering is not always confined to a disturbance directly concerned with the mechanism of enunciation, but other muscles may be involved in the spasm, especially when great effort is made to overcome it. On the other hand in phlegmatic individuals there may be but little noticeable spasm, the victim will only stand and stare. This is sometimes known as the silent form of stammering. In many sufferers the difficulty lies in the enunciation of the initial syllables of certain words, especially if they begin with *b*, *p*, *t*, or *d*. In some cases, when once pronounced, the syllable is involuntarily repeated many times. This variety of stammering is sometimes termed stuttering.

Among predisposing causes heredity is most important. The trouble begins soon after the child, who is generally of a nervous temperament, begins to talk, and lasts through youth and even to old age. Sex is a predisposing factor, 84 per cent of all cases reported being in males; other authorities give the proportion of males to females as 4½ to 1. Besides attention to the general health, such conditions as eyestrain, hypertrophied tonsils, adenoid growths, and deficient nasal breathing, must be taken into consideration and remedied. In many children the condition must be considered a true neurosis, following nervous shock, fright, or injury. Ridicule, scolding, or disciplinary measures tend to make the condition worse. Stammerers can usually sing without difficulty, and on this fact are based most successful methods of cure. The patient is taught to breathe properly and to sing or intone his speech, every advantage being taken of the sense of rhythm, until finally new habits of normal coördination are established. Consult E. W. Scripture, *Stuttering and Lisping* (New York, 1912).

STAMP (AS. *stempan*, to stamp). A small piece of paper with an imprint of a mark or device authorized by law, adapted for attachment to an object chargeable with a duty or tax of some nature. Stamps are usually gummed on the back and attached to the instrument or article by adhesion, and are usually made to represent different values to suit the requirements of the tax law or revenue act under which they are imposed.

The British government has long employed stamps for the above purposes, and the United States government for the purpose of raising revenue during the Civil War imposed a stamp tax upon legal instruments and a great variety of other articles of property. The stamp is required to be affixed to an article before it can be sold, this being done by the manufacturer. During the Spanish-American War and also during the Great War the United States government passed war-revenue acts requiring stamps on legal instruments and certain articles of commerce. Such acts are generally repealed when the necessity for the increased revenue has ceased. Internal-revenue stamps are required on tobacco, snuff, liquors, cigars, etc., under excise laws, as this is the most satisfactory method of collecting revenue upon such articles. Where a stamp tax is imposed on legal instruments the revenue act usually provides that an instrument shall be void unless properly stamped. The courts usually hold an instrument good if the parties have omitted the stamp inadvertently. Consult: N. J. Highmore, *The Stamp Laws* (2d ed., London, 1902); T. M. Cooley, *Treatise on Constitutional Limitations* (7th ed., Boston, 1903); Theophilus Parsons, *Law of Contracts* (9th ed., 3 vols., ib., 1904). See POSTAGE STAMPS.

STAMP ACT. In American history, an act passed by the British Parliament and signed for George III (then insane) March 22, 1765, "for granting and supplying certain stamp duties, and other duties, in the British colonies and plantations in America, towards further defraying the expenses of defending, protecting, and securing the same." This act, which was to go into effect on November 1, prescribed (1) that stamped paper be used for legal and official documents, diplomas, and certificates; (2) that stamps be placed on playing cards, dice, books (excepting in the schools), newspapers, pamphlets, calendars, almanacs, and other articles; and (3) that jury trial be denied offenders at the discretion of authorized prosecuting officers. Lord Grenville had given notice in March, 1764, of an intention to introduce such an act, and various Colonies had protested vigorously through their authorized agents, but had been unable to suggest any satisfactory substitute. News of its passage reached America early in May, 1765, and immediately opposition everywhere manifested itself on the ground that the colonists were not represented in Parliament and could not legally be taxed without their consent. It was urged that the duties would be burdensome and would cause the withdrawal from circulation of what little specie there was in various Colonies. The stamp agents were nearly everywhere compelled by the Sons of Liberty (q.v.) to resign or to destroy their stamps, while many of them were mobbed and much property destroyed; so that by the time it was to go into effect the act had been virtually nullified. Resolutions, moreover, were passed by many of the Colonial assemblies, notably by Virginia (May 30) (see HENRY, PATRICK), insisting on the general rights of the colonists as British subjects, and denying the jurisdiction of Parliament over the Colonial pocketbook. The famous Stamp Act Congress, composed of delegates from New York, Massachusetts, Connecticut, Rhode Island, New Jersey, Pennsylvania, Delaware, Maryland, and South Carolina, assembled at New York on October 7, in pursuance of a circular letter sent out June 8 by Massachusetts, and issued a dignified "Declaration of Rights and Grievances," a formal address to the King, and petitions to each House of Parliament. Many able pamphlets were written to oppose the act, and on November 1, when it was to go into effect, bells were tolled, flags were at half-mast, and newspapers put in mourning. Finally, on March 18, 1766, after a long and bitter debate, Parliament repealed the objectionable measure, having previously, however, passed (March 7) a "Declaratory Act" asserting a right to "bind the colonies and people of America . . . in all cases whatsoever." The repeal caused great rejoicing throughout America, though dissatisfaction was soon expressed with regard to the Declaratory Act. The whole affair has been regarded as one of the chief immediate causes of the Revolution. For the text of the act, consult Pickering's *Statutes at Large*, xxvi. Consult: M. C. Tyler, *Literary History of the American Revolution* (2 vols., New York, 1897–98); G. E. Howard, *Preliminaries of the Revolution* (ib., 1905); Richard Frothingham, *Rise of the Republic* (10th ed., Boston, 1910).

STAM'PÆ. See Etampes.

STAMP COLLECTING. See Postage Stamps.

STAMPING OF METALS. See Dies and Die Sinking; Mint.

STAMP MILL. See Grinding, Crushing, and Pulverizing Machinery.

STAMP MILLING AND AMALGAMATION. See Gold.

STANCH'FIELD, John Barry (1855–). An American lawyer and Democratic politician, born at Elmira, N. Y. He graduated from Amherst in 1876, and attended the Harvard Law School in 1877–78. Admitted to the bar in the latter year he was then a law partner of David B. Hill at Elmira until 1885, and continued to practice there until 1900, when he moved to New York City. He was district attorney of Chemung Co., N. Y., in 1880–85, mayor of Elmira in 1886–88, and assemblyman and Democratic minority leader in 1895–96. Stanchfield was an unsuccessful Democratic candidate for Governor of New York in 1900, and for United States Senator in 1901. He made a wide reputation as a lawyer. In 1915 he was a delegate to the New York State Constitutional Convention.

STANCHIO, stäŋ'kyō, or **STANKO,** stäŋ'kō. See Cos.

STANDARD. A battle flag; in a broader sense the emblem of a ruler or a nation. On the Egyptian monuments are representations of standards, usually consisting of the image of some sacred animal, a fan or semicircular disk, an ostrich feather, the symbol of victory, the name of the king, or some other symbolic device. The Bible refers to the use of banners or standards to mark the divisions and subdivisions of the children of Israel on their march from Egypt to Palestine. The Assyrian monuments show standards attached to the chariots. According to Xenophon the Persian standard was a golden eagle. The Greeks do not seem to have used flags or standards of any kind, though we hear on some occasions that the signal was given by displaying a scarlet cloak on a spear or pole.

Legend claimed that the first Roman standard was a wisp of hay (*manipulus*) on a pole. In historic times, however, we find a thorough system of military standards or signa. One of these belonged to each maniple (consisting of two centuries), and their details naturally differed from the legion and the nature of the troops, for the auxiliaries and cavalry naturally bore ensigns not like those of Roman legionaries. As represented on the monuments, the signum of the maniple of the legion was a long pole, shod with metal, and near the top a crossbar, on which seems to have been a plate with the name of the company. From the ends of this bar hung ribbons tipped with silver oak leaves. Below the bar along the pole are a number of metal disks, which seem to have been marks of distinction, and consequently vary with the legion and company. Above the bar is sometimes a disk, or a hand, the emblem of fidelity, or the figure of an animal, though these latter seem to appear on the standards of native troops in the Roman service. Another standard bore the image of the Emperor. The standard of the legion was a golden eagle, with spread wings, and usually holding a thunderbolt in its claws. Another form of standard was the vexillum, a piece of fringed cloth, hanging from a crossbar on a pole. This was a very old form, as it was the banner hoisted when the Comitia Centuriata was in session. It gave the signal for battle when raised over the general's tent, and was used by any division on detached duty. It was carried by the cavalry of the legion, and seems sometimes to have been attached to the signum. The color of the cloth was red or white.

In the United States army the term standard designates the national and regimental silk flags carried by regiments of cavalry and field artillery.

In a narrower sense the standard of a country is the personal flag of the ruler, and is hoisted on a building, or ship, when he is in the building or on board. In Great Britain the royal standard displays the English leopards, Scottish lion, and Irish harp, quartered as on the field of the royal arms. France has the tricolor with the initials of the President in gold on the central stripe. In the United States the standard is usually called the President's flag, and is a blue field with the national coat of arms in colors. The same flag with a white field is used by the Vice President, and with a red field by the Secretary of the Navy. The flag of the Secretary of War is of scarlet bunting, carrying the coat of arms in the centre and a five-pointed white star in each corner. That of the Assistant is the same, with colors reversed. In addition to flags, there are colors of silk for the President and the two secretaries. See Colors; Ensign; Flag; Heraldry; National Arms; National Flags.

STANDARD, Battle of the. A name frequently given to the battle fought between the English and the Scotch, Aug. 22, 1138, near Northallerton (q.v.), in which the latter were defeated.

STANDARD OF LIVING. In economics, the term used to designate the degree of comfort or enjoyment derived from the use of material goods which each social class regards as essential to tolerable existence. For a high standard of living control is demanded over a large and varied quantity of consumption goods; those whose wants are few and tastes inexpensive have a low standard of living. The terms are usually without moral connotations, injurious and degrading modes of consumption entering into a "high" standard of living, as well as consumption of goods which exercise a refining influence. In some sociological studies, however, the test of a high standard of living is its moral influence. Students of the housing problem (q.v.) regard the development of a higher standard with respect to house room as an advance in the standard of life, although this may result in lessening other expenditures. In a developing society like that of the United States, the gradations of standards of living are numerous. The professional and business classes have a higher standard of living than artisans; the standard of the latter is higher than that of the laborer. The American standard of living is generally higher than the European, which in turn is higher than the Asiatic.

Much emphasis has been laid upon the influence of the standard of living upon wages. If a social class has a high standard, each individual in it will exert himself to the utmost to maintain the same control over goods as his fellows. A rising standard thus acts as a spur to those whose individual wants would demand no great degree of exertion. To raise the standard of backward races or classes is therefore regarded as a prerequisite to industrial improvement. In the second place, a high standard, assuming that it consists in the consumption of goods which improve the physical and mental condition of the laborer—e.g., good food, clothing, housing, a thorough education and technical training for children—tends in the long run to increase industrial efficiency. Thirdly, it is difficult for an employer to beat down wages of laborers whose standard is high. Thus a greater share in the social dividend may be diverted to labor. Fourthly, men whose standard is high refuse to marry until they have a fair prospect of bringing up their children in a way in keeping with class standards. Hence the supply of labor is kept from exceeding the demand for it and wages are kept from falling to a subsistence level. See POLITICAL ECONOMY; WAGES.

STANDARD OF VALUE. See MONEY.

STANDARD OIL COMPANY. A group of business interests, varying in form of organization according to exigencies of business and law, and holding since 1880 a dominant position in the petroleum industry. The foundations of the group were laid in 1867 with the formation of the firm of Rockefeller, Andrews, and Flagler, reorganized in 1870 under the name of the Standard Oil Company of Ohio. This concern controlled not more than 10 per cent of the industry, but in 1880 the company, together with other companies in which the same men were interested, controlled 90 per cent of the industry. This control had been attained partly through efficiency of operation, but more largely through a manipulation of rates of transportation which placed competitors of the allied Standard Oil interests at a ruinous disadvantage. In 1882 the capitalists forming the Standard Oil group replaced their informal working agreements by an organization known as the Standard Oil Trust. The entire stock holdings of 14 companies and the majority holdings in 26 other concerns were placed in the hands of nine trustees having irrevocable powers of attorney. In return the stockholders of the several companies combined received trust certificates on which dividends were declared. The trust certificates amounted to $70,000,000 par value, of which the nine individuals acting as trustees owned $46,000,000. In 1892, in consequence of an adverse decision in the Ohio courts involving the legality of the trust form of organization, the trust was formally dissolved and the stocks in the several companies distributed to the holders of trust certificates on a pro rata basis which in fact left the interests of the shareholders of these companies practically as inextricable as under the trust. In 1899 the device of a holding company, the Standard Oil Company of New Jersey, was adopted to attain the same end as had been attained by the trust. This company acquired the stocks still in the hands of the trustees, issuing its own securities in return for them. It also acquired on the same basis stock that had been already distributed to individuals by the trustees. The authorized capital of the Standard Oil Company of New Jersey was $110,000,000. It controlled, along with refining plants, a number of crude-oil-producing companies, most of the pipe lines, a number of important marketing companies, and natural-gas companies. An important feature of the new concern was the number of subsidiary companies launched by it in the foreign field. As a result of the development of new petroleum fields, the proportion controlled by the Standard Oil Company was less under the new form of organization than under the old. But in 1904 the Standard refineries consumed 84.2 per cent of the crude oil of the whole country and produced 86.5 per cent of the refined oil. Standard Oil exports amounted to 87 per cent of the total.

In 1906 suit was brought against the Standard Oil Company in the United States Circuit Court at St. Louis, under the Sherman Antitrust Law. The company was convicted and its dissolution ordered in 1909. Under appeal the decision of the Circuit Court was affirmed by the Supreme Court May 15, 1911, and the corporation was given six months' time for working out a plan of dissolution. The plan adopted resulted in the distribution of stock in the subsidiary companies on a pro rata basis which, as in the case of the dissolution of the earlier trust, left the interests of the several stockholders combined and rendered serious competition in the industry impossible.

The profits of the Standard Oil combinations have since the beginning been large. The earnings under the trust, from 1882 to 1891, never fell below $8,000,000, and from 1886 averaged above $15,000,000. In the years after the ostensible dissolution, from 1892 to 1896, the earnings increased from $19,174,878 to $34,077,517. Under the corporate form between 1899 and 1905 earnings rose from $34,420,314 to $57,459,356. Since 1906 no figures have been published for the aggregate earnings of the concerns formerly constituent of the Standard Oil Company and still operating harmoniously.

Consult: G. H. Montague, *The Rise and Progress of the Standard Oil Company* (New York, 1904); *Report of the Commissioner of Corporations on the Petroleum Industry* (Washington, 1907); *Brief for the United States, Standard Oil Co. et al., defendants v. United States of America, October term 1909* (2 vols., ib., 1909); I. M. Tarbell, *History of the Standard Oil Company* (new ed., 2 vols., New York, 1911).

STANDARDS, UNITED STATES NATIONAL BUREAU OF. A bureau of the Department of Commerce of the United States government, charged by law with the custody of the national standards of weights and measures, the comparison with them of the standards used in scientific investigations, engineering, commerce, and educational institutions, the construction or reproduction of such standards, their multiples and subdivision, testing and calibration of standard measuring apparatus, the solution of problems arising in connection with standards, and the determination of physical constants and the properties of materials, when such data are of great importance to scientific or manufacturing interests and are not to be obtained with sufficient accuracy elsewhere. The Bureau of Standards, which took the place of the former Office of Standard Weights and Measures, was organized by Act of Congress approved March 3, 1901, with Dr. S. W. Stratton as its first director, who continued in that position in 1916. The laboratories and other buildings are located in the suburbs in the northwest section of Washington, D. C., about 3.5 miles from the White House. In 1914 there were 144 members of the scientific organization, in addition to other employees concerned with the office and general administration. The total appropriations for the fiscal year 1914 amounted to $839,215. The scientific work of the bureau is organized in divisions, as follows: Weights and Measures, Heat and Thermometry, Electricity, Optics, Chemistry, Structural Engineering and Miscellaneous Materials, Engineering Research, and Metallurgy.

In a fireproof vault are maintained the national standards of length and mass, two platinum-iridium meter bars, and two standard kilograms of the same material made at the Bureau Internationale, Sèvres, France, and by law the fundamental standards of weights and measures in the United States, to which such customary units as the foot and pound are referred and legally defined.

The Bureau of Standards prepares official specifications for much of the material purchased by the government, and also tests the quality of supplies when delivered. It undertakes researches to determine methods of testing and manufacture, and in coöperation with various manufacturing and industrial organizations aims to establish national standards which shall be adapted for universal use. It tests and calibrates accurate measuring devices for the various departments and their bureaus. It maintains several useful series of publications, which have achieved a high scientific reputation, and the services of its staff are in constant demand from various scientific and other organizations, especially in making investigations where ordinary commercial testing facilities are lacking, or methods have not been developed. The Bureau of Standards, in addition to its laboratories in Washington, maintains a special laboratory for the testing of structural materials at Pittsburgh, where a ten-million-pound Olsen testing machine is maintained. It also maintains an elaborate equipment of special cars for testing railway-track scales.

For further information consult *Annual Reports of the Director, Bureau of Standards*, and various bulletins listed in a bibliography published from time to time by the bureau.

STANDARD TIME. See Time, Standard.

STANDARD-WING. Either of two African nightjars of the genus *Macrodipteryx*, in which the second primary wing quill of the male is enormously elongated, so as to look like a pennant floating from the wing as the bird flies. In one species it has no vane except near the tip; and when the bird sits upon the ground these feathers stand upright. See Plate of Nightjars, etc.

One of the birds of paradise (*Semioptera wallacii*) is also known by this name.

STANDING FISHES BIBLE. See Bible, Curious Editions of.

STANDING STONES. See Megalithic Monuments.

STAND'ISH, Miles or Myles (1584–1656). An American colonist, born in Lancashire, England. He served in the English army in the Netherlands, and emigrated to America in 1620, being a passenger on the *Mayflower*. He was active among the Plymouth colonists as an explorer and Indian fighter, becoming military leader. In the summer of 1625, the Colony being in straits, Standish was sent to England to seek government intervention against the merchant adventurers, but was unsuccessful. He returned to the Colony in 1626 with supplies, and became one of the proprietors and settlers of Duxbury, Mass., where he held for life the office of magistrate. A granite monument to his memory has been erected in Duxbury. The second courtship of Standish is the subject of Longfellow's poem, *The Courtship of Miles Standish.* (See Alden, John.) Consult: J. S. C. Abbott, *Miles Standish, Captain of the Pilgrims* (New York, 1898); Tudor Jenks, *Captain Myles Standish* (ib., 1905); William Bradford, *History of Plymouth Plantation, 1606–1646*, edited by W. T. Davis (ib., 1908).

STANDPIPE. See Water Works.

STAN'FIELD, Clarkson (1793–1867). An English marine and landscape painter. He was born of Irish parents in Sunderland, Durham, and was self-taught in art, having commenced his career as a sailor and a scene painter. In 1835 he became Royal Academician, and, after painting many Italian, French, and Dutch views, in 1848 settled at Hampstead, where he executed some of his finest pictures, including "The Abandoned" (1856), and the "Battle of Trafalgar," painted for the United Service Club. He is represented in the Tate Gallery and the South Kensington Museum. He painted in a broad effective style, but his coloring is cold.

STAN'FORD, Sir Charles Villiers (1852–). A British composer, born in Dublin. He studied composition under O'Leary and Stewart, and singing at Queens' College, Cambridge. In 1873 he became organist of Trinity College and the following year a conductor of the university chorus. In 1883 he received the appointment of professor of composition and conductor of the orchestra at the Royal College of Music and in 1887 succeeded Macfarren as professor of music at Cambridge. Stanford was conductor of the Bach Choir (1885–1902), of the Leeds Philharmonic Society (from 1897), and of the Leeds Festival (1901–10). In 1902 he was knighted. His compositions include several operas, notably *Savonarola* (1884) and *Shamus O'Brien* (1896); incidental music to Tennyson's *Queen Mary* and *Thomas à Becket*, Æschylus' *Eumenides*, Sophocles' *Œdipus Rex;* some symphonies, concertos, etc.; the oratorio, *The Three Holy Children* (1885); a mass, a requiem, a *Stabat Mater;* numerous choral works with orchestra. Consult C. V. Stanford, *Pages from an Unwritten Diary* (New York, 1914).

STANFORD, Leland (1824–93). An American capitalist and patron of education. He was born at Watervliet, N. Y. In 1849 he removed to Wisconsin and for a time practiced law in Port Washington. In 1856 he established a commercial business in San Francisco. He was elected Governor of California on the Republican ticket in 1861. In the same year he became president of the new Central Pacific Railway Company, and, repairing to Washington, successfully urged upon Congress the passage of a bill granting government aid to the project. In the construction of the road he personally undertook the responsibility and supervision of that part of the road crossing the ridge of the

Sierra Nevada Mountains, and as a result 530 miles of mountain road were constructed in 293 days. The road was completed in 1869. Stanford was elected United States Senator in 1884 and in 1890. He founded Leland Stanford Junior University (q.v.) at Palo Alto, California, as a memorial to his son.

His wife, Jane Leland Stanford (1825–1905), was born at Albany, N. Y., and was married in 1850 to Mr. Stanford. She devoted herself largely to the development of Stanford University, particularly in connection with its notable architectural scheme. She also established a system of kindergarten schools in San Francisco, and a children's home at Albany, N. Y. She died at Honolulu.

STANG, stăng, Emil (1834–1912). A Norwegian statesman, son of Fredrik Stang. He studied law in Christiania and in 1884, two years after his election to the Storthing, was reckoned the leader of the Conservative party. In 1891 he was forced to retire after two fairly successful years as Prime Minister and became an assessor of the Christiania Supreme Court.

He was called upon again in 1893 to form a ministry and stayed in office through the confusion of the early part of 1895. The dispute as to the division of the consular offices between the two kingdoms caused his overthrow. Stang then returned to his former post in the Supreme Court.

STANG, Fredrik (1808–84). A Norwegian statesman, leader of the Conservative party and Norway's first Prime Minister. He represented Christiania in the Storthing in 1859–60, in 1861 formed a ministry, and in 1873 became first Prime Minister under the new cabinet regulations. He became popular owing to his part in the introduction of railroads and telegraphs and kept office in spite of a large radical majority in the Storthing until 1880, when he voluntarily resigned. Stang was a national authority on jurisprudence and constitutional law, his principal works being *Systematisk fremstilling af Kongeriget Norges konstitutionelle eller grundlovsbestemte ret* (1833) and *Om den kongelige sanktioneret efter Norges grundlov* (1883).

STANG, Fredrik (1867–). A Norwegian jurist and statesman, born in Christiania. He studied, with stipend, in Germany and England (1893–94), became advocate before the Supreme Court in 1896, and in 1897 was appointed professor of law in Christiania University. In Paris he studied French and comparative law of property in 1905–06. He was member of the Christiania City Council (1905–08) and leading conservative member of the Storthing (1906–09), to which he declined reelection in order to continue his work at the university and his literary activities. In 1911 appeared his important work *Norsk Formuesret* (Norwegian Law of Property), vol. i. In 1912 he served the Bratlie ministry as chief of the Department of Justice.

STANGE, shtăng'ĕ, Carl (1870–). A German Protestant theologian. He was born at Hamburg, and was educated at Halle, Göttingen, Leipzig, and Jena. He became privatdocent at Halle in 1895, and professor of systematic theology at Königsberg in 1903, at Greifswald in 1904, and at Göttingen in 1912. His writings include: *Die christliche Ethik in ihrem Verhältnis zur modernen Ethik* (1892); *Die systematischen Prinzipien in der Theologie des Johann Musäus* (1897); *Das Dogma und seine Beurteilung in der neueren Dogmengeschichte* (1898); *Einleitung in die Ethik* (2 vols., 1901–02); *Der Gedankengang der Kritik der reinen Vernunft* (1902; 3d ed., 1907); *Luthers älteste ethische Disputationen* (1904); *Theologische Aufsätze* (1905); *Das Frömmigkeitsideal der modernen Theologie* (1907; 3d ed., 1908); *Schleiermachers Glaubenslehre* (1910); *Christentum und moderne Weltanschauung* (1913); *Die Gemeinschaft mit dem lebendigen Gott* (1913).

STANGELAND, stăng'*e*-länt, Karin Michaëlis. See Michaëlis, Sophus.

STANGL, shtăng''l, Thomas (1854–). A German classical scholar, born at Aufhausen, Ober-Pfalz. He studied at Regensburg, and at the University of Munich. He traveled often, for purposes of study, in Italy, Greece, Sicily, and France. In 1908 he became professor of classical philology at the University of Würzburg. His publications include: *Boethiana* (1882); editions of Cicero, *Orator* (1885), *Brutus* (1886), *De Oratore* (1893); *Virgiliana* (1891); *Tulliana* (1898); an edition of Q. Curtius Rufus (1902); *Pseudoasconiana* (1909); *Asconiana* (1910); *Ciceronis Orationum Scholiastæ*, vol. ii, *Commentarios Continens* (1912).

STANHOPE, stăn'*o*p, Charles, third Earl (1753–1816). An English statesman and scientist. He was born in London and was educated at Eton and at Geneva. Returning to London, he married the eldest daughter of Lord Chatham (1774), was elected to Parliament (1780), and succeeded to his father's peerage (1786). Sympathizing with the French Revolution, he introduced into the House of Lords a motion against English interference in the affairs of France. As his motion had no support, he was thereafter known as "the minority one." He was caricatured as "Citizen" Stanhope. He devised several mechanical inventions, of which the most important was an iron hand press, called the Stanhope printing press. He also perfected a process of stereotyping, and constructed two calculating machines. Consult Stanhope and Gooch, *Life of Charles, Third Earl Stanhope* (New York, 1914).

STANHOPE, Lady Hester Lucy (1776–1839). The eldest daughter of Charles, third Earl Stanhope. In 1803 she went to reside with her uncle, William Pitt, and became his most trusted confidant and private secretary. Till his death she exercised her imperious instincts. After that a pension of £1200 a year was assigned her by the King. She left England and wandered in the Levant, finally settling among the semicivilized Druses of Mount Lebanon in a convent, which she fortified, at the village of Djoun. Here she adopted Eastern manners and by her strong character obtained a curious ascendancy among the rude races around her. She was regarded with reverence as a sort of prophetess, and gradually came so to consider herself. Assuming the garb of a Mohammedan chieftain, she adopted a religion which seems to have been sincere and was compounded in about equal proportions from the Koran and the Bible. Consult: C. L. Meryon, *Memoirs of Lady Hester Stanhope* (3 vols., London, 1845); id., *The Seven Years' Travels of Lady Hester Stanhope* (ib., 1846); Mrs. Charles Roundell, *Lady Hester Stanhope* (ib., 1909); Frank Hamel, *Lady Hester Lucy Stanhope: A New Light on her Life and Love Affairs* (New York, 1913).

STANHOPE, James, first Earl (1673–1721). An English soldier, born in Paris and educated at Oxford. He took an important part in the siege of Barcelona in 1705, and in 1706 was appointed Minister to Spain. In 1708, under Eugene's orders, he captured Port Mahon, and in 1710 saw the final success of his policy of offensive action in the victories of Almenara and Saragossa. But at the close of the year, separated from his allies and surprised by the swift approach of the Bourbon army under Vendôme, after a brief defense he surrendered at Brihuega. Upon his return to England (1712) he entered politics; became Secretary of State for the Southern Department in 1714; and, after being Chancellor of the Exchequer, was again Secretary of State. His foreign policy was vigorous and excellent, especially in the formation of the Quadruple Alliance in 1718 between England, France, Austria, and Holland.

STANHOPE, Philip Dormer. See Chesterfield, P. D. Stanhope, fourth Earl.

STANHOPE, Philip Henry, Earl (1805–75). An English historian, born at Walmer and educated at Christ Church, Oxford. To his efforts are largely due the National Portrait Gallery, the Historical Manuscript Commission, and the copyright law (1842). Though not a great historian, as Macaulay said, he was clear, concise, and exhibited "great diligence in examining authorities, great judgment in weighing testimony, and great impartiality in estimating characters." His most important works are: *The War of the Succession in Spain; A History of England from the Peace of Utrecht to the Peace of Versailles, 1713–1783*, in 7 vols.; *The History of England, Comprising the Reign of Queen Anne, until the Peace of Utrecht* (4th ed., 1872). The two works last named are the most elaborate. He also wrote a *Life of the Right Hon. W. Pitt.*

STANIMAKA, stă'nê-mă'kȧ. A town of Bulgaria, 12 miles southeast of Philippopolis (Map: Balkan Peninsula, E 3). It has a trade in wine. Pop., 1893, 13,089.

STAN'ISLAS I LESZCZYNSKI, lyĕsh-chĭn'y'skê (1677–1766). King of Poland from 1704 to 1709, and again in 1733. He was born at Lemberg, Galicia, of one of the greatest among the old Polish noble families. He was Palatine of Posen at the time of the war between Augustus II (q.v.) of Saxony and Poland and Charles XII (q.v.) of Sweden, which cost Augustus the Polish throne, and conducted negotiations between them in such a manner as to win the regard of the Swedish King, who secured the election of Stanislas to the Polish throne in 1704. In 1709, when Charles XII was crushed by Peter the Great in the battle of Poltava, Augustus recovered Poland. The property of King Stanislas was confiscated and he joined Charles at Bender, in Bessarabia. He was Governor of Zweibrücken, in the Palatinate, from 1714 until the death of Charles XII, when he took up his residence in Alsace. His daughter Maria became the wife of Louis XV of France in 1725, and this alliance enabled Stanislas to obtain the election to the Polish throne on the death of Augustus II, in 1733. The latter's son, Augustus III, was, however, installed with the support of a Russian army. The War of the Polish Succession ensued, and by the preliminary Treaty of Vienna, in 1735, Augustus III was recognized as King of Poland. Stanislas retained his estates and received the duchies of Lorraine and Bar (after his death to fall to France), together with a pension of two million francs. He was also allowed to retain the title and dignity of King of Poland. He maintained a court at Lunéville and Nancy, encouraged letters, established institutions of learning, and earned the title *le bienfaisant*. He left four volumes, *Œuvres du philosophe bienfaisant* (1767). Consult Marquis des Réaulx, *Le roi Stanislas et Marie Leczinska* (Paris, 1895).

STANISLAS II AUGUSTUS (1732–98). The last King of independent Poland (1764–95). He was the son of Count Stanislas Poniatowski (q.v.) and was born at Wolczyn. In 1752 he was elected to the Diet and afterward was sent as a representative to the Russian court. There he gained the favor of the future Catharine II, who, after the death of Augustus III of Poland (1763), successfully exerted her influence to bring about the election of Stanislas to the throne in September, 1764. Although he was very well educated and was a fine specimen physically he lacked force of character, and the anarchic condition of the country in his reign brought spoliation by Russia, Austria, and Prussia. On the third and final partition of the Kingdom, in 1795, he laid down his crown. See Poland.

STANISLAU, stăn'ĭs-lou (Pol. *Stanislawów*). A town in the Crownland of Galicia, Austria, on the Bistritza, 75 miles southeast of Lemberg (Map: Austria, J 2). There are railway construction shops, flour mills, dyeworks, and tanneries. Stanislau was occupied, but later evacuated, by the Russians in the Great War which began in 1914. See War in Europe. Pop., 1900, 29,628; 1910, 33,328.

STANKEVITCH, stȧn'kĕ-vĭch, Nikolai Vladimirovitch (1813–40). A Russian literary leader. He was born in the Province of Voronezh and studied at Moscow University, where began the intellectual leadership that culminated in the formation of the famous "Circle of Stankevitch." This circle, in contradistinction to a rival group of intellectuals constituting the "Circle of Herzen" (see Herzen, A. I.), was held together by a common interest in philosophy, art, and literature and thus counteracted the utilitarian and materialistic thought of the day. In this way Stankevitch, through his intimate intercourse with the great writers of his time, exercised a dominant influence on his contemporaries—an influence which is the more remarkable from the fact that he himself wrote nothing worth mentioning.

STAN'LEY, Arthur Penrhyn (1815–81). An English scholar and divine. He was born at Alderley, of which his father (afterward Bishop of Norwich) was rector. From 1829 to 1834 he was at Rugby, and was profoundly impressed by the influence of Dr. Arnold, head master, which molded his whole life. His own position in the school was one of marked power, the impression of which is reproduced in Hughes's *Tom Brown's School Days*, though Hughes and Stanley were not, as is supposed, intimate friends at Rugby. He entered Balliol College, Oxford, in 1834. In 1838 he was elected a fellow of University College, was ordained deacon in 1839, and priest in 1843, and soon acquired a great influence, taking a definite stand in favor of latitude and liberality in religious matters, defending Ward and Hampden, as later he defended Jowett and Colenso. He was made canon of Canterbury in 1851, regius professor of ecclesiastical history and canon of Christ Church in 1856, and dean of Westminster in 1864. Here he assumed a commanding position, and used it, as the recognized leader of the Broad Church party in England, for widening the bounds of the national church. His preaching was more ethical than doctrinal, and his intercourse with those outside the Church of England, whom he welcomed to the abbey and even to its pulpit, although it offended many strict churchmen, gained him a wide popularity. He accompanied the Prince of Wales (later King Edward VII) on his tour through the East in 1862, and was closely associated with Queen Victoria—her chaplain for many years. In 1863 he married Lady Augusta Bruce, daughter of the Earl of Elgin. He traveled in the United States in 1878, and made memorable addresses. His most important literary work was his *Life and Correspondence of Dr. Arnold* (1844, new ed., 1903). Other noteworthy books were his *Historical Memorials of Canterbury* (1855, new ed., 1906); *Sinai and Palestine* (1856, new ed., 1903); *Lectures on the History of the Eastern Church* (1861, new ed., 1907); *Lectures on the History of the Jewish Church* (1863–76, new ed., 1901–02); *Memorials of Westminster* (1868, new ed., 1899); *Essays on Church and State* (1870); *Christian Institutions* (1871, new ed., 1906). Consult: R. E. Prothero, *Life and Correspondence of Dean Stanley* (2 vols., London, 1893, new ed., 1909); id., *Letters and Verses of Dean Stanley* (ib., 1895); C. G. Bradley, *Recollections of A. P. Stanley* (ib., 1883); Bryce, *Studies in Contemporary Biography* (New York, 1903); Julia Wedgwood, *Nineteenth Century Teachers* (London, 1909); Paul Thureau-Dangin, *English Catholic Revival in the Nineteenth Century* (2 vols., ib., 1914).

STANLEY, Charles. See Monck, Charles Stanley, fourth Viscount.

STANLEY, David Sloane (1828–1902). An American soldier, born in Cedar Valley, Ohio. He graduated at West Point in 1852. During 1861 he served in Kansas and Missouri, taking part in the battle of Wilson's Creek, and in 1861 was appointed brigadier general of volunteers. In 1862 he commanded a division of the Army of the Mississippi in operations at New Madrid and Island Number 10, and in the battles of Iuka and Corinth. In 1862 he became chief of cavalry of the Army of the Cumberland, and on November 29 was promoted major general of volunteers. He was in the battle of Stone River, in the Atlanta campaign, in the movement of concentration about Nashville, and in the engagement at Franklin, Nov. 30, 1864. A wound received there terminated his active campaigning. For gallantry in this battle he received the brevet of major general, U. S. A. After the war he became colonel of the Twenty-second Infantry and was actively engaged against the Indians in the Northwest. In 1884 he became a brigadier general, retiring in 1892.

STANLEY, Edward Henry Smith. An English statesman, fifteenth Earl of Derby (q.v.).

STANLEY, Sir Henry Morton (1841–1904). A British African explorer. He was born at Denbigh, Wales, the son of John Rowlands, who died when the boy was two years old. After spending nine years in a workhouse and then living with various relatives, he shipped at 18 as a cabin boy on a sailing vessel to New Orleans. There he found employment through the help of a merchant named Stanley, whose name he took. While living in Arkansas he enlisted in the Confederate army. In the battle of Shiloh (1862) he was captured, but after two months in prison he enlisted in the Federal artillery (his sympathies had really been with the North). Discharged after severe illness, he returned to his Welsh relatives, but was not received. In 1864 he enlisted in the United States navy and became a ship's writer. A swim of 500 yards under fire to fix a line to a Confederate steamer was an exploit for which he became noted. After the war he left the navy and wrote for newspapers, had various adventures in Asia Minor (1866), and in 1867 acted as newspaper correspondent in one of the Indian campaigns in the West. By this time he had gained a reputation for enterprise and for vivid and able journalistic writing. In 1868 he was sent by the New York *Herald* to Abyssinia with the British expedition under Sir Robert Napier. In 1869 James Gordon Bennett (q.v.) of the *Herald* dispatched Stanley to find David Livingstone (q.v.) in Central Africa, but because of certain other commissions given him, Stanley did not reach Zanzibar until Jan. 6, 1871. He left for the interior March 21, with about 200 men, and on November 10 met the feeble and almost helpless Livingstone at Ujiji, on Lake Tanganyika (see Tanganyika), nursed him back to better health, and, since Livingstone declined to return to Europe, gave him the supplies needed to continue his explorations. After taking part with Livingstone in an exploration of the northern end of Lake Tanganyika, Stanley returned to Europe in 1872, and in 1873 was sent by the *Herald* to west Africa to report the British campaign against the Ashantis.

In 1874 Stanley determined to take up the exploration of Africa where Livingstone, dying, had left it. The New York *Herald* and the London *Daily Telegraph* shared the expense of fitting out this expedition. On Nov. 11, 1874, Stanley left Zanzibar, with 356 native followers, two white companions, and a white servant. Stanley's first great work was a boat survey of the coasts of the Victoria Nyanza (q.v.), to the west of which he discovered Lake Edward (q.v.), or Edward Nyanza, one of the head reservoirs of the Nile. He found that the Kagera or Alexandra Nile, rising near Lake Tanganyika, was the most important feeder of the Victoria Nyanza. Arriving at Tanganyika (1876), he sought in vain for its outlet, the fact being that the level of the lake was then so low that no water was passing through the Lukuga into the Congo (q.v.). His expedition had been greatly enfeebled by fever and smallpox, but he pushed westward to Nyangwe, on the Lualaba, which Livingstone and Cameron had visited. Stanley determined to make his way down the great river, and in November, 1876, embarked on the perilous journey. He was frequently attacked by cannibals, thousands of whom sometimes pursued him in canoes, and if it had not been for his guns his expedition would undoubtedly have perished. After a voyage of over 1500 miles, in the course of which he twice crossed the equator, he emerged on the Atlantic coast, having lifted the veil that had hitherto hung over the Congo, which was thus shown to be the same river as the Lualaba. On Aug. 9, 1877, the party marched into Boma, on the lower Congo, having traveled more than 7000 miles. Besides his three white companions, Stanley lost 170 of his porters. In the spring of 1879 he sailed again for Africa, under the auspices of the African International Association (q.v.), which King Leopold II (q.v.) of Belgium had been instrumental in founding. (This organization developed into the International Association of the Congo.) Stanley now began five years of incessant toil, founding stations from Vivi, on the lower Congo, to Stanley Falls, about 1300 miles up the river, acquiring treaty rights from more than 400 native chiefs, building a road through the cataract country, and having all his supplies and even steamboats (in sections) carried 235 miles around the rapids of the lower Congo. The years 1885 and 1886 were a period of comparative rest for the explorer, who had now been the recipient of honors from learned societies all over the world and was the most distinguished of living explorers.

In 1886 Stanley was placed at the head of an expedition for the relief of Emin Pasha (q.v.), Governor of the Equatorial Province of the Egyptian Sudan. In March, 1887, he reached the mouth of the Congo, ascended it to the Aruwimi, pushed on to the head of navigation on this tributary, and then struck out through the equatorial wilderness in the direction of the Albert Nyanza. (See Lake Albert.) The party for months had to hew their way through seemingly interminable tropical forests, and did not reach the Albert Nyanza until Dec. 13, 1887. In April, 1888, the intrepid Emin Pasha made his appearance on the shores of the lake. Stanley now retraced his steps to the Aruwimi in order to bring up a detachment of men which he had left there. For the third time he crossed the vast forest, and in January, 1889, with the remnant of his men, only one-third of the original number, he rejoined Emin, with whom he proceeded to the coast. On this journey Stanley made his second crossing of Africa, emerging at Zanzibar, Dec. 6, 1889, after learning the extent of the great forest, and discovering the water connection of Lake Albert with Lake Edward, the snow-capped Ruwenzori mountain chain between the two lakes, and the southwestern prolongation of the Victoria Nyanza. This expedition ended his active career in Africa, about which continent he had given to the world more knowledge than any other man. The successful founding of the Congo Free State (see Congo, Belgian) was largely due to the confidence he inspired and the friendships he won. At the same time he did not hesitate to fight the Africans with every resource at his command if their hostility threatened the destruction of his expeditions or imperiled his enterprises.

Stanley was married to Miss Dorothy Tennant, an artist, in 1890. The next year he became again a subject of Great Britain, and in July, 1895, he entered Parliament for North Lambeth, as a Liberal Unionist, but did not seek reëlection in 1900. He paid a last visit to Africa in 1897. In 1899 he was made G.C.B. He died in London, May 10, 1904, and after a funeral in Westminster Abbey was buried at Pirbright, Surrey. The dean of Westminster refused to have him buried in the abbey because of a belief that Stanley had been inhuman to the African natives, but this belief has since been discredited by authoritative writers. His books, which are among the most notable of their kind and most of which have been translated into several languages, comprise: *How I Found Livingstone* (1872); *My Kalulu* (1872); *Coomassie and Magdala* (1874); *Through the Dark Continent* (1878); *The Congo* (1885); *In Darkest Africa* (1890); *My Dark Companions and their Strange Stories* (1893); *Slavery and the Slave Trade in Africa* (1893); *My Early Travels and Adventures in America and Asia* (1895); and *Through South Africa* (1898). Consult Stanley's *Autobiography*, edited by his wife (London, 1909); also A. J. Wauters, *Stanley's Emin Pasha Expedition* (London, 1890).

STANLEY, Thomas (1625–78). An English translator, born at Cumberlow, Hertfordshire, and educated at Cambridge. During the Civil War he traveled on the Continent, returning near its close and taking rooms in the Middle Temple, where he devoted himself to literature. He wrote considerable verse, and translated many classical writers. Long famous were his edition of Æschylus with a Latin translation (1663) and his compilation under the title *History of Philosophy* (4 vols., 1655–62). Consult Stanley's *Poems and Translations*, edited with memoir by S. E. Brydges (London, 1814–15), and his translations of Anacreon, edited by A. H. Bullen (Bohn's Classical Library, ib., 1893).

STAN'NARD, Henrietta Eliza Vaughan (Palmer) (1856–1911). An English novelist, born at York. She became well known under the pseudonyms John Strange Winter and Violet Whyte. In 1884 she married Arthur Stannard, a civil engineer. Of her stories Ruskin said that they were the most faithful of studies of the character of the British soldier. She was first president of the Writers' Club in 1892 and president of the Society of Women Journalists in 1901–03. Her first great successes were *Sketches of Cavalry Life* (1881), *Bootles' Baby* (1885), and *Houp-la* (1885). Among later writings are: *On March* (1886); *Garrison Gossip* (1887); *A Blameless Woman* (1895); *Heart and Sword* (1898); *The Married Miss Binks* (1900); *A Blaze of Glory* (1902); *Marty* (1903); *Cherry's Child* (1904); *Little Vanities of Miss Whittaker* (1904). She also wrote some 70 other books, mostly novels and stories.

STAN'NITE, or Tin Pyrites. A sulphostannate of copper and iron occurring in isometric tetrahedral crystals. It is found with other tin ores in Cornwall.

STAN'NOTYPE. See Photography, *Photomechanical Processes.*

STANOVOI (stä'nô-voi') **MOUNTAINS.** A mountain range of east Siberia. It begins on the Mongolian frontier south of Lake Baikal, where it merges with the Altai Range and is known as the Yablonoi Mountains (Map: Asia, P 3). Thence it extends northeast in a large zigzag line 2400 miles, following for a part of its length the shores of the Sea of Okhotsk, and terminating in the East Cape on the Bering Strait. It reaches its highest altitude, over 8000 feet, in Mount Tehokhondo, or Sokhondo, in the extreme southern part, where it consists of rounded ridges covered with birch and larch forests; from this point the heights decrease northward until they lose their mountain character and become an irregular collection of plateaus, hills, and small peaks, the water parting between the Pacific and Arctic oceans.

STANSFELD, Sir James (1820–98). An English politician, born at Moorlands, Halifax. He graduated from University College, London, in 1840, and was called to the bar in 1849. He became an intimate friend of Mazzini, and from 1859 to 1895 was a member of Parliament, where he advocated the cause of Italian unity.

In 1863–64 he served as Junior Lord of the Admiralty, was successively Undersecretary of State for India, Third Lord of the Treasury, Financial Secretary to the Treasury, President of the Poor Law Board, and finally served as President of the Local Government Board in 1871–74 and in 1886. In 1895 he was created G.C.B.

STAN'TON, Edwin McMasters (1814–69). An eminent American statesman, born at Steubenville, Ohio, Dec. 19, 1814, of Quaker descent. He studied at Kenyon College from 1831 to 1833, later studied law, and was admitted to the bar in 1836. He first practiced in Cadiz, Ohio, and in 1837 became prosecuting attorney of the county. Later he practiced in Steubenville, Ohio, and in Pittsburgh, Pa., where he became the leader of the bar, and gained a high reputation, in particular, for his conduct of cases. In 1856 he removed to Washington, practicing before the United States Supreme Court. In 1858 he was in California as counsel of the United States in important land cases. After Lincoln's election in 1860, on the reorganization of Buchanan's cabinet, Stanton became Attorney-General, succeeding Jeremiah Black. In politics he had been a Jacksonian Democrat, but later became an antislavery advocate, and while in Buchanan's cabinet took a firm stand for the Union, declaring that the surrender of Sumter would be a public crime. In March he retired with the outgoing cabinet, but in January, 1862, was recalled by Lincoln, and given the portfolio of Secretary of War, in which office he shared with the President the burden of vast war operations. His administration was marked by integrity, judgment, determination, and force, which won admiration, though provoking some just criticism.

After the assassination of President Lincoln Stanton tendered his resignation, but was induced by President Johnson to remain. After the breach between President Johnson and Congress over questions growing out of reconstruction Stanton strongly supported Congress. The President called for his resignation on Aug. 5, 1867. Stanton refused to resign, on the ground that his withdrawal would interfere with the execution of the reconstruction acts, to which the President was bitterly opposed, and was encouraged by the Republican leaders to hold to the office. On the 12th of August the President suspended him, and, Congress being in recess till November, Stanton felt obliged to yield, and General Grant became Secretary ad interim by an executive order. On the reassembling of Congress, Stanton was restored, Grant retiring. Later, Johnson again tried to displace him, but impeachment (q.v.) intervened. Stanton afterward resumed the practice of his profession, but with failing health. On Dec. 20, 1869, President Grant nominated him an associate justice of the Supreme Court, and he was at once confirmed by the Senate. He died four days after this appointment. Consult: G. C. Gorham, *Life and Public Services of Edwin M. Stanton* (2 vols., Boston, 1899); D. M. DeWitt, *The Impeachment and Trial of Andrew Johnson* (New York, 1903); F. A. Flower, *Edwin McMasters Stanton* (Akron, Ohio, 1905).

STANTON, Elizabeth Cady (1815–1902). An American reformer and pioneer leader in the woman's suffrage movement. She was born at Johnstown, N. Y., and married Henry B. Stanton (q.v.), the antislavery reformer. She became interested in the antislavery and other reform movements at an early age, and through acquaintance with Lucretia Mott (q.v.) was led to sign the call for the first woman's rights convention, held in Seneca Falls, N. Y., in 1848. This convention made the first formal demand for the extension of the suffrage to women, and of the National Woman's Suffrage Association there formed Mrs. Stanton became the first president, retaining that office until 1893. From 1848 she devoted much time to traveling from State to State, addressing political conventions and State Legislatures in behalf of woman's rights. In 1868 she was a candidate for Congress. She was connected editorially with various reform periodicals, and was joint author with Susan B. Anthony and others of *A History of Woman Suffrage* (4 vols., 1887–1902). For her daughter, also a leader in the woman's suffrage movement, see Blatch, Harriot Stanton. Consult Mrs. Stanton's autobiography, *Eighty Years and More* (New York, 1898).

STANTON, Frank Lebby (1857–). An American poet and journalist, born at Charleston, S. C. He was connected editorially with newspapers in Atlanta, and finally joined the staff of the Atlanta *Constitution*. Some of his poems were collected as *Songs of the Soil* (1894); *Comes One with a Song* (1898); and *Little Folks down South* (1904). Stanton's verse has distinct literary merit, presenting faithfully the folklore and crude poetry of the Southern negro.

STANTON, Henry Brewster (1805–87). An American reformer and journalist, born in Griswold, Conn. In the Abolition movement he became prominent and allied himself with the political Abolitionists in opposition to the followers of William Lloyd Garrison, who did not favor political action. In 1840 he married Elizabeth Cady, and proceeded to London, where he was secretary of the World's Antislavery Convention. Later he studied law, and practiced in Boston, and later in Seneca Falls, N. Y., being elected from there to the State Senate in 1849 and 1851 as a Free-Soil Democrat. He took part in the organization of the Republican party. He was a member of the staff of the New York *Tribune* for several years, and an editor of the New York *Sun* from 1868 until his death. He published *Sketches of Reforms and Reformers in Great Britain and Ireland* (1849), and *Random Recollections* (1886).

STAN'WIX, John (1690–1766). An English soldier. He entered the army in 1706, and in 1756 he came to America as commander of the Sixtieth or Royal Americans, and was put in charge of the southern district with headquarters at Carlisle, Pa. He was sent to Albany in 1758 and erected Fort Stanwix at the Oneida portage. At the time of Wolfe's expedition against Quebec Stanwix commanded in Pennsylvania and repaired and strengthened Fort Pitt. He returned to England in 1760, and was appointed Governor of the Isle of Wight. He was drowned while crossing St. George's Channel.

STAN'YHURST, Richard (1547–1618). A translator of Vergil, born in Dublin, Ireland, and educated at Oxford. He contributed a "Description of Ireland" and a "History of Ireland" (during the reign of Henry VIII) to Holinshed's *Chronicles* (1577). Two years later he passed over to the Continent never to return. At Leyden he published his translation of the first four books of the *Æneid* into English hexameter verse (1582). The work is curious as an attempt to base English verse on quantity rather than on stress or accent. He thereafter devoted himself to histories and theological treatises in Latin prose. Having become a Roman Catholic, probably not long after he had left England, and having entered the priesthood of his church, Stanyhurst was appointed chaplain to Archduke Albert, the Spanish ruler of the Netherlands, and was involved in the intrigues against Elizabeth. He died at Brussels. Consult the reprint of the *Translation of Vergil*, edited, with introduction, by Arber (London, 1895).

STANYUKOVITCH, stȧn-yōō'kō-vĭch, KONSTANTIN MIKHAILOVITCH (1844–1903). A Russian writer, born at Sevastopol. He received a military education and entered the navy, in which he served till 1864. Afterward he went to St. Petersburg to devote himself to literature. Having incurred government displeasure by his advanced opinions, he was banished to the Province of Tomsk. The three years' exile gave him leisure to elaborate the abundant material he had gathered while in the navy. The immediate results were his *Letters of a Famous Foreigner* and *Sea Tales*, the latter perhaps his best-known and most representative work. His writings have been repeatedly published (12 vol. ed., St. Petersburg, 1906–07, with a biographical sketch of the author). Notable are his novels, *The Two Brothers*, *The Unconcerned*, and *No Way Out*. Stanyukovitch's great service to Russian literature consisted in graphically depicting the life of sailors, as Tolstoy had portrayed military life.

STAPFER, stȧp'fâr', PAUL (1840–). A French essayist, born in Paris, where he was educated at the Bonaparte Lyceum. He was tutor in the family of Guizot, and afterward became a professor of foreign literature in the faculty of Grenoble. In 1883 he accepted a similar chair at Bordeaux. Stapfer's essays are remarkable for their clearness of style, perfection of finish, and accuracy of detail. Among his works are: *Petite comédie de la critique littéraire de Molière selon les trois écoles philosophiques* (1866); *Causeries guernesiaises* (1881); *Shakespeare et l'antiquité* (1883); *Goethe et ses deux chefs-d'œuvre classiques* (1881); *Racine et Victor Hugo* (1886); *Rabelais, sa personne, son génie, son œuvre* (1889); *Montaigne* (1894); *La grande prédication chrétienne en France: Bossuet, Adolphe Monod* (1898); *Des réputations littéraires* and *Victor Hugo et la grande poésie satirique en France* (1901); *Questions esthétiques et religieuses* (1906); *Vers la vérité* (1909). He edited the *Grands écrivains* series.

STAPH'YLOCOC'CUS. See BACTERIA.

STAPH'YLO'MA (Neo-Lat., defect of the eye within the cornea). A protrusion of the cornea (rarely of the sclera) of the eye due to weakening of its coats through injury or ulceration. Excessive intraocular tension is often a factor. The iris is generally prolapsed or incarcerated. Staphyloma of the cornea may be total, partial, or multiple, depending on whether the entire cornea or a circumscribed portion of it is involved. The affection is accompanied by pain, loss of vision, and disfigurement. The treatment is purely surgical. It may often be prevented by the use of compression during the healing of a perforating ulcer, until a firm cicatrix is formed. When staphyloma is fully established ablation of the apex may be practiced, the lens being removed at the same time, and the wound allowed to heal under a compress bandage, with or without stitching. When this is not successful, removal of the contents of the globe (exenteration) or enucleation of the eye must be resorted to.

STAPH'YLOR'APHY. See PALATE.

STAPLE (AS. *stapel*, prop, post). In England, a town officially designated by the government as a market for sale and exportation of the staple commodities. All towns were not staple towns. They were originally for the convenience of the tax collector, but their inhabitants appreciated the monopoly and jealously guarded their privileges. Consult: Charles Gross, *The Gild Merchant* (2 vols., Oxford, 1890); A. L. Jenckes, *The Origin, the Organization and the Location of the Staple of England* (Philadelphia, 1908); William Cunningham, *Growth of English Industry and Commerce* (5th ed., 3 vols., Cambridge, 1910–12).

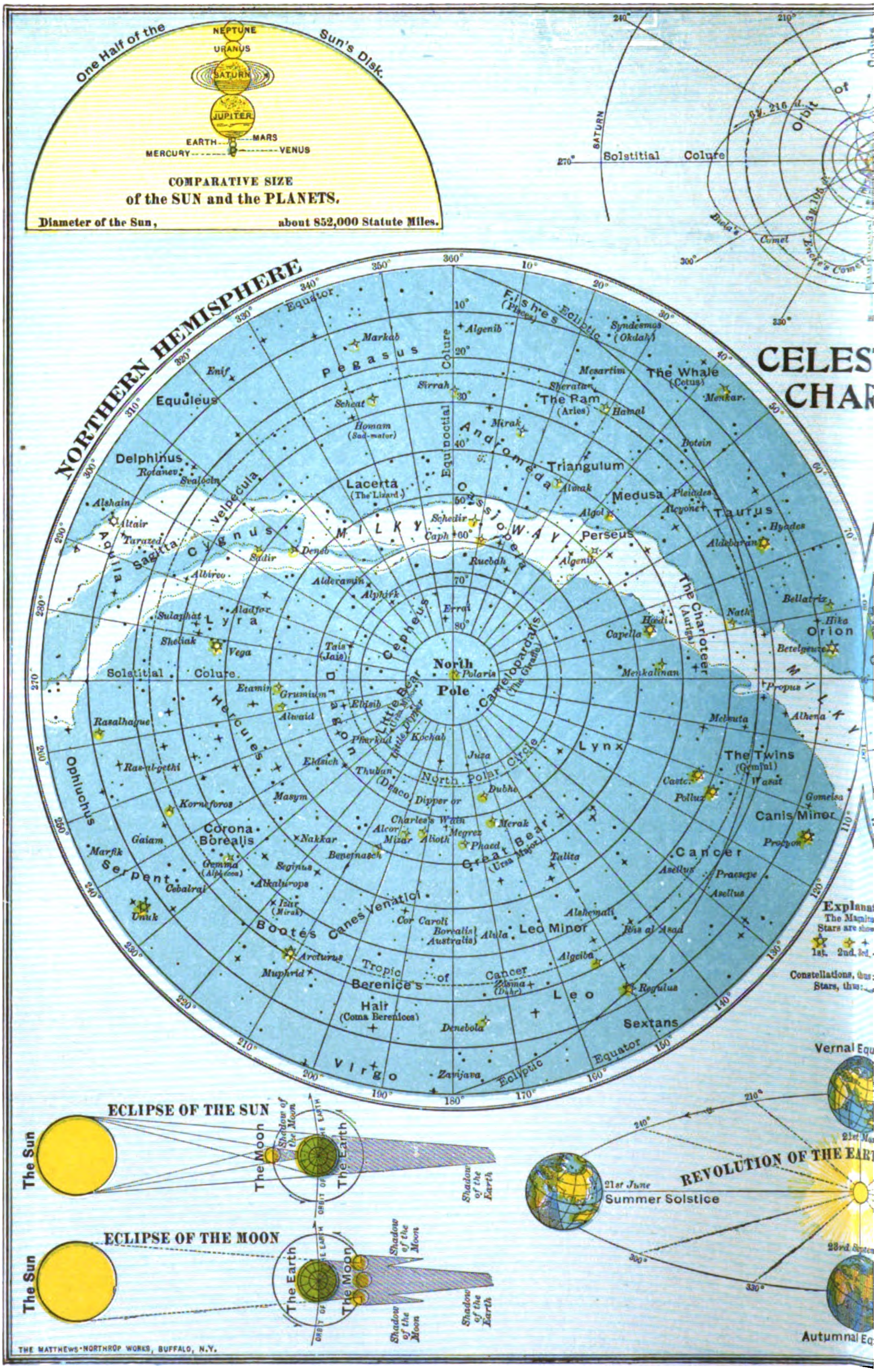
STAPLES, stā'p'lz. A city in Todd Co., Minn., 132 miles northwest of Minneapolis, on the Northern Pacific Railroad (Map: Minnesota, C 4). It has railroad repair shops. Pop., 1900, 1504; 1910, 2558.

STAPLES, THE. See FARNE ISLES.

STAPLES, WILLIAM READ (1798–1868). An American jurist and historian, born in Providence, R. I. He graduated at Brown University in 1817, studied law, and in 1819 was admitted to the bar. He rose rapidly in his profession, was an associate justice of the Supreme Court of Rhode Island from 1835 to 1854, and from 1854 to 1856 was Chief Justice. He was an authority on Rhode Island history and published *Annals of Providence to 1832* (1843); *Proceedings of the First General Assembly for the Incorporation of Providence Plantations in 1647* (1847); *Rhode Island Farm-Book* (1859). He edited vol. ii of the Rhode Island Historical Society's *Collections* and Samuel Gorton's *Simplicities' Defense Against Seven-Headed Policy* (1835).

STAPPEN, *Fr. pron.* stȧ'päN', CHARLES PIERRE VAN DER (1843–). A Belgian sculptor, born at St. Josse-ten-Noode, near Brussels. He studied in the studio of Portaels, and afterward independently in Paris under the influence of Rude, Mercié, and Carpeaux. Among his early works are "Faun's Toilet" (1869, gold medal, Brussels), the "Man with the Sword" (1876, Brussels Museum), and "Orchestration," a pediment for the Brussels Conservatory. Maturer works, such as a youthful "David" (Munich Academy), resulted from a sojourn in Italy. In 1883 he was appointed professor at the Brussels Academy, and thereafter produced the group "Instruction in Art" (Palais des Beaux-Arts), "Saint Michael" (Hôtel de Ville), the statue of "William the Silent" (Place du Petit Sablon); "The Wrestlers," "The City Builders," the "Chimera Fountain" (all in Brussels). He also fashioned portrait busts of great vivacity, and various objects of industrial art, notably a silver centrepiece for the municipality of Brussels. Van der Stappen was one of the founders of the modern Belgian realistic school. His work has fine decorative quality, is skillfully executed, and combines grace with power. In 1898 he was appointed director of the Brussels Academy and received the great gold medal in Berlin.

STAR (AS. *steorra*, star). One of those heavenly bodies which remain apparently immovable with respect to one another. Hence they were early called fixed stars, a name which they retain, though their perfect fixity has been



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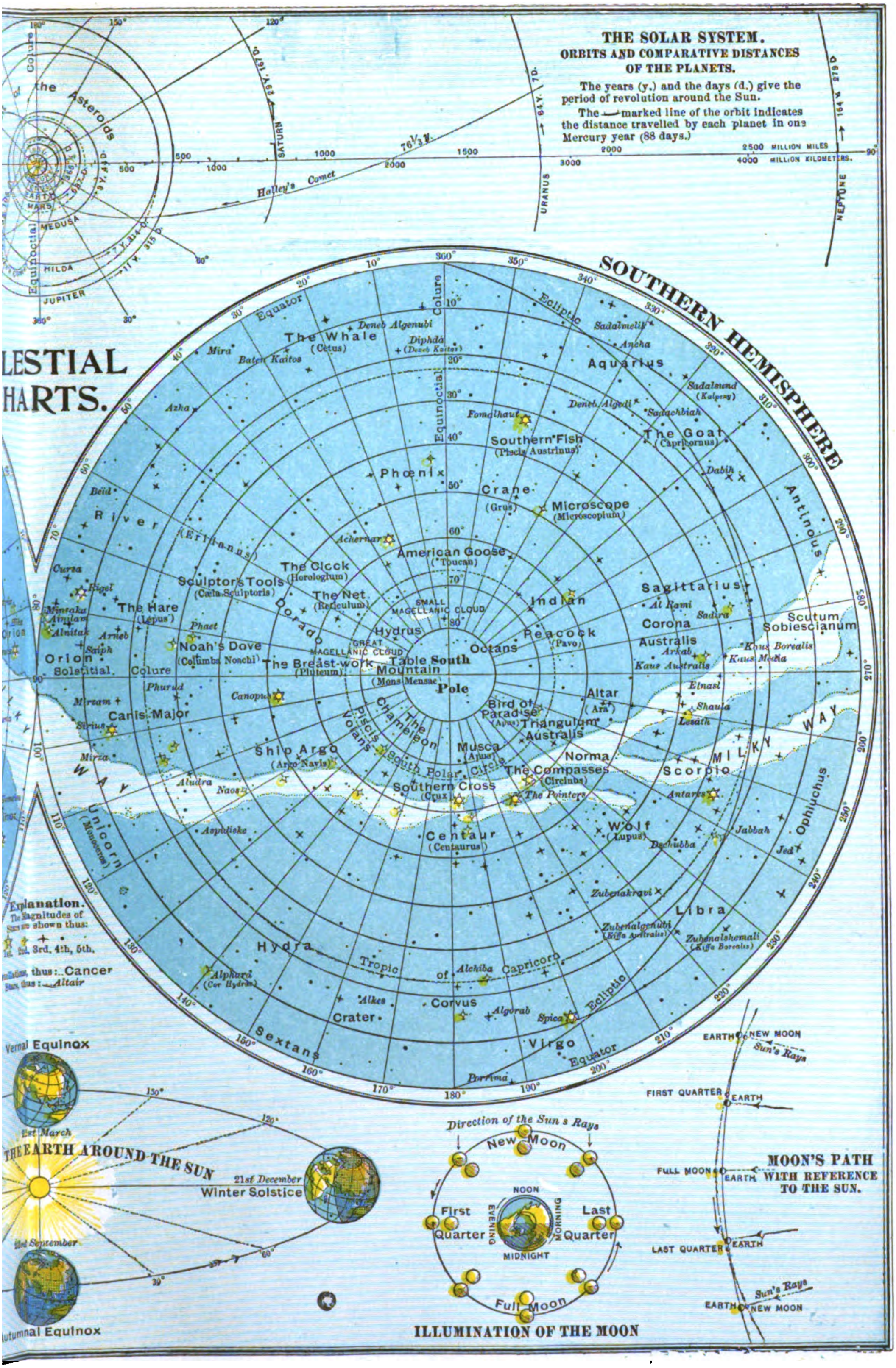


LESTIAL
HARTS.
THE SOLAR SYSTEM.
ORBITS AND COMPARATIVE DISTANCES OF THE PLANETS.
The years (y.) and the days (d.) give the period of revolution around the Sun.
The marked line of the orbit indicates the distance travelled by each planet in one Mercury year (88 days.)
500
1000
1500
2000
2500 MILLION MILES
500
1000
2000
3000
4000 MILLION KILOMETERS.
SATURN 29 Y. 167 D.
URANUS 84 Y. 7 D.
NEPTUNE 164 Y. 279 D.
Halley's Comet
76⅓ Y.
the Asteroids
Colure
Equinoctial
MARS
EARTH
MEDUSA
HILDA
JUPITER
SOUTHERN HEMISPHERE
Equator
Ecliptic
Equinoctial Colure
The Whale (Cetus)
Deneb Algenubi
Diphda (Deneb Kaitos)
Baten Kaitos
Mira
Azha
Aquarius
Sadalmelik
Ancha
Sadalsund (Kalpeny)
Deneb Algedi
Sadachbiah
The Goat (Capricornus)
Dabih
Fomalhaut
Southern Fish (Piscis Austrinus)
Phœnix
Crane (Grus)
Microscope (Microscopium)
Antinous
Achernar
American Goose (Toucan)
The Clock (Horologium)
River (Eridanus)
Beid
Cursa
Rigel
Sculptor's Tools (Cœla Sculptoris)
The Hare (Lepus)
The Net (Reticulum)
Dorado
Hydrus
SMALL MAGELLANIC CLOUD
GREAT MAGELLANIC CLOUD
Indian
Sagittarius
Al Rami
Sadira
Corona Australis
Arkab
Kaus Australis
Kaus Borealis
Kaus Media
Scutum Sobiescianum
Peacock (Pavo)
Octans
Mintaka
Ainilam
Alnitak
Arneb
Saiph
Phaet
Noah's Dove (Columba Noachi)
Orion
Solstitial Colure
The Breast-work (Pluteum)
Table Mountain (Mons Mensae)
South Pole
Phurud
Canopus
Mirzam
Canis Major
Sirius
Mirza
Altar (Ara)
Elnasl
Shaula
Lesath
Bird of Paradise (Apus)
Triangulum Australis
The Chameleon
Piscis Volans
Ship Argo (Argo Navis)
Musca (Apus)
South Polar Circle
Norma
The Compasses (Circinus)
Southern Cross (Crux)
The Pointers
Scorpio
Antares
Milky Way
Aludra
Naos
Unicorn (Monoceros)
Aspidiske
Centaur (Centaurus)
Wolf (Lupus)
Dschubba
Jabbah
Jed
Ophiuchus
Zubenakravi
Libra
Zubenalgenubi (Kiffa Australis)
Zubenalshemali (Kiffa Borealis)
Hydra
Alphard (Cor Hydræ)
Tropic of Capricorn
Alchiba
Alkes
Crater
Corvus
Algorab
Spica
Virgo
Sextans
Porrima
Equator
Explanation.
The Magnitudes of Stars are shown thus:
1st, 2nd, 3rd, 4th, 5th,
Constellations, thus: Cancer
Stars, thus: Altair
Vernal Equinox
21st March
THE EARTH AROUND THE SUN
21st December
Winter Solstice
21st September
Autumnal Equinox
Direction of the Sun's Rays
New Moon
First Quarter
Last Quarter
Full Moon
NOON
EVENING
MORNING
MIDNIGHT
ILLUMINATION OF THE MOON
EARTH
NEW MOON
Sun's Rays
FIRST QUARTER
FULL MOON
LAST QUARTER
MOON'S PATH WITH REFERENCE TO THE SUN.

disproved in numerous cases, and the theory is not now held. Twinkling or scintillation is another mark which distinguishes stars from planets. The first thing the observer notes is the apparent daily motions of the stars. Many appear to rise in the east, describe small or great arcs in the sky, and set in the west; while others describe complete circles around the celestial pole. These apparent motions arise from the rotation of the earth. (See EARTH.) With few exceptions the distance of the fixed stars is unknown, and must in all cases be enormous. Since the time of Bradley many attempts have been made to measure what is called the annual parallax (q.v.) of the stars, and thus determine their distances. When we consider that the motion of the earth round the sun alters our position in space a whole diameter of its orbit (185,000,000 miles) in six months, we should expect a change in the relative positions of certain stars as seen from two opposite points of the orbit. But no such change is seen to take place, and this was one of the early objections to the theory of Copernicus (q.v.). The only answer that the Copernicans could give was that the distance of the stars from us is so great that the diameter of the earth's orbit shrinks into insignificance when compared with it. The detection of the parallax of the fixed stars depended upon the perfection of instruments. If the parallax amounted to a second the distance of the star would be at least 206,000 times that of the sun; and when the measurement of angles came to be reliable to a second and still no parallax was discernible, astronomers could say that the distance of the nearest stars must be more than 206,000 times that of the sun, i.e., 206,000 times 93,000,000 miles.

The first successful measurement of the parallax of a star was made by Bessel (q.v.) in 1838. He employed in his observations a remarkably fine heliometer (q.v.) and adopted what is called the differential method, in which the position of a star suspected of having a measurable parallax is determined at different times during the year with reference to certain smaller stars apparently near it, though from their minuteness presumably at a much greater distance and consequently possessed of negligible parallax. The star chosen by Bessel for observation was 61 Cygni, a star of large proper motion and hence one which might reasonably be supposed to be one of our nearest neighbors. Bessel made 96 observations in all, extending from August, 1837, to September, 1838, and from them deduced for the parallax of 61 Cygni the value 0.3136″, which he announced to the world in December, 1838, anticipating by a few weeks only Henderson's publication of the parallax of α Centauri. This observation of Bessel's is one of the most famous in the annals of astronomy.

When quite a number of stars came to have known parallaxes, their distances were found to be too great to be expressed conveniently in miles. Therefore astronomers invented a new unit, the "light year," for the distance traversed by light in one year. As light travels about 180,000 miles per second, it will be seen that the light year is a unit of stupendous magnitude, and well fitted to measure the profound distances of stellar space. With the exception of α Centauri, the stars given in the following table of sensible parallaxes are all visible in northern latitudes:

STAR	Magnitude	Parallax	Distance in light years
α Centauri	1.0	0 .76″	4.3
Lalande 21,185	7.5	0 .47	6.9
61 Cygni	6.1	0 .41	8.0
Sirius	—1.4	0 .3	8.7
ν Draconis	4.9	0 .32	10.2
τ Ceti	3.7	0 .32	10.2
Procyon	0.7	0 .30	10.9
Altair	0.9	0 .23	14.2
Aldebaran	1.2	0 .11	29.6
Polaris	2.1	0 .074	44.0

The ancients grouped the stars into constellations which, although entirely fanciful and devoid of anything like systematic arrangement, still serve astronomers as the basis of stellar nomenclature. (For the names of the constellations, see CONSTELLATION.) The several stars belonging to the same constellation are usually distinguished from one another by Greek letters, beginning the alphabet with the brightest; and when these are not sufficient, by Roman letters and by numbers. Many of the most brilliant stars have special names. They are also divided according to their brightness into stars of the first, second, third, etc., magnitudes, a division which is necessarily somewhat arbitrary. The smallest stars discernible by the unaided eye are usually called stars of the sixth magnitude. The quantity of light given by a star of any magnitude is taken as 2.512 times as great as the quantity given by a star one magnitude fainter. This number is called the "light ratio," and it is so chosen that a diminution of five magnitudes corresponds to a division of stellar light by just 100 ($2.521=\sqrt[5]{100}$). In other words, 100 average stars of the sixth magnitude should give as much light as one of the first magnitude.

But the whole matter of stellar photometry is subject to some uncertainty. According to the *Harvard Photometry* the following are the brightest stars in the order of lucidity: Sirius, Canopus*, α Centauri*, Vega, Capella, Arcturus, Rigel, Procyon, α Eridani*, β Centauri*, Altair, Betelgeux, α Crucis*, Aldebaran, Pollux, Spica, Antares, α Piscis Australis*, α Cygni, Regulus. Those marked with an asterisk are not visible in northern latitudes. No real magnitude in the proper sense of the word has yet been observed in any star. In the best and most powerfully magnifying telescopes even the brightest stars of the first magnitude appear, not with small disks as all the planets do, but as luminous points without any visible diameter. We are, therefore, totally ignorant of the real size of the fixed stars; nor could it be determined though we were sure of their distances, for the apparent diameter is an essential element in the calculation. We cannot, then, say whether the greater brilliancy of one star, when compared with another, arises from its greater nearness, its greater size, or the greater intensity of its light; but it is certain that the fixed stars are self-luminous. In spite of the deceptive appearance of the heavens at night, the stars visible to the unaided eye in the Northern Hemisphere amount only to about 3000. Stars of the first magnitude visible north of 35° south declination are reckoned by Heis at 14, of the second at 48, of the third at 152, of the fourth at 313, of the fifth at 854, and of the sixth at 2010; in the following classes the numbers increase very rapidly, so that an accurate census of the heavens becomes impossible. The total number of stars in both hemispheres has been estimated by Chapman at between 1000 millions and 2000 millions, half of them being brighter than a magnitude between 23 and 24, which is the faintest that could possibly be photographed with the most powerful telescope at present available.

That the fixed stars are not really immovable is seen in the phenomenon of double or multiple stars—systems of two or more stars that revolve about one another, or rather about their common centre of gravity. Galileo discovered their existence and proposed to make use of them in determining the yearly parallax of the fixed stars. After a long time Bradley, Maskelyne, and Mayer directed attention to the phenomena of double stars, but nothing important was made out respecting them until the observations of the elder Herschel, which led to the most remarkable conclusions as to their nature. The apparent angular distance between two stars must be less than about thirty seconds in order that they may be counted a double. The theory of probabilities renders it almost certain that this vast number of double stars could not exist unless there were some real physical connection between the component numbers of a double. Still, there is always a possibility of doubleness being merely apparent, the two stars lying nearly in the same direction in space, but one far beyond the other. Such apparent doubles are called optical doubles, and those in which a real physical connection has been demonstrated by observed gravitational rotation of the component members are called binary stars. The two members of double stars are mostly of one color when the two components are nearly equal; but a difference of color is often observed when components are widely different in size. In many cases the one color is the complement of the other. It was Sir W. Herschel who first advanced the view (since confirmed) that multiple stars are connected systems of two or more stellar bodies revolving in regular orbits around their common centre of gravity. Their motions are found to follow the same laws as prevail in the solar system, and the orbits are elliptical. These distant bodies are therefore subject to the Newtonian law of gravitation. The period of revolution has, in many cases, been computed; the shortest is estimated at 5½ years; others are set down at hundreds. In cases where the parallax is known the size of the orbits can be determined. Thus the orbit described by the two components of the double star α Centauri about each other is 24 times as large as that of the earth around the sun. Even the masses of these stars have been calculated as being together twice that of our sun. In addition to the double stars that can be seen to revolve and change their relative positions there are others, called spectroscopic doubles, the components of which are so close together that even our most powerful telescopes fail to separate them. These doubles are known to exist from peculiarities in their spectra. They show a doubling of the spectral lines that must be caused by a duplicity in the source of light, and where this doubling is shown to occur periodically we must conclude that the two sources of light are revolving in some way or other.

The proper motion of stars is of another kind. It consists in a displacement in various directions of the individual stars, so that the configuration of constellations is slowly changing. The annual proper motions yet observed vary from nothing to 8.7″. The proper motion of the binary star 61 Cygni amounts to 5.2″, so that in 360 years it would pass over a space equal to the moon's diameter. It must thus take thousands of years to alter sensibly the aspect of the heavens; although, taking into account the enormous distances, the actual velocities must be great. But the observed proper motions of the stars do not give us very accurate information as to their real motions and velocities. In the first place, it is only the angular change of the star's position that we observe; and we cannot tell the corresponding linear shift unless we know the distance of the star from the earth. And even where this distance is known we can obtain only the transverse motion, as projected on the sky. There may be also a component of motion directly towards us or away from us. This radial component remained entirely unknown until recently, when it became possible to measure it with the spectroscope.

It was first observed by Sir W. Herschel that there is a perceptible tendency in the proper motions, as observed, to make the stars generally diverge or open up in one quarter of the heavens, and draw together in the opposite quarter; and this he attributed to a proper motion of our sun with his planets in the direction of the former point. The apparent motion thus caused is complicated with the real independent motions of individual stars. The point towards which the motion is directed, which is called the "solar apex," was fixed by Herschel in the constellation Hercules. The result of recent researches gives a point situated very near Vega, the brightest star in the neighboring constellation Lyra. The velocity has been calculated at about 11 miles per second, a figure still very uncertain. In this connection memtion should be made of Kapteyn's researches on the proper motion of the stars. He found that there are really two regions of the sky where the stellar density tends to increase, and not one, as Herschel supposed; and that the stars may be separated into two great streams, each with its own apex. The two streams are almost equivalent in point of numbers, distributions, distance, and brilliancy of the component stars, but one moves about half as fast again as the other. Kapteyn's conclusions have been confirmed by Dyson, Eddington, Beljawsky, and others whose investigations, although in each case directed to different classes of stars, lead to results which agree very closely. Dyson found that the apparent motions of the streams could be resolved into a motion of the solar system with a velocity 1.55 towards a point not far removed from Herschel's solar apex, and a motion of two streams to and from a point about halfway between Pollux and Aldebaran with a relative velocity 4.04.

Coming now from a consideration of stellar motions and velocities to their physical characteristics, we must again have recourse to information derived from a study of star spectra. Fraunhofer was the first to study them, and after the discovery of Kirchhoff's Law it became possible to identify in the stars many of the terrestrial chemical elements. The real founders of stellar spectroscopy, however, were Sir William Huggins and Father Secchi. Having subjected more than 4000 stars to examination with the spectroscope, Secchi in 1863 proposed a fourfold classification of the stars based on the character of their spectra. Later researches by Vogel and others have revealed the existence of a number of well-marked subclasses, but the four types defined by Secchi still form the basis of the various classifications in use at the present time. Secchi's four classes are as follows: I, Sirian stars, comprising nearly half the total number examined. They are blue, or bluish white, in color, and their spectra are mostly characterized by the breadth and intensity of the dark absorption bands due to hydrogen and by the presence of comparatively few metallic lines. In some cases, however, the absorption is largely due to helium, and these stars constitute the important subclass of helium stars. Sirius, Canopus, Vega, Altair, and Rigel belong to this class, the last mentioned being a helium star. II, Solar, or yellow stars, the spectra of which resemble that of the sun, being distinguished by the presence of innumerable fine dark lines. They are almost as numerous as the Sirian stars. Capella, Arcturus, Procyon, Aldebaran, and the sun are examples of this type. III, Antarian, or red, stars. Their spectra show dark absorption bands or flutings which are sharply defined in the violet and gradually disappear towards the red. They number about 500, Antares and Betelgeux being the most conspicuous examples. IV, Carbon stars, showing spectra similar to those of Class III, but with the bands most sharply defined in the red, the absorption being due to carbon or its compounds. They are deep red in color, and about half as numerous as the stars of Class III. They are without exception faint, the brightest being of about the fifth magnitude. About 100 stars exhibit spectra of a peculiar character, in which dark lines and bands, many of them of unknown origin, and also bright lines, appear to be superimposed on a continuous spectrum. The first of these was discovered by Wolf and Rayet in 1867, and hence they are known as Wolf-Rayet stars. They are gaseous stars, and are almost entirely confined to the Milky Way. It is generally agreed that they stand first in the order of stellar development and form a class quite distinct from the helium and Sirian stars, which come next in succession.

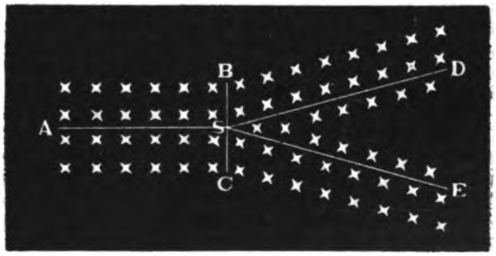
Many stars exhibit well-marked periodic alterations of magnitude, and are hence called variable stars. Perhaps the most remarkable of these are Mira (the wonderful) in Cetus (q.v.), and Algol (q.v.) in Perseus. Variable stars are classified into nonperiodic variables, in some of which the brightness suffers a slow but continuous change, while in others it fluctuates irregularly; and periodic variables, which are further subdivided into three classes: long-period variables, like Mira, in which the periods range from 10 to 18 months; short-period variables, like β Lyræ, the periods seldom exceeding 12 days; and Algol, or eclipsing, variables. The last class, of which Algol is typical, comprises between 30 and 40 variables of short periods (in few cases exceeding five days), in which the variation is due to the periodical interposition of a dark companion star across the line of sight so that the light of the brighter star is greatly diminished during a comparatively short interval of the entire period.

Temporary Stars, or **Novæ,** are stars which burst suddenly into great splendor and then dwindle until invisible except by the aid of powerful telescopes, or disappear entirely. During the past 400 years 24 such stars have been observed. Since the application of photography to astronomy the discoveries of these stars have been of comparatively frequent occurrence. One of the most famous *novæ* was that observed at the end of 1572 by Tycho Brahe in the constellation Cassiopeia. It was then of the first magnitude, and in less than a month was so bright as to be visible in broad daylight, but in about six months it had vanished. Another was the star observed in 1604 by Kepler in the constellation of Ophiuchus, which, at its brightest, was as brilliant as Jupiter.

In more recent times two *novæ*, both first detected by the same observer, Dr. Anderson of Edinburgh, have been carefully studied. The first, *Nova Aurigæ*, was observed by him at the end of January, 1892. It blazed up to the fourth magnitude, and after some variation began to fade rapidly at the beginning of March until, at the end of the month, it was only of the 12th magnitude. Later in the year its brightness increased again, and after fluctuating for nearly a year finally decreased to insignificance. The second of Anderson's discoveries was *Nova Persei*, which he first observed about the end of February, 1901. It was then of about the third magnitude, but in two days its brightness had increased until it was the third brightest star in the heavens. It then faded slowly and, after going through a series of fluctuations during March and April, settled down to a telescopic star.

Spectroscopic observations indicate that most of the *novæ* recently observed have themselves become nebulous or are in some way connected with nebulous matter.

Star Systems. Sir W. Herschel came to the conclusion that the stars forming our firmament do not extend indefinitely into space, but are limited in all directions, the mass having a definite shape. He conceived the shape to be something like that of a huge millstone, having one side cleft and the two laminæ set apart at a small angle. Let the diagram represent a vertical section of such a broad flat stratum and suppose the solar system situated as at *S*. To a spectator looking on either side, in the direction of the thickness, as *SB*, the stars would appear comparatively sparse, but all round in the direction of the breadth (as *SA*) there would appear a dense ring, which would separate into two branches (*SE*, *SD*), in the direction of the cleft side. This supposition accounts for the appearance of the Milky Way.



STAR SYSTEM.

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STAR. A frequent charge in heraldry (q.v.). See Estoile.

STAR AND GARTER. A former London tavern in Pall Mall, the meeting place of the Literary Club.

STAR ANISE. See Illicium.

STAR APPLE (*Chrysophyllum cainito*). A West Indian tree about 20 or 30 feet high, introduced in other warm countries, beyond which it is not hardy. It is named from the starlike cross section of its large white or rose-colored, green, and yellow fruits, which have an agreeably flavored soft, sweet pulp. The tree is very beautiful in foliage.

STARAYA LADOGA, stä′rȧ-yȧ lä′dô-gȧ. A small village in the Government of St. Petersburg, Russia, on the Volkzhov, a few miles south of Lake Ladoga. It is one of the oldest Russian settlements and has considerable historic interest.

STARAYA RUSSA, rụs′sȧ. An ancient town and noted health resort in the Government of Novgorod, Russia, 181 miles south-southeast of St. Petersburg (Map: Russia, D 3). It is well built, and has a number of fine parks. The saline springs are used both for drinking and bathing. Pop., 1910, 19,986.

STARA-ZAGORA, stä′rȧ-zä′gô-rȧ. See Eski-Zagra.

STARBOARD. A naval term to denote the right side of a vessel to an observer looking forward. See Helm.

STAR CATALOGUE. See Astrophotography.

STARCH (AS. *stearc*, strong, stiff). A form of carbohydrate (see Carbohydrates), occurring as stored food in all plants. Its composition corresponds to the empirical formula $C_6H_{10}O_5$, but its molecular formula, and, of course, its constitution, are as yet doubtful. The number of atoms in its molecule is probably very large. As ordinarily obtained, starch consists of minute uncrystallizable granules insoluble in water. However, when starch is acted upon by hot water, the outer coats of the granules are ruptured and their contents form a viscous liquid that is usually referred to as starch paste and that turns to a firm solid on cooling. Several methods have been described by which ordinary starch can be transformed into soluble starch. Both starch paste and soluble starch give an intense blue coloration with iodine, a reaction exhibited by no other known substance; the composition of the blue starch-iodine compound is not definitely known. Starch is largely used as a food and for laundry purposes; it is used industrially for dressing cloth, for sizing cotton goods and paper, for making dextrin (q.v.) and British gum, etc. The processes employed in the manufacture of starch vary with the source as well as with the use to which the starch is to be applied. The simplest process is involved in making starch from potatoes: here the potatoes are simply reduced to a pulp, and the latter is washed with water in fine sieves, which allow the starch granules to pass through, while the cellulose of the potatoes is held back.

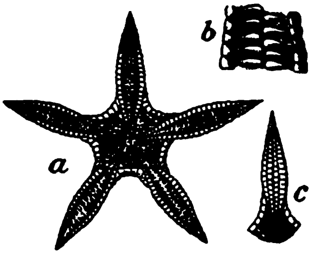
Starch is formed as a condensation product from sugar by the action of certain specialized portions of the protoplasm of plant cells. The typical starch formers are leucoplasts (q.v.), which occur in all cells where starch is permanently stored. But the chloroplasts of the leaves may form starch when the green cells become overloaded with sugar. Thus leaves are often found to contain large quantities of starch, especially at the end of a long period of bright illumination. The sugar formed by the process of photosynthesis (q.v.) is constantly diffusing away into other parts of the plant, but during periods of bright light it is formed more rapidly than it can diffuse, and it is then condensed by the chloroplasts to form starch. During periods of darkness or of weak illumination, when the photosynthetic process ceases or lags, the starch of leaves is reconverted into sugar by the enzyme diastase (q.v.), and then diffuses to other regions of the plant. Thus leaves seldom contain starch in the morning or on cloudy days. But by far the greater part of the starch found in any plant is organized into grains by leucoplasts. By the action of these bodies, sugar which comes from the green leaves is condensed or polymerized into starch. Starch is thus formed in all parts of plants, being especially plentiful in tubers, in thickened roots, and in the endosperm and embryo of seeds. See Alcohol; Dextrin.

STAR CHAMBER. A celebrated English tribunal, which met in the council chamber of the old palace of Westminster. The origin of the name is unknown. According to Sir Thomas Smith it was derived from a decoration of gilded stars on the ceiling. This theory is unsupported by evidence, but it is now well established that since the middle of Edward III's reign the Star Chamber (Camera Stellata) was the usual meeting place of the King's council, or Privy Council, as it was afterward known. The history of the Star Chamber Court is particularly associated with the Act of 3 Henry VII, c. 1. By this statute the "chancellor and treasurer of England for the time being and keeper of the King's privy seal, or two of them, calling to them a bishop and a temporal lord of the King's most honorable council and the two chief justices of the King's Bench and Common Pleas for the time being, or other two justices in their absence," are given jurisdiction in seven offenses: unlawful maintenance; giving of liveries, signs, or tokens; retainers by indentures, oaths, writings, or otherwise; embraceries of the King's subjects; untrue demeanings of sheriffs in the making of panels, and other untrue returns; taking of money by juries; and great riots and unlawful assemblies. Since the days of Elizabeth it has been very commonly held that the historical Star Chamber was created by this act; and that its proper jurisdiction was restricted to the offenses just enumerated. Recent research has shown that such was not the case. The Star Chamber claimed and possessed the entire jurisdiction of the King's council. As a criminal court, it could inflict any punishment short of death, and had cognizance of all cases that might be brought under the head of contempt of the royal authority. Jurors were there punished for verdicts against the crown. Offenders against the royal proclamations or the religious laws were there condemned. The form of proceeding was by written information and interrogatories, except when the accused person confessed, in which case the information and proceedings were oral. Abuses grew out of this; forced confessions, pressure, torture prevailed. Admissions of the most immaterial facts were construed into confessions; and fine, imprisonment, and mutilation were inflicted on a mere oral proceeding, without hearing the accused, by a court consisting of the immediate representatives of prerogative. The proceedings of the Star Chamber had always been viewed with distrust by the commons; but during the reign of Charles I its excesses reached a height that made it absolutely odious to the country at large; and in the last Parliament of that sovereign a bill was carried in both Houses (16 Car. I, c. 10) which decreed its abolition. Consult C. L. Scofield, *A Study of the Court of Star Chamber* (Chicago, 1900) and *Select Cases before the Court of Star Chamber* (ed. by I. S. Leadam for the Selden Society, 2 vols., London, 1903–11). See CAMERA, IN.

STARE DECISIS, stă′rē dē-sī′sĭs (Lat. *Stare decisis, et non quieta movere*, "to stand by decisions and not to disturb matters once settled"). A phrase employed to describe a doctrine prevailing in most judicial systems of modern times, which, briefly expressed, is that the courts will follow the principles of law declared in former decisions where they are not contrary to the ordinary principles of justice. The theory on which this doctrine was established is that when a point of law is once decided it will be followed by the public as a guide. The doctrine of stare decisis does not apply to a decision until the time for appeal has elapsed; and a superior court may at any time overrule or repudiate the principles of a case previously decided in an inferior court and never appealed. Under such circumstances the original case erroneously decided would not be affected, and would remain res judicata between the parties thereto, but would no longer be cited as an authority. Courts of equal jurisdiction in the same State are not bound by each other's decisions, and one United States circuit court is not bound by the decisions of another. The United States courts will usually follow the decisions of the courts of the various States where an interpretation or application of their laws is involved. The courts of one State are not bound by the decisions of the courts of another, nor by those of a foreign country.

The courts are especially averse to disturbing the principles of law involving titles to and interests in real estate. The policy seems to be not to do so where it is only a question of expediency, and to do so with caution even where the principles of a decision are erroneous and will tend to work injustice in the future. Consult J. C. Wells, *Treatise on the Doctrines of Res Adjudicata and Stare Decisis* (Des Moines, 1878), and James Kent, *Commentary on American Law* (14th ed., Boston, 1896).

STARFISH. Echinoderms with a starlike or pentagonal body, with two or four rows of ambulacral feet or tentacles on the oral side. The body is covered with small, short spines, often arranged in groups. The nervous system is pentagonal, with nerves extending into the arms. Most of the species are bisexual; the young usually pass through a metamorphosis, the starfish budding out from the water-vascular system of the pluteus, bipinnaria, or brachiolaria form, which previously passes through a cleavage, gastrula, and cephalula stage. Starfish are covered with scattered pedicellariæ, pincer-like spines consisting of two prongs. Sense organs (sphæridia) are also present. They have the sense of smell, supposed to be localized in the suckers at the back of the eyeplate.



A PALEOZOIC STARFISH.

a, ventral aspect of *Aspidosoma petaloides* (Lower Devonian); *b*, ambulacral surface of an arm, in detail; *c*, dorsal plates of an arm.

Starfish crawl or glide by means of from two to four rows of slender tubular processes or feet, with a sucker at the end. These ambulacral feet are thrust out, fastened to the bottom, and by means of them the body is warped along over mussel or oyster beds, rocks, or weeds, the arms being capable of slow but rather complete bending movements. At the end of each arm is the red eye, terminating the radial nerve. Starfish are very destructive to oysters, clams, mussels, barnacles, snails, worms, and small crustacea. By a steady strain on the valves they open and devour oysters. The injury to the oyster beds of Rhode Island caused by starfish in one year was estimated at $100,000. See ECHINODERMATA (and Plate); OYSTER.

Fossil starfish are found first in the Ordovician rocks, and they occur sparingly in later formations, with some increase in the Devonian and Carboniferous, but they are never of geological importance. Some Mesozoic sandstone formations of middle Europe have furnished abundant casts, and they are found also in a few Tertiary localities. The Paleozoic species are grouped in the subclass Encrinasteriæ, in which the ambulacral ossicles alternate with each other along the middle line of the ambulacra; while the Mesozoic and Tertiary species, and also the recent, are included in the Euasteriæ, which have the ambulacral ossicles opposite each other.

Consult G. J. Romanes, *Jellyfish, Starfish, and Sea Urchins*, in "International Scientific Series," vol. xlix (New York, 1893), and A. D. Mead, "Natural History of the Starfish," in *United States Fish Commission, Bulletin, 1899* (Washington, 1900).

STARGARD, stär′gärt. A town in the Province of Pomerania, Prussia, situated on the navigable Ihna, 22 miles east-southeast of Stettin (Map: Germany, F 2). It is the most important town in the eastern part of the province. The town manufactures railway supplies and other machinery, has foundries, and is a woolen and cotton and also a horse and cattle market. It belonged to the Hanseatic League and was strongly fortified. Pop., 1900, 26,858; 1910, 27,551.

STAR GAZER. See CATFISH.

STAR GRASS. A popular name for several grasslike plants whose flowers or other parts resemble stars in outline. Among them are species of Hypoxis, Callitriche, Aletris, and Rynchospora. See Colored Plate of AMARYLLIDACEÆ.

STARHEMBERG, shtä′rem-bĕrk, ERNST RÜDIGER, COUNT VON (1638–1701). An Austrian general, born at Graz and educated for the army by Montecuccoli. He was present at St. Gotthard in 1664, and gained especial glory by his brave defense of the city of Vienna for nine weeks in 1683 against the Turkish army. The Emperor Leopold made him a field marshal and Minister of State. Three years afterward he was wounded at Bude and forced to retire from active service. He settled in Vienna and became president of the Council of War.

STARK, JOHN (1728–1822). An American soldier, born at Londonderry, N. H. In early life he was a farmer, but in the French and Indian War he served with Rogers's Rangers, first as lieutenant and later captain. At Cambridge early in 1775 he was commissioned colonel and, with a regiment raised in one day by himself, took part at Bunker Hill. Later he served in the Canada expedition and then under Washington in New Jersey, distinguishing himself at Trenton and Princeton; but, resenting promotions over him, he resigned in April, 1777, and returned home. On the approach of Burgoyne he accepted an independent command from New Hampshire, and defeated a force of Hessians in the battle of Bennington (q.v.), Aug. 16, 1777. For this he was made brigadier general and formally thanked by Congress. With New Hampshire recruits he took part in the Saratoga campaign, and in 1778 and again in 1781 he commanded the Northern Department. Consult Caleb Stark, *Memoir and Official Correspondence* (Concord, N. H., 1860), and Edward Everett, "John Stark," in Jared Sparks, *American Biography*, vol. v (new ed., New York, 1902).

STARK′EY, THOMAS ALBERT (?1871–). A Canadian hygienist. He was born at Hartford, England, and graduated in medicine at London University in 1894. After a course in London hospitals he went to India for research work in the cure and prevention of the bubonic plague and cholera and was engaged thereon at the Imperial Research Laboratory, Bombay, in 1899–1901. He next took charge of the sanitation of two large districts in India, continued his researches in public health work on his return to England, and was bacteriologist to the London County Council. In 1902 he was appointed professor of hygiene at McGill University. He was elected a fellow of the Royal Sanitary Institute (London) in 1906 and in 1910 became the first president of the Canadian Public Health Association.

STARK′IE, WILLIAM JOSEPH MYLES (1860–). An Irish classical scholar, born at Sligo. He was educated at Shrewsbury School, Trinity College, Cambridge, and Trinity College, Dublin. He held important administrative positions in educational matters in Ireland, being Resident Commissioner of National Education after 1899. In 1914 he was made Privy Councilor for Ireland. His publications include elaborate editions of plays of Aristophanes, the *Wasps* (1897), the *Acharnians* (1909), the *Clouds* (1911); *Recent Reforms in Irish Education* (1902); *A History of Irish Primary and Secondary Education during the Last Decade* (1911); *Continuation Schools* (1912).

STARK′VILLE. A city and the county seat of Oktibbeha Co., Miss., 103 miles by rail north of Meridian, on the Illinois Central and the Mobile and Ohio railroads (Map: Mississippi, H 4). It is the seat of the Mississippi Agricultural and Mechanical College. There are important stock-raising interests, and a lumber yard and cotton and cottonseed-oil mills. Pop., 1900, 1986; 1910, 2698.

STARLING (AS. *stær*, starling). A European bird (*Sturnus vulgaris*) of the family Sturnidæ, famous for its song and powers of mimicry. It is rather smaller than the American meadow lark, its nearest analogue in the New World, and is brown finely glossed with black, with a pale tip to each feather. It was introduced into New York City in 1890, and in the subsequent 25 years spread rapidly over most of the northeastern States. It did a great deal of damage to fruit and in driving away native birds and may in time become as great a pest as the English sparrow.

The starling family is a large one, containing about 200 species, mostly living in the tropics of Africa and Asia. They fall between the Corvidæ and Icteridæ, and are divisible into two sections: one containing the more typical terrestrial starlings, the oxpeckers, the pastors, the mynas, pied starlings (*Sturnopastor*), and wattled starlings (*Dilophus*). In the second group, often regarded as a separate family (Eulabetidæ), distinguished by the absence of rictal bristles and by the fact that they lay spotted eggs, whereas the true starlings lay blue unspotted eggs, are the African glossy starlings (*Lamprotornis*), with richly colored plumage, and the grackles or hill mynas. Consult Richard Lydekker, in *Standard Natural History* (London, 1895), and E. H. Forbush, "The Starling," in *Massachusetts State Board of Agriculture, Fifty-eighth Annual Report* (Boston, 1915).

STARNBERGER (shtärn′bĕr-gẽr) **LAKE.** A lake in South Bavaria, 15 miles southwest of Munich. Its length from south to north is about 18 miles; its altitude nearly 2000 feet. The Würm flows through the lake. The shores are picturesque and covered by lordly villas affording splendid views.

STAR-NOSED MOLE. See MOLE.

STAR OF BETHLEHEM (so called from its star-shaped flowers, which are white within), *Ornithogalum.* A genus of about seventy species of bulbous-rooted plants of the family Liliaceæ. The species are natives almost exclusively of the Eastern Hemisphere—only a few are grown in flower gardens. The common star of Bethlehem (*Ornithogalum umbellatum*), a native of Europe, the Levant, etc., cultivated and escaped from gardens in the United States, has racemes of six to nine large white fragrant flowers, which open about 11 o'clock in the morning and close about three or four in the afternoon. The plant is hardy and may be grown three or four years without being disturbed. *Ornithogalum arabicum* is a tender species often grown in glasses like hyacinths. It produces large creamy-white fragrant flowers. The hardy species flourish in well-drained garden soil. Propagation is effected by offsets from the bulbs, which are planted in the fall about nine inches deep in sheltered places.

STAR OF INDIA, Order of the. A British order with three classes founded by Queen Victoria in 1861, consisting of the sovereign, the Viceroy of India, and 246 members, in addition to an unrestricted honorary membership. The decoration is an oval medallion bearing a bust of Victoria in onyx, surrounded by a blue band with the device *Heaven's Light our Guide,* and surmounted by a diamond-studded crown.

STAROKONSTANTINOV, stä′rō-kŏn′stän-tyē′nôf. A district town in the Government of Volhynia, Russia, 86 miles southwest of Zhitomir (Map: Russia, C 5). The chief manufactures are tobacco and soap; mineral waters are marketed. Pop., 1911, 24,439.

STAROOBRYADTSY and **STAROVYERTSY.** See Raskolniki.

STARR, Frances (Grant) (1886-). An American actress, born at Oneonta, N. Y. She first appeared on the stage at Albany, N. Y., in 1900, and played in San Francisco, Cal., in 1903. In 1906 she appeared in *Gallops,* and then starred in *The Music Master* in New York City. As leading lady she achieved a great success as Juanita in *The Rose of the Rancho* (1906–08), and afterward as Laura Murdock in *The Easiest Way* (1909–11). In 1911–13 she played in *The Case of Becky,* and in 1915–16 in *Marie Odile.*

STARR, Frederick (1858-). An American anthropologist, born at Auburn, N. Y. He studied at the University of Rochester and at Lafayette, where he graduated in 1882. He was registrar of Chautauqua University in 1888–89, and after being for two years in charge of ethnology in the American Museum of Natural History, New York (1889–91), was assistant professor (1892–95), and thereafter associate professor of anthropology in the University of Chicago. In 1905–06 he made a careful study of the pygmy races of Central Africa, and made investigations in the Philippine Islands in 1908, in Japan in 1909–10, and in Korea in 1911. His publications include a *Catalogue of Collections of Objects Illustrating Mexican Folklore* (1899); *Indians of South Mexico* (1900); *The Ainu Group at the Saint Louis Exposition* (1904); *The Truth about the Congo* (1907); *In Indian Mexico* (1908); *Filipino Riddles* (1909); *Japanese Proverbs and Pictures* (1910); *Liberia* (1913); *Mexico and the United States* (1914).

STARR, M(oses) Allen (1854-). An American neurologist, born in Brooklyn, N. Y. He graduated from Princeton (1876) and from the College of Physicians and Surgeons, New York (1880). At the latter institution, which became part of Columbia University, he was lecturer (1887–89) and professor of diseases of the mind and nervous system (1889–1909), and professor of neurology from 1903 till his retirement in 1915. In 1896–97 he served as president of the American Neurological Association, and he became a corresponding member of foreign societies. Besides being connected editorially with the *Journal of Nervous and Mental Diseases* and the *Psychological Review,* Dr. Starr published many articles and: *Familiar Forms of Nervous Diseases* (1893); *Brain Surgery* (1895); *Atlas of Nerve Cells* (1897); *Nervous Diseases, Organic and Functional* (1913).

STAR-ROUTE FRAUDS. Frauds in the management of the star-route postal service during the administration of President Hayes. A star designated in the Postal Guide the routes over which, owing to lack of railroads and steamboats, mail was carried by horse or wagon. A ring, including Brady, Second Assistant Postmaster General, and Senator S. W. Dorsey, of Arkansas, and certain mail contractors, was alleged to have been formed to defraud the government by increasing payments to certain mail contractors. Operations included 135 mail routes wherein compensation for carrying the mail was raised from $143,169 to $622,808. This was accomplished by securing petitions from the localities interested for an increase in the number of trips, the schedule time for each trip being shortened. The frauds were brought to light early in Garfield's administration, and the chief participants were prosecuted and the frauds stopped.

STARS. See Star.

STARS AND BARS. The popular name applied to the flag adopted by the Confederate States of America early in 1861. See Flag.

STAR SAPPHIRE. See Girasol.

STAR-SPANGLED BANNER, The. The national hymn of the United States, written by Francis Scott Key (q.v.) on board the frigate *Surprise* during the bombardment of Fort McHenry, Md., by the British, in 1814. He directed that the words should be sung to the tune "Anacreon in Heaven," composed in England by John Stafford Smith between 1770 and 1775. "The Star-Spangled Banner" was first sung in a tavern near the Holiday Street Theatre, Baltimore, by Ferdinand Durang. Consult: Johnson, *Our Familiar Songs* (New York, 1881); FitzGerald, *Stories of Famous Songs* (London, 1898); O. G. T. Sonneck, *The Star Spangled Banner* (Washington, 1914), containing "various versions both of text and of music with notes as to the historical evolution."

STARTER. See Motor Vehicle.

STAR THISTLE. See Centaurea.

STARVATION (AS. *steorfan,* to die), or Inanition. Emaciation, enfeeblement, lowered vitality, and finally death, resulting from insufficiency of or total deprivation of food. The fact is stated, quoted from Chossat, that death from starvation occurs after the loss of four-tenths of the body weight. The same observer recounts the following phenomena: (1) Dropsical effusion. (2) Softening and destruction of the mucous membrane. (3) Blackening of the viscera, especially of the liver. (4) Bluish, livid, yellow, and reddish stains during life in the transparent parts of the skin. (5) Hectic fever, and a continuous decrease in the power of the body to resist cold. (6) At first a scanty excretion of dry, bilious, grass-green fæces, and afterward diarrhœa of liquid saline matter. (7) Convulsions similar to those in death by hemorrhage. (8) Death by starvation seems to be in reality death by cold; since the temperature of the body is not much diminished until the fat is nearly consumed, when it rapidly falls, unless kept up by heat applied externally. (9) Young animals succumbed soonest. (10) Results of insufficient food were in the end the same as those of total deprivation, the amount of loss being almost the same, but the rate being less, so that a longer time was required to produce it.

Death supervenes earlier when liquids as well as solid food are withheld. During the famine of 1847 in Ireland, the symptoms observed were: pain in the stomach, relieved by pressure; pallor and emaciation; bright and wild eyes; parched mouth, thick and scanty saliva; intolerable thirst; fetor; tottering gait. See Fast.

The time during which life can be supported under entire abstinence from food and drink varies much. In one case, reported by Sloan, a healthy man, aged 65 years, survived 23 days' imprisonment without food in a coal mine, having impure water for the first ten days of this period. He died three days after rescue. The average healthy individual will survive a week or 10 days of complete abstinence from food and water. Consult: Leeson, "Death from Starvation," in *Dublin Medical Press* (Dublin, 1847); Davies, "Starvation," in *Popular Science Monthly*, vol. xxvi (New York, 1884–85); Fernet, "Amaigrissement extrême et mort par inanition," in *Bulletin et mémoire de la Société médicale de l'hôpital de Paris* (Paris, 1901); F. G. Benedict, *A Study of Prolonged Fasting*, published by the Carnegie Institution (Washington, 1915).

STARWORT. See Chickweed.

STARY-OSKOL, stä′rē-ŏs-kôl′. A district town in the Government of Kursk, Russia, on the river Oskol, 92 miles east-southeast of Kursk (Map: Russia, E 4). It has tanneries and tobacco factories. Pop., 1910, 27,310.

STAS, stȧs, Jean Servais (1813–91). A Belgian chemist. He was born in Louvain, studied under and later assisted Dumas, and was for many years professor in the Royal Military School at Brussels. Later he held a post in the royal mint. In 1872 he retired from active service. Stas devoted years to the determination of the atomic weights of the elements, and it is principally for this research that he is celebrated. His impulse was from discussion as to whether the atomic weights are or are not exact multiples of the atomic weight of hydrogen—a question connected with Prout's hypothesis that the several chemical elements are derived from hydrogen and are not essentially different substances. But the results of Stas's work have been of much further-reaching importance, and its precision has but recently been surpassed. His collected works appeared in three volumes (Brussels, 1894). Consult Spring, *Notice sur la vie et les traveaux de J. S. Stas* (Brussels, 1893).

STASI′NUS (Lat., from Gk. *Στασῖνος*). A Greek epic poet, born in Cyprus. The dates of his birth and death are unknown. He was author of a poem, in 11 books, called the *Cypria* (q.v.). Internal evidence shows that this poem was written later than the *Iliad*. For a good account of the *Cypria* consult the Appendix to D. B. Monro's edition of the *Odyssey* (Oxford, 1901).

STASIS, Intestinal (from Gk. *στάσις*, *stasis*, a standing, stagnation, from *ἵστημι*, *histēmi*, to stand, to stagnate). A medical term introduced by Sir William Arbuthnot Lane, designating a stoppage or retardation of the passage of the contents of the intestinal tract, in consequence of the presence of angulations, kinks (Lane's kink), or constrictions (Jackson's membrane) of the gut brought about by the growth of fibrous bands or peritoneal processes. The origin of these bands has not been settled. They have been considered as the results of atavistic development, or as products of inflammation in neighboring organs, i.e., the gall bladder, liver, or appendix, or as caused by low-grade bacterial infection of the gut itself. Lane and his followers, regarding the intestinal canal merely from the standpoint of drainage, and attributing the indefinite congeries of symptoms, called autointoxication, to retention and absorption of fecal matter, assert that by severing these constricting bands and restoring the normal patency of the intestinal canal, intestinal stasis, and consequently autointoxication, will be entirely relieved, unless there is insufficiency of the ileocæcal valve. Short circuiting, i.e., resecting of a greater or less length of the bowel and suturing the severed ends together, is also practiced. Diagnosis is largely made by means of the X ray after the patient has ingested bismuth to render the intestine opaque to the rays.

While Lane and his followers claim great success for their operations, others severely criticize and condemn it. These surgeons point out that the intestines may be matted together after peritonitis, also that many individuals suffer from so-called stasis and even constipation, without the production of autointoxication; they also ridicule the theory of atavistic development. About 80 per cent of such patients, it is stated, are relieved by the wearing of a proper abdominal support and the administration of mineral oil. This mineral oil (in contradistinction from animal and vegetable oils) is not absorbable by the body and acts mechanically on the fæces and bowels, but being a refined product of petroleum, should only be used after absolute elimination of the higher hydrocarbons, so dangerous to the kidneys and urinary system.

STASSFURT, shtäs′fụrt. A town in the Province of Saxony, Prussia, on the Bode River, 20 miles south of Magdeburg. There are iron mills, and the important royal salt works, which mine potash and rock salts. Extensive chemical works are also found here. Pop., 1900, 20,031; 1910, 16,794. The town has been known since 806.

STASSOV, shtȧs′ŏf, Vladimir Vassilievitch (1824–1906). A famous Russian musical critic. He gained his musical views from a general study of the world's great composers and from association with Serov (q.v.). For half a century after 1847 he wrote musical criticism. A firm believer in nationalist music, he vigorously championed the new Russian school of composers founded by Balakireff (q.v.). Although his criticism was often too polemic—sometimes vitriolic—his general influence in spreading correct ideas on musical art was important. His writings include: *L'Abbé Santini et sa col-*

lection musicale à Rome (1852); *Liszt, Schumann, and Berlioz in Russia* (1889); and monographs on Glinka, Borodin, and other Russian composers. He published also noteworthy editions of the letters of Glinka, Dargomyzhsky, Serov, and Mussorgsky.

STA'TANT (heraldic Fr., standing). In heraldry, a term applied to an animal standing still, with all the feet touching the ground. If the face be turned to the spectator, it is said to be statant gardant, or in the case of a stag, at gaze. See HERALDRY.

STATE (Lat. *status*, state), THE. The theory of the state in its broadest sense may be taken to cover the whole field of political philosophy, involving the comprehensive examination of the laws underlying political phenomena. (See POLITICAL SCIENCE.) In a narrower sense, the theory of the state is concerned primarily with the essential nature of the state, its origin and basis, its various forms, and proper function or purpose.

The essential elements of the state, together distinguishing it from other social groups, are generally considered to be the following: a territorial basis serving as its physical foundation, a population constituting its citizenship, and a more or less complete form of political organization exercising the power of life and death. Finally, the state is a sovereign body, supreme over all persons on its territory and independent internationally.

The origin and basis of the state have been explained in various ways. It has been held that the state owes its genesis and continuance to the will or command of God, a doctrine used in the defense of all forms of government, including democracy. The origin of the state has been traced by others to the family, and explained as a development of the power of the early patriarchs. Others have maintained that the state was created by and exists in virtue of a voluntary contract to which the parties were either (1) the government on the one hand and the people on the other; or (2) separate individuals who agreed to form a political society and a government by a contractual process. Again it is argued that the foundation and support of the state is superior force. The modern theory is that the state owes its being to a historical process in which many or all of the foregoing factors may have played a part. The explanation of the present existence of a coercive power over individuals is generally found in a variety of motives for obedience. Of these the principal ones are custom or habit, fear, utility, or the calculation of accruing advantages and disadvantages, and the element of conscious and rational consent. The general tendency of political development is toward a state based on general perception of its utility, and consequent consent to its laws.

The forms of the state are three, monarchy, aristocracy, and democracy, according as political power rests with one, the few, or the many. All other forms of government may be resolved into the three forms enumerated. Thus, theocracy is any one of these three forms in which the rulers are supposed to possess a special divine sanction for their government. The so-called federal state may be resolved either (1) into a union of many states for certain general purposes; or (2) one state with a dual form of government and with sovereignty vested in the group as a whole. Plutocracy and oligarchy are perverted forms of aristocracy. Constitutional, despotic, free, when applied to states, have reference to the method in which the government is organized or administered, rather than to the form of the state, and might be applied to any of the three types.

As to the function or purpose of the state, it has been held that its proper function is the development of the moral or religious nature of its subjects, and that this should be the controlling purpose of its activity. Again it has been maintained that its function is merely to preserve order among its citizens and to protect them from external attack, leaving all else to the domain of individual initiative. It is also held that the function of the state is to further the general welfare of its subjects, including in this all sides of their life. In modern times the contest lies between the advocates of the legal state and those of the paternal state, holding respectively the individualistic and the socialistic conceptions of the function of organized political society. One of these theories has been carried to the extreme of a demand for anarchy, and the other to the opposite pole of a demand for the extension of the functions of government to the immediate control of industrial activity. At present the most widely accepted doctrine is that no general principle governing the activity of the state can be laid down, but that each case of proposed state action must be decided in accordance with what appears to be the greatest good to the greatest number.

A philosophy of politics was first developed by the classical school of which Plato, Aristotle, and Cicero were the leading exponents. The most marked characteristics of the political thinking of this time were the development of political theory from the city as a basis—the city state—the complete subordination of the individual to the state in the discussion of political problems and the constant confusion of political and ethical theory. In the next great period, that of the Middle Ages, political theory was interpreted in the light of Christian theology. A system of politics was deduced from the joint authority of the Scriptures, the writings of the Fathers, the philosophy of Aristotle, and the Roman law—all analyzed and presented with the subtlest refinement of which Scholasticism was capable. The point around which political speculation centred was the true and proper relation between church and state. Thomas Aquinas (*Summa Theologica* and *De Regimine Principum*) was the most successful champion of the church; Marsilius of Padua (*Defensor Pacis*) and Dante (*De Monarchia*) of the state. During the Renaissance and the Reformation political theory made important advances. By the work of Machiavelli (*Il principe, Discorsi*) politics was divorced from theology and ethics, and elevated to the position of an independent science. Jean Bodin, reviving the method and spirit of Aristotle, laid the foundations of modern systematic politics in his epoch-making treatise, *De Republica*. In the revolutionary period of the seventeenth and eighteenth centuries the so-called natural-law philosophy was dominant. The fundamental premise of this system was the universal prevalence of an immutable law of natural justice, under which and independently of any government all men hold certain rights, e.g., life.

liberty, and property. From this premise followed the theory of a contract as the basis of all legitimate government, the administration of government for the good of the parties to the contract, and the right of revolution whenever government is perverted to selfish ends by the rulers. Of these doctrines John Locke (*Two Treatises of Civil Government*) and Jean Jacques Rousseau (*Le contrat social*) were the most influential expounders. During the same period the opposing doctrines of the divine right of kings and governmental absolutism were developed by Robert Filmer (*Patriarcha*) and Bossuet (*Politique tirée de l'écriture sainte*), while Thomas Hobbes turned the natural-law theory to the defense of absolutism (*The Leviathan*). As opposed to the a priori conception of these writers, Montesquieu (*Esprit des lois*) placed the study of political science upon an historical basis.

The modern theory of politics, dating from the reaction against the excesses of the French Revolution, is based on the historical-scientific premise that all institutions are the product of an evolutionary movement in which the conscious will of individuals plays a comparatively unimportant part. The method followed is historical and comparative, in contrast to the deductive style of the preceding school. The numerous problems arising out of the development of modern democracy, those involved in nationalism, federalism, and imperialism, and the determination of the proper function of government, are the questions upon which general attention is fixed.

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STATE, Department of. One of the 10 executive departments of the government of the United States, presided over by a secretary who is a member of the cabinet (q.v.) and next in the line of succession to the presidency after the Vice President. In rank the Department of State stands first among the other departments and is also the oldest in point of origin. It was in fact the logical successor of the old Department of Foreign Affairs created in 1781 and presided over first by Robert R. Livingston and afterward by John Jay. The Department of State is the organ of communication between the government of the United States and all foreign governments, as well as with the governors of the individual States. The Secretary of State conducts all such correspondence and has charge of the negotiation of all treaties and conventions; he preserves the originals of all treaties, public documents, and correspondence with foreign governments as well as of the laws of the United States; he publishes all statutes and resolutions of Congress and proclamations of the President; he is the custodian of the great seal which is affixed to all commissions of appointment requiring the consent of the Senate, proclamations, warrants for extradition, pardons, etc., emanating from the President; deals with the ambassadors to foreign countries; issues and keeps a record of passports granted to American citizens traveling abroad; issues warrants for the extradition of criminals to be delivered to foreign governments; presents foreign ministers to the President; etc. He makes an annual report of the conduct of foreign affairs for the year, publishes the consular reports and the "foreign relations" of the United States, and performs such other duties relative to the conduct of foreign affairs as the President may direct.

The following is a list of the Secretaries of State from the organization of the department in 1789 to the present, with the dates of their appointment: John Jay, holding over (as former Secretary of Foreign Affairs), March, 1789; Thomas Jefferson, September, 1789 (seated March, 1790); Edmund Randolph, January, 1794; Timothy Pickering, December, 1795; John Marshall, May, 1800; James Madison, March, 1801; Robert Smith, March, 1809; James Monroe, April, 1811; John Q. Adams, March, 1817; Henry Clay, March, 1825; Martin Van Buren, March, 1829; Edward Livingston, May, 1831; Louis McLane, May, 1833; John Forsyth, June, 1834; Daniel Webster, March, 1841; Hugh S. Legaré, May, 1843; Abel P. Upshur, July, 1843; John Nelson, February, 1844; John C. Calhoun, March, 1844; James Buchanan, March, 1845; John M. Clayton, March, 1849; Daniel Webster, July, 1850; Edward Everett, November, 1852; William L. Marcy, March, 1853; Lewis Cass, March, 1857; Jeremiah S. Black, December, 1860; William H. Seward, March, 1861; Elihu B. Washburne, March, 1869; Hamilton Fish, March, 1869; William M. Evarts, March, 1877; James G. Blaine, March, 1881; Frederick T. Frelinghuysen, December, 1881; Thomas F. Bayard, March, 1885; James G. Blaine, March, 1889; John W. Foster, June, 1892; Walter Q. Gresham, March, 1893; Richard Olney, June, 1895; John Sherman, March, 1897; William R. Day, April, 1898; John Hay, September, 1898; Elihu Root, July, 1905; Robert Bacon, January, 1909; Philander C. Knox, March, 1909; William J. Bryan, March, 1913; Robert Lansing, June, 1915.

Consult *History of the Department of State* (Washington, 1901).

STATE CONSTABULARY. See Military Police.

STATE FORESTRY. See Lumber Industry.

STATEN (stăt′*e*n) **ISLAND.** An island of New York constituting Richmond County, and since 1898 the Borough of Richmond, New York City (q.v.) (Map: New York City and Vicinity, B 8). It is distant a little more than five miles from the southern extremity of Manhattan Island, and is separated from Long Island on the east by The Narrows, which connect the upper New York bay with the lower bay. Staten Island is triangular in form, about 13½ miles long from northeast to southwest, and nearly eight miles wide. Its area is about 70 square miles. Two ranges of hills occur in the northeastern portion of the island, and here the highest altitude, 400 feet, is reached, one mile from the shore line of The Narrows. From this point the land slopes to the south to the level of the coastal plain, while along the west coast there are considerable areas of salt marshes. The Narrows are commanded by Forts Tompkins and Wadsworth. The chief villages are New Brighton, West New Brighton, Port Richmond, Stapleton, and Tompkinsville along the north shore, and Tottenville (Bentley Manor) on the southwest coast. Part of the island was granted by the Dutch West India Company in 1636 to David Pietersen de Vries, who established a settlement at Oude Dorp, near South Beach, in 1641. In the Billopp mansion, built by Captain Christopher Billopp about 1668 and still standing, a peace conference was held on Sept. 11, 1776, between Lord Howe and Benjamin Franklin, John Adams, and Edward Rutledge.

STATE RIGHTS, or STATES' RIGHTS. A term referring to the rights of individual states as compared with the Federal government. In the United States, the term is used to denote a view prevailing in some sections with regard to the nature of the Union. According to this view the Union was a compact of sovereign and independent States; the Federal government was the mere agent of the States as principals; the primary allegiance of the individual was to his State rather than to the United States. In effect this view upheld the right of a State to interpose its authority when the central government enacted oppressive or unconstitutional laws. (See Nullification.) Many political leaders had contended for this view with reference to the controversy over slavery. Many of the Southern States held to the States'-rights view of the Constitution, although some of them were not nullifiers. Early in the nineteenth century, particularly at the time of the War of 1812, the States'-rights view was strong in the North and East, and was not entirely abandoned, but became the view and support of the slavery interest. It is no longer a constitutional question. In the German Empire, States' Rights, or Particularism, as the Germans call it, is very strong, and has caused many great constitutional struggles in that country. The Imperial Constitution recognizes a large sphere of autonomy of the individual states, and some of those in south Germany enjoy rights which are survivals of the Confederation. See Dartmouth College Case.

STATES, Popular Names of. *Badger State;* Wisconsin, from the animal.—*Bay, or Old Bay, State;* Massachusetts, from the earliest settlements on the bay, called "Bay Colony."—*Bayou State;* Mississippi, from the number of its bayous (rivulets).—*Bear State;* Arkansas, from the animal.—*Beaver State;* Oregon, from the animal.—*Blackwater State;* Nebraska, formerly so called from the dark color of its rivers; now known as the Tree-planter State.—*Blizzard State;* South Dakota. The word "blizzard," of obscure origin, was used early in the sense of a blow or discharge from a gun; now a severe storm.—*Blue Grass State;* Kentucky, from its blue grass.—*Blue Hen State;* Delaware. The term is said to have originated from gamecocks of a breed of blue fowl. This lacks proof.—*Blue Law State;* Connecticut. See Blue Laws.—*Bread and Butter State;* Minnesota, from its wheat and dairy products.—*Buckeye State;* Ohio, because of the horsechestnut, popularly called *buckeye.*—*Bullion State;* Missouri, from the sobriquet "Old Bullion," applied to Senator Thomas Hart Benton of that State from his stand for gold and silver currency.

Centennial State; Colorado, admitted into the Union in the Centennial year, 1876.—*Central State;* Kansas, from its location.—*Corn Cracker State;* Kentucky, perhaps because of the great use of corn as food.—*Cotton State;* Alabama, the central State of the cotton belt.—*Cracker State;* Georgia, from the poor white population, often called Crackers.—*Creole State;* Louisiana, from its many descendants of French and Spanish settlers.—*Dark and Bloody Ground;* Kentucky, in early times the scene of frequent Indian wars.—*Diamond State;* Delaware, from its small size.—*Dominion, Ancient or Old;* Virginia, from early documents in which there are allusions to "the Colony and Dominion" of Virginia, or "the Dominion" of Virginia, and "the Ancient Colony and Dominion."—*Egypt;* Southern Illinois, from its alleged intellectual darkness or its fertile soil.—*El Dorado;* California. El Dorado (q.v.) was the name of a fictitious region or city abounding in gold.—*Empire State;* New York, from its size, wealth, and population. —*Empire State of the South;* Georgia, from its enterprise.—*Evergreen State;* Washington.—*Excelsior State;* New York, from the motto on its seal (adopted 1778).

Freestone State; Connecticut, from its freestone quarries.—*Gem of the Mountains;* Idaho, a rendering of the State name (Indian).—*Golden State;* California, from its gold mines.—*Gopher State;* Minnesota, from the animal.—*Granite State;* New Hampshire, from its granite hills.—*Green Mountain State;* Vermont, from the Green Mountains.—*Hawkeye State;* Iowa. Apparently an allusion to J. G. Edwards, familiarly known as "Old Hawkeye," editor of the Burlington *Patriot,* now the *Hawkeye and Patriot.* —*Hoosier State;* Indiana. Its origin is obscure. —*Jayhawker State;* Kansas, from a derisive epithet applied to James Montgomery and his men, who took part in the territorial troubles.—*Keystone State;* Pennsylvania, probably because it was the central State of the Union at the formation of the Constitution.—*Lake State;* Michigan.—*Land of Steady Habits;* Connecticut. See Blue Laws.—*Little Rhody;* Rhode Island, from its small size.—*Lone Star State;* Texas, from the single star in the flag of the Texas Republic (1836–45).—*Lumber State;* Maine.—*Magnolia State;* Mississippi, from its many magnolia trees.—*Mormon State;* Utah.—*Mother of Presidents;* Virginia, because the birthplace of eight Presidents.—*Mother of States;* Virginia, because the first settled of the States.

New England of the West; Minnesota.—*Nutmeg State;* Connecticut, in allusion to the alleged manufacture of wooden nutmegs there.—*Old Colony;* That part of Massachusetts which up to 1692 was the Plymouth Colony.—*Old Line State;* Maryland, probably from the "Maryland Line" distinguished in the Revolution.—*Old North State;* North Carolina.—*Palmetto State;* South Carolina, from the device on its seal.—*Panhandle State;* West Virginia, from the irregular section of the State northward between Pennsylvania and Ohio.—*Pelican State;* Louisiana, from the device on its seal.—*Peninsula State;* Florida, from its location.—*Pine Tree State;* Maine, from the device on its seal, adopted in 1820.—*Prairie State;* Illinois, from its prairies.—*Sage-Brush State;* Nevada, from the plant.— *Silver State;* Nevada, from its silver mines.—*Sucker State;* Illinois, because in early days the miners returned from "up river" at the season when the sucker migrated. The term was first used about 1833.—*Sunflower State;* Kansas.—*Tree-planter State;* Nebraska.—*Turpentine State;* North Carolina.—*Volunteer State;* Tennessee, from its number of enlistments in old wars.—*Web-Foot State;* Oregon, from the quantity of rain which falls there.—*Wolverine State;* Michigan, from the animal.

STATESBORO, stāts′bŭr-ô. A city and the county seat of Bulloch Co., Ga., 60 miles northwest of Savannah, on the Central of Georgia and the Savannah and Statesboro railroads (Map: Georgia, E 3). It contains the First Congressional District Agricultural College and a good high school. There is a cottonseed-oil mill, and a trade in cotton, watermelons, and cantaloupes is carried on. Pop., 1900, 1197; 1910, 2529.

STATE'S EVIDENCE (or, in England, KING'S or QUEEN'S EVIDENCE). A popular phrase used to denote the testimony given by an accomplice in the commission of a crime against the other accomplices on their trial, under an agreement or understanding with the prosecuting officer that the witness shall not be brought to trial for his part in the crime, in consideration of his aid to the state. Such an agreement or understanding on the part of the prosecution is not valid and enforceable as a matter of law, but in practice such agreements are usually adhered to by the prosecutor as a matter of good faith and are countenanced by courts as a justifiable and proper means of securing convictions for crime. Where a confession is obtained under promise of immunity by the prosecutor, who subsequently revokes the promise and puts the offender on trial it is the general rule that the confession cannot be used against the person making it. In several states there are statutes providing that there shall be no conviction for crime upon the uncorroborated testimony of an accomplice. In applying this statute, whether a witness is an accomplice whose testimony requires corroboration is a question for the jury, unless the facts are undisputed or the question rests upon some rule of law, where it must be passed upon by the court. See ACCESSORY; ACCOMPLICE; PRINCIPAL.

STATES-GENERAL (Fr. *états-généraux*). The name given to the convocation of the representative body of the three orders of the French Kingdom, representing the nobility, clergy, and bourgeoisie or *tiers état* (Third Estate). As early as the time of Charlemagne, there were assemblies of clergy and nobles twice a year to deliberate on matters of public importance, and in these assemblies the extensive body of laws bearing the name of the Capitularies of Charlemagne was enacted. These national convocations seem to have ceased to be held at the time of the final disruption of the Carlovingian realm, about 70 years after Charlemagne's death. From that time there is no trace of a national assembly in France till 1302, when the *états-généraux*, including the three orders, clergy, nobles, and citizens, were convoked by Philip the Fair, with the view of giving weight to the King's course in his quarrel with Pope Boniface VIII. In 1308 Philip obtained from the states-general a condemnation of the Knights Templars. During the Hundred Years' War (1337–1453) they were frequently convoked, and played an important rôle in connection with revenue and taxation. Not a law-making body, they enabled the voice of the nation to assert itself against abuses of royal power. As royalty became more absolute, and a standing army made the sovereign less dependent upon financial grants from his subjects, the summoning of the states-general gradually ceased. The advisers of Louis XIII convoked the states-general, after a long interval, in 1614, but they were soon dismissed for looking too closely into the finances; from that time there was no convocation of the states-general till the memorable meeting in 1789, initiating the French Revolution. The states-general voted by orders, but in 1789 the Third Estate refused to abide by a regulation which enabled the other two orders to combine against it. They insisted that the vote should be by members in a single body (with the Third Estate as numerous as the other two orders combined), and they achieved their object by constituting themselves the National Assembly. See FRENCH REVOLUTION.

The name States-General is also applied to the existing legislative body of the Kingdom of the Netherlands (q.v.), as was formerly the case in the Republic of the Netherlands from 1593 to 1795.

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STATES OF THE CHURCH. The territory in Central Italy formerly under the temporal sovereignty of the holy see. For their history, see PAPAL STATES; and for the theory involved, TEMPORAL POWER.

STATES' RIGHTS. See STATE RIGHTS.

STATES′VILLE. A city and the county seat of Iredell Co., N. C., 44 miles north of Charlotte, on the Southern Railway (Map: North Carolina, B 2). One of the State experiment farms is just outside the city limits. There are furniture factories, flour mills, cotton mills, tanneries, foundries, tobacco factories, a large herbarium, and ironworks. Here are the Statesville Female College and Long's Sanitarium. Pop., 1900, 3141; 1910, 4599.

STATE TRIALS. In English law, a phrase employed to denote trials involving offenses against the state, or which determine questions concerning the duties and privileges, etc., of important officers of the crown. The first collection of State Trials appeared in 1719; a second in 1730; a third in 1742; Hargrave's edition in 10 volumes in 1776–81; and between 1809 and 1826 the fifth edition in 33 volumes was published. This edition is the one now used, and is known as "Howell's State Trials," after the real editor, Thomas Bayley Howell, who compiled the work, although the name of one Cobbett appears as editor on the title-page of volume i. A new series covering years from 1820 to 1858 was published, under the supervision of a Parliamentary Committee, in eight volumes (1888–98), including all important cases in constitutional and international law.

STATIA. See Eustatius Island.

STATIC (stăt′ĭk) **ELECTRICITY.** See Electricity.

STATICS, stăt′ĭks (from Gk. *στατικός*, relating to standing). That branch of mechanics which treats of the properties of material bodies when, under the action of forces, their motion is not changing. They are then said to be in equilibrium. See Equilibrium; Graphic Statics; Mechanics.

STATIC SENSE. In close anatomical connection with the cochlea of the inner ear there are in man and most other vertebrates three bent tubes of bone inclosing three membranous tubes, filled with and floating in a fluid, and near the otolith apparatus. (See Ear, *Internal Ear*, and Illustration.) We now have evidence for regarding them and the otolith apparatus as the organs of a static sense, by which is meant (1) that they constitute a physiological apparatus for the maintenance of equilibrium (probably, also, for the maintenance of muscular tonicity); (2) that any irregularity in their operation makes itself felt mentally as giddiness or dizziness; and more doubtfully (3) that an acceleration or a diminution of the rate of movement of the body as a whole so affects them as to set up sensations which are interpreted as what has very loosely been termed a "sense of translation." Consult: Mach, *Bewegungsempfindungen* (Leipzig, 1875); Wundt, *Physiologische Psychologie* (6th ed., ib., 1908; Eng. trans. by Titchener, New York, 1905); McKendrick, *The Internal Ear*, in E. Schäfer, "Textbook of Physiology," vol. ii (ib., 1900); Titchener, *Textbook of Psychology* (ib., 1910).

STATIONERS' HALL. The guildhouse of the "Master and Keepers or Wardens and Commonalty of the Mystery or Art of Stationers of the City of London," now situated near Ludgate Hill in London. This company, which had been preceded by a voluntary association as early as 1403, was incorporated in 1556. For nearly 300 years it regulated the publication of all books in England. Since the passage of the copyright law (1842), registration is no longer compulsory, but it is necessary for securing copyright. For a history of the company, consult the first volume of E. A. Arber's valuable *Transcript of the Stationers' Registers, 1554–1640* (5 vols., London, 1875–94).

STATIONS (Lat. *statio*, from *stare*, to stand). A name applied in the Roman Catholic church to certain places which are appointed to be visited as places of prayer at which a ritual is appointed on specified "station days." The word is also employed in reference to a popular devotional practice of the Roman Catholic church, known as that of "the stations of the cross," which became common after the middle of the seventeenth century. The number of the stations is commonly fourteen; the subject of all is a sort of pictorial narrative of the passion. The devotional exercise is performed by kneeling at the several stations in succession, and reciting certain prayers, or joining in their recitation by the priest. Consult Herbert Thurston, *The Stations of the Cross* (London, 1906). See Via Dolorosa.

STATIS′TICS. Etymologically, the science of states. The word seems to have been introduced into England about the beginning of the nineteenth century. It came into use in Germany about half a century earlier, and was there applied to lectures or books upon descriptive political science, of which the *Statesman's Year Book* and the *Almanach de Gotha* are typical modern representatives. If either of these annual publications be imagined stripped of its numerical statements, a fair notion is left of Achenwall's *Outlines of Modern Political Science* ("Abriss der neuesten Staatswissenschaft," etc., 1749), which opens with the statement: "The notion of statistics so called, i.e., the political science of the several kingdoms, is very differently understood, and among the many books on the subject it is not easy to find any one that agrees with the rest in the number and the arrangement of its parts." The title "Statistics" thus adopted by Achenwall established itself as the prevailing name for a sort of descriptive political science, which had existed long before as the Elzevir *Republics* and the writings of Conring illustrate, and which maintained itself at the universities and before the public in Germany until into the nineteenth century.

Meantime in England a different line of work had begun about the middle of the seventeenth century, after the disastrous visitations of the plague had aroused interest enough in the mortality it did so much to swell to cause weekly reports of the burials and later of the christenings in London to be published. The keen interest in the methods of observation and measurement which culminated in and were reënforced by the Royal Society, chartered in 1662, induced Capt. John Graunt to apply methods of observation, induction, and measurement to the births and deaths of London. He presented to the Royal Society in 1662 his "Observations on the Bills of Mortality," the foundation of statistics as that word is now understood. It was then called "political arithmetic." Süssmilch in 1741 hailed Graunt as a scientific Columbus who had discovered a new continent and confessed himself Graunt's disciple, but showed no knowledge of Achenwall's work and made no use of the name "statistics." Gradually the word "statistics" spread to Great Britain, where, in 1798, Sir John Sinclair published his *Statistical Account of Scotland.* The word was taken up by Malthus in editions of his *Principle of Population* after the first, and in such connection as to indicate that he borrowed it from Sinclair. Malthus's subject matter was in the line of previous writers on political arithmetic. Meantime the study of political arithmetic, born in England, extended to the Continent, gradually displacing the older statistics of Achenwall, sometimes called "university statistics," from its prevalence as a subject of university lectures. Perhaps the most striking difference between the two notions of statistics, the older and the newer, is that the former is purely descriptive and takes no account of the underlying notion of modern science, the notion of causation, while the latter subordinates description to explanation, or an attempt at explanation. At the same time it would be inconsistent with present usage to limit the word statistics any further than to say that it refers to the results that may be obtained in any field of reality by methods of counting and that these methods are mainly employed in the study of societies politically organized into states.

Methods of counting apply especially to the study of human societies, because in them the individual units are widely different, and it is with the differences almost as much as with the resemblances between individuals that science is concerned. In the organic sciences and to a less extent in the sciences of plant and animal life, the units taken for purposes of investigation resemble one another far more closely than human individuals do, or at least their resemblances are far more obvious and for man's purposes more important than their differences. In other than the social sciences, therefore, the observation of one or a few units may serve as a basis for general statements about the group, but in human societies it is frequently necessary to ascertain the existence, or nonexistence, of a particular characteristic in every member of the group. This involves counting, and results in a statement in some numerical form, as a percentage, an average, or a series of figures showing the distribution of the characteristic among the members of the group. This indicates a fundamental reason for the imperfect development of methods of measurement in the social sciences and a reason that statistics or the science of measuring aggregates of units, as distinct from individual units, is more necessary and has a wider range of applications in the study of social sciences than it has in the study of natural sciences. There is, therefore, much ground for the opinion of those who define statistics as the numerical study of social facts, or the numerical investigation of man's social life. But it seems more correct to hold that, e.g., an enumeration through the century of the number of auroras observed each year and an observation through the same period of the extent of spots on the sun, and an arrangement of these two measurements in such a way as to show that they have fluctuated in close conformity, are to be included in statistics.

Theory. The United States Census reported, in 1900, 27,765,707 persons in the country who were over 15 years of age and married; in 1910 this class of the population numbered 35,777,287. On computing the ratios it was found that among each 1000 adults 557 were married in 1900 and 572 in 1910. The Bureau of the Census reported 691,594 deaths in the registration area in 1908, of which 6086 were caused by railroad accidents, and, in 1911, 839,284 deaths, of which 7696 were due to the same cause; so that railroad accidents caused, in 1908, 881 deaths and, in 1911, were responsible for 926 deaths out of each 100,000 reported. The foregoing will serve to illustrate a regularity or uniformity often, but not always, traceable in the distribution of conditions or the recurrence of events in society. Upon this uniformity in the characteristics of, and this regularity in the events occurring in, social groups, which has been called "the law of large numbers," the statistical method rests. These uniformities and regularities do not exist in the individual or even in the small group, and if they could not be traced in the large group the laborious and uninviting statistical method would add little to information. It is this "law of large numbers," or the permanence of numerical relations in social life, that makes it possible to describe human societies with accuracy in quantitative terms, to frame inductions from their past, which are found to hold for their future, to forecast the influence of a given change upon their life and so in multitudinous ways to control that life. Perhaps the best illustration of the importance of the "law of large numbers" is found in the business of insurance, which could not exist were it not for that law as a foundation. In social phenomena it is seldom possible to carry the isolation of causes to the perfection it has reached in the natural world. The marriage of an individual man or woman is influenced by so many complex considerations that it is impossible to perceive in the vast majority of marriages taken separately any effect of so subsidiary a cause as the price of bread or the spread of business depression. What this subsidiary cause loses, however, in power over each individual instance it gains by the number of individuals it reaches and the fact that its effect is uniformly in the same direction, while the influence of age, of example, of personal affection, of gain or loss of property, etc., though in many individual cases far more powerful, is felt sometimes in one direction and sometimes in another. Such causes, therefore, are as powerless on the aggregate as they are potent on the individual, and, on the contrary, the society as a whole betrays the undeniable effects of slight causes, which perhaps few individuals therein would admit to have swayed their action. The "law of large numbers" thus assumes that the causes of any social phenomenon may be divided into two groups, the individual, accidental, or disturbing causes, and the essential or primary causes, and that causes of the former sort have no constant tendency to act in one direction rather than another, and, accordingly, no tendency to move the group as a whole in any one direction. If a sufficiently large number of instances be taken, the disturbing or individual causes cancel and allow the influence of the essential or group causes to be traced. How large a number of instances must be enumerated to eliminate these individual causes with any specified degree of completeness is a mathematical problem dealt with by the calculus of probabilities.

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STATISTICS, VITAL. See VITAL STATISTICS.

STATIUS, stā′shĭ-ŭs, PUBLIUS PAPINIUS (c.40–c.96 A.D.). A Roman poet, born at Naples. He became famous for his poetic gifts, especially for his skill in extemporaneous verse, and three times gained the prize in the Alban contests. But finally, having been vanquished in the quinquennial games, he retired with his wife, Claudia, to his birthplace, Naples, where he died. He is polished and correct, and his verses, especially in the *Silvæ*, often have much charm, but one frequently feels the note of artificiality in his writings. He wrote a dull and laborious epic entitled *Thebais;* the *Silvæ*, five books of miscellaneous poems; and an epic of the Trojan cycle, *Achilleis*, of which only a portion has survived. The best modern editions are: of the *Silvæ*, by Baehrens (Leipzig, 1876); Vollmer (Leipzig, 1898), with extensive German commentary; Klotz (Leipzig, 1900); and Phillimore (1904); of the *Achilleis* and the *Thebais*, by Kohlmann (Leipzig, 1879), and Garrod (1906). There are English translations, in whole or in part, by Pope, Howard, Stephens, Lewis, and Slater (Oxford, 1908; the Introduction treats Statius's life and work). Consult H. E. Butler, *Post-Augustan Poetry* (Oxford, 1909); W. S. Teuffel, *Geschichte der römischen Literatur*, vol. ii (6th ed., Leipzig, 1910); Martin Schanz, *Geschichte der römischen Litteratur*, vol. ii, part ii (3d ed., Munich, 1913).

STA′TUS EP′ILEP′TICUS. See EPILEPSY.

STA′TUS LYMPHAT′ICUS (Lat., state, condition). A condition, occurring usually in children, characterized by overgrowth of the thymus gland, the lymphatic and lymph tissues generally, including the bone marrow and spleen. There is also a tendency towards enlargement of the tonsils, and sometimes of the thyroid gland, with anæmia. The condition is associated with a marked tendency towards death from slight causes, such as the administration of antitoxin, general anæsthesia, and minor operations. Status lymphaticus is particularly of interest in connection with hypertrophied tonsils, since such patients are apt to die during the first stage of anæsthesia induced for their removal, and the cause of death is only discovered at autopsy. Where any suspicion that status lymphaticus exists an X-ray photograph should be taken of the thymus region when, if lymphatism is present, this gland will be seen to be hypertrophied; and an examination should also be made of the general lymphatic system before any operative procedure is undertaken. See THYMUS GLAND.

STATUTE (Lat. *statutum*, statute). A law enacted or promulgated in writing by the supreme legislative body of a government or by its authority. Statute law is sometimes spoken of as written law to distinguish it from common or unwritten law, established exclusively by judicial decision. All statutes have their source in the official action of the legislative body, their form varying according to the form of government under which it acts. The validity of a statute in any given case depends not only upon lawful constitution of the legislative body, but on its constitutional authority to act. (See CONSTITUTIONAL LAW.) Statutes may be enacted by indirect legislation—by some subordinate legislative body whose acts derive validity from the sanction of the supreme legislative body. Thus, in England Orders in Council and the various rules of court adopted under the judicature acts, and in the United States the ordinances of Boards of Aldermen, and of Boards of Health under the various public health acts, are examples of statutes enacted by indirect legislation.

For the procedure by which statutes are created, see PARLIAMENT; CONGRESS; LEGISLATION; ETC. In England the acts of Parliament have the full force of statutory law without the approval of the sovereign, but it is the established custom for the sovereign to promulgate statutes "by and with the advice and consent of the Lords Spiritual and Temporal in this present Parliament assembled." In the United States the acts of Congress require the signature of the President, and the acts of the various legislatures require signatures of the governors of their respective States to give them validity. See VETO.

Statute laws may be classified with reference to the purpose for which they are enacted, and to the subject matter of the statutes, and also to compliance with the statute required. With reference to their purpose, statutes are said to be (*a*) declaratory, when passed for the purpose of affirming a rule of the common law which is indefinite, or a statute of doubtful meaning; (*b*) remedial, when passed for the remedying of defects or supplying omissions in the statute or common law; (*c*) penal, when passed to prohibit acts specified in the statute and imposing a penalty for violation. With reference to subject matter, they are said to be (*a*) public, when applicable to the entire community, and (*b*) private (see explanation of these terms under LAW; LEGISLATION; PUBLIC LAW; ETC.), as distinguished from public when applicable to a single individual or corporation, or to a limited number of individuals. The distinction between public and private statutes, first made in the reign of Richard II, now is important, owing to statutory and constitutional provisions requiring the publication of public and private statutes separately. Statutes have also been classified with reference to the extent of territory to which they apply. Those statutes are said to be (*a*) general, when they apply to the entire territory subject to the legislative jurisdiction of the lawmaking body, and (*b*) local, when they extend only to a limited political division of such territory, as statutes enacted by State legislatures which apply only to a single town, city, or county. With reference to the subject matter also, statutes are classified as Enabling acts, which confer rights or privileges, as the Married Women's Enabling acts; and Disabling acts, which take away rights or privileges hitherto enjoyed, as statutes requiring legal voters to have new or additional qualifications.

With reference to the compliance required statutes are said to be (*a*) mandatory when they direct an act to be done with the consequence that if it is not done all acts or proceedings taken under the statute are invalid. Thus statutes formulating the procedure for organizing corporations or authorizing civil arrest are mandatory, since they must be strictly complied with, or all acts under them have no validity. (*b*) Directory, when failure to comply with the statute does not affect the validity of acts done under it or entail the imposition of any penalty for failure to comply with it. Many statutes specifying the time and manner of filing official reports are directory only. There is no penalty for failure to comply with the statute, and compliance with it can be compelled only by mandamus (q.v.). (*c*) Prohibitory, when they forbid the doing of any act either with or without penalty for failure to comply with the statute. (*d*) Permissive, when they allow acts to be done not before permitted, or give to them some additional legal effect, although such acts are not required to be done, as the various statutes permitting the disposition of property by will.

A statute may contain four distinct parts: title, preamble, enacting clause, and purview. The title is a brief description of its purport, e.g., An Act Prohibiting Sabbath Breaking. In some states this is of great importance, because of constitutional provisions requiring statutes to have titles descriptive of the subject matter. In the absence of this, it is usual to omit the title. The preamble is an introductory and explanatory statement setting forth the reason and purpose of the statute. It is only an aid in interpreting the purview of the statute following. All early English statutes included the preamble, but it is now seldom used. The enacting clause is a brief direction that the statute be enacted; as, "Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled." The purview is that portion of the statute following the enacting clause, and is the only part of the statute which has the effect of law. It may contain various subdivisions or clauses known as provisos, exceptions, the saving clause, the repealing clause—terms self-explanatory.

At common law a statute was deemed to take effect as upon the first day of the session in which it was enacted. This was modified by Statute 33 Geo. III, c. 13, which provided that all statutes should become operative from the date of their receiving the royal assent. It is now generally the rule in the United States that statutes shall become operative from the date of their receiving the assent of the Executive, unless a different date is otherwise specified in the statute itself.

Courts will take judicial notice of all public statutes operative within their jurisdiction, and it is therefore not necessary generally to plead or prove a public statute upon which a litigant founds an action or defense. In the case of statutes or ordinances passed by legislative bodies not of supreme authority, such as a city board of aldermen, proof is generally required. Some rule of public policy may, however, require a public statute to be pleaded in special cases, as the Statute of Limitations (see Limitation of Actions) and Statute of Frauds (see Frauds, Statute of). But private statutes are required to be pleaded, and the statutes of foreign states and countries, being regarded as matters of fact, are required to be pleaded and proved like other matters of fact.

The volume of statute law enacted each year in the United States is so large that lawyers with great difficulty keep themselves informed concerning it. For the layman the task is very great. The best annual summary of American statute law appears, beginning with 1915, in the *Report of the American Bar Association*. Many problems connected with statute law come from faulty and careless bill drafting. To remedy this, many States have created legislative drafting departments for expert assistance in framing legislation. The American Bar Association has a special committee devoted to this, which is preparing a Manual of Instructions to Draftsmen, with model clauses for constantly recurring legislative provisions. Portions of this have been published in the Reports for 1913, 1914, and 1915.

For discussion of the amendment and repeal of statutes, consult those topics respectively; and for a discussion of the interpretation of statutes, see Abrogation; Constitutional Law; Interpretation; Law; Revised Statutes. See references under Law; Legislation.

STATUTE DE DONIS CONDICIONALIBUS. See Donis Condicionalibus, Statute de.

STATUTE OF FRAUDS. See Frauds, Statute of.

STATUTE OF LIMITATIONS. See Limitation of Actions.

STATUTE OF PROVISORS. See Provisors, Statute of.

STATUTE OF USES. See Uses.

STATUTE QUIA EMPTORES, or Quia Emptores Terrarum. The Statute of Westminster III, 18 Edw. I, c. 1 (1289), generally known as the Statute Quia Emptores, provided that there should thereafter be no reservation, in grants of estates in fee simple, of rent service, reversion, or other interest which should establish feudal tenure as between grantor and grantee. The effect of this statute was the abolition of subinfeudation. The question of whether these provisions are in force at the present day in the various States of the United States has been much discussed, although the general abolition of feudal tenure has made the point one of academic rather than practical interest. For a detailed description of the rules of law and statutes bearing upon this mooted question in the individual States, consult: Gray, *The Rule against Perpetuities* (3d ed., Boston, 1915); A. G. Reeves, *Treatise on the Law of Real Property* (2 vols., Boston, 1909); and authorities cited under Real Property. See Feudal System; Subinfeudation; Tenure.

STATUTES OF JEOFAILS, jĕf′ālz. English statutes permitting amendments to pleadings or curing certain mistakes or omissions in proceedings in an action. The name was derived from the old phrase *jeo faile* (I have failed), by which the leader acknowledged an error in his pleadings or proceeding, after which he could take advantage of the provisions of these statutes. The procedure acts in practically all of the United States provide for the amendment of pleadings, but the term *jeofails* is not commonly applied to such acts. Consult Chitty, *Treatise on Pleading* (16th Am. ed., Springfield, 1876); Perry on *Common-Law Pleading* (Boston, 1897); Stephen, *Principles of Pleading* (2d ed., Chicago, 1901).

STAUBBACH, stoub′bäG. A celebrated waterfall in the southern part of the Canton of Bern, Switzerland, 8 miles south of Interlaken. It is one of the highest in Europe, having a descent of between 800 and 900 feet. Long before it reaches the bottom it is blown into a dust of spray, whence its name *Staubbach* (dust stream).

STAUNTON, stạn'ton. A city in Macoupin Co., Ill., 38 miles northeast of St. Louis, Mo., on the Wabash, the Litchfield and Madison, and the Illinois Traction railroads (Map: Illinois, E 7). There are in the vicinity several coal mines and large oil and gas wells. The Labor Temple is a notable structure. Pop., 1900, 2786; 1910, 5048; 1915 (State census), 6495.

STAUNTON. A city and the county seat of Augusta Co., Va., 135 miles northwest of Richmond, on the Baltimore and Ohio and the Chesapeake and Ohio railroads (Map: Virginia, E 3). It is the seat of the Western State Hospital for the Insane and of the Virginia School for the Deaf and Blind and has the Mary Baldwin Seminary, Virginia Female Institute, and Staunton Military Academy. Other prominent features are the city hall, courthouse, Masonic Temple, and Gypsy Hill and Highland parks. Staunton manufactures pennants, bricks, building material, organs, flour, overalls, machine-shop products, and agricultural implements. The city-manager form of government was adopted in 1909. The water works and the electric-light plant are owned and operated by the municipality. Staunton is the birthplace of Woodrow Wilson (q.v.). Pop., 1900, 7289; 1910, 10,604; 1915 (U. S. est.), 11,485.

STAUNTON, Sir George Thomas (1781-1859). An English traveler and Orientalist, born near Salisbury. In 1792 he went with his father, Sir George Leonard Staunton (1737-1801), to China, where he learned to speak and write the language. After two terms at Cambridge he was appointed writer in Canton for the East India Company's factory. He introduced vaccination into China in 1804 by translating George Pearson's treatise. He translated from Chinese: *La Tsing lew lee, Being the Fundamental Laws of China* (1810), the first book translated from Chinese into English; the *Narrative of the Chinese Embassy to the Khan of the Tourgouth Tartars* (1821), and wrote: *Miscellaneous Notices Relating to China* (1822; 3d ed., 1850); *Notes of Proceedings and Occurrences during the British Embassy to Peking* (1824); *Observations on our Chinese Commerce* (1850); *Memoir of Sir J. Barrow, Bart.* (1852).

STAUNTON, Howard (1810-74). An English chess master and Shakespearean scholar. In 1843 he defeated St. Amant, then the chess champion of Europe, and three years afterward won from the German experts Harrwitz and Horwitz. His plans at all times displayed great originality in attack, fertility in defense, and untiring patience. He founded the *Chess Player's Chronicle* in 1840, which he edited until 1854, and from 1844 until his death conducted the chess column of the *Illustrated London News*. His Shakespearean researches resulted in an edition of the plays and poems (1857-60), edited and analyzed with shrewdness and good taste, a facsimile of the 1623 folio, and a series of articles contributed to the *Athenæum*, on "Unsuspected Corruptions of Shakespeare's Text" (1872-74). His other writings include: *Chess Player's Hand-Book* (1847; new ed., 1909); *Chess Player's Companion* (1849); *Chess Praxis* (1860); *Chess: Theory and Practice* (1876).

STAUPITZ, shtou'pīts, Johann von. A friend and spiritual guide of Martin Luther (q.v.).

STAUROLITE, stạ'rô-līt (from Gk. *σταυρός*, *stauros*, cross + *λίθος*, *lithos*, stone), or Fairy Stone. A mineral hydrated iron-aluminium silicate crystallized in the orthorhombic system. It has a subvitreous to resinous lustre and is dark brown to black in color. The crystalline varieties are frequently cruciform, owing to twinning. On account of their resemblance to a cross these forms are popularly believed to have fallen from heaven, and are used to some extent not only as ornaments but also as charms. These peculiar forms occur in crystalline schists, and are usually associated with garnet, syenite, and tourmaline.

STAUROSCOPE, stạ'rô-skōp (from Gk. *σταυρός*, *stauros*, cross + *σκοπεῖν*, *skopein*, to view). A variety of polariscope (q.v.) adapted to the study of crystals, and consisting essentially of a mirror, two Nicol's prisms, and a revolving stage. By it sections cut from crystals along any desired direction are examined by use of parallel rays of plane polarized light. See Conoscope; Crystallography.

STAVANGER, stă'vàng-ĕr. A seaport of southwest Norway, on the south shore of the wide entrance to the Stavanger or Bokn Fiord, 190 miles southwest of Christiania (Map: Norway, C 7). It has a Gothic cathedral, one of the finest in Norway. The town produces woolen, linen, and cotton goods, soap, preserves, oleomargarine, hardware, pottery, and bricks. There are iron foundries, and the harbor is provided with shipyards. Fisheries and the curing of fish are important industries. The principal exports are fish, preserved foods, butter and margarine, marble, and manure. Pop., 1901, 30,613; 1910, 37,261.

STAVROPOL, stäv'rô-pôl-y'. A government of Ciscaucasia (Map: Russia, F 5). Area, 23,398 square miles. The surface is largely steppe-like in character, and only the southwestern part is mountainous, the highest point being about 2200 feet. The principal rivers are the Kuma and the Great Egorlyk. Agriculture and stock raising are the principal occupations, though fruit raising engages a large proportion of the population. The chief cereals are wheat, oats, and barley. In 1910 there were in the government over 4,000,000 head of live stock, including nearly 3,000,000 sheep. Four fairs are held here annually. Pop., 1912, 1,294,400, of whom the Russians constituted 90 per cent.

STAVROPOL. The capital of the Russian government of the same name, situated about 700 miles south-southeast of Moscow (Map: Russia, F 5). Farming and gardening are the main occupations. Pop., 1911, 60,527.

STAWELL, stạ'el. A town of Borung County, Victoria, Australia, 150 miles by rail northwest of Melbourne, the centre of a rich gold-producing region (Map: Australia, G 6). There are important freestone quarries. Pop., 1901, 5296; 1911, 4410.

STAWELL, Sir William Foster (1815-89). An Australian chief justice, born in County Cork, Ireland. After graduating from Trinity College, Dublin, in 1837, he was admitted to the Irish bar in 1839 and to the Melbourne (Australia) bar in 1843. He advocated the separation of Port Phillip from New South Wales, and when it was formed into the separate Colony of Victoria was its first Attorney-General in 1851-55. After the adoption of the new constitution in 1856 Stawell was returned as a member of the House of Representatives of Victoria, and was a member of the first responsible ministry as Attorney-General in 1856-57.

Thereafter until 1886 he was Chief Justice, and in 1887–89 served as Lieutenant Governor of Victoria. Knighted in 1858, he was made a K.C.M.G. in 1886.

STAY (from MDutch *staeye*, a stay). In law, a suspension of legal proceedings by order of a court. A stay is usually granted by the court in which an action or proceedings are pending, and is commonly ordered for the purpose of compelling a party to an action to comply with some condition or order of the court, as to pay costs on some interlocutory motion, or to give security for costs, etc. In a few instances the courts may grant absolute stays, as, e.g., where an unfounded action is begun merely to harass or annoy the defendant. It is customary for the United States courts to stay the proceedings in all actions pending against a bankrupt in State courts during the pendency of the bankruptcy proceedings. A temporary stay of execution may usually be obtained, especially where the defeated party desires to appeal. No rights are destroyed by a stay, as it only operates to suspend proceedings and does not involve their merits. Where an inferior court is taking cognizance of matters beyond its jurisdiction the proper practice is to obtain a writ of prohibition from a superior court. See Chitty, *Treatise on Pleading* (16th Am. ed., Springfield, 1876).

STEAD, stĕd, Alfred (1877–). An English journalist and author, son of William T. Stead. He was educated privately and at University College, London. Entering journalism, he became associated with his father on the *Review of Reviews*, traveled extensively, especially in the British possessions and the Far and Near East, and wrote numerous letters to the newspapers. A student of international politics, he worked in behalf of the Anglo-Japanese Alliance and for the resumption of diplomatic intercourse between Britain and Servia after it had been discontinued by reason of the murder of King Alexander and Queen Draga. In 1912–13 he was editor of the *Review of Reviews*. He published: *South Africa* (1899), with W. D. MacKenzie; *China and her Mysteries* (1901); *Japan, our New Ally* (1902); *Japan by the Japanese* (1904); *Great Japan* (1905); *Japanese Patriotism* (1906); *Modern Roumania* (1908).

STEAD, Francis Herbert (1857–). An English clergyman and social reformer. He was born at Howdon-on-Tyne, Northumberland County, and was educated at Owens and Airedale colleges, at Glasgow University, and in Germany. He was a reporter on provincial newspapers in 1874–76, studied for the Congregational ministry (1876–84), and was pastor of a church at Leicester (1884–90) and editor of the *Nonconformist and Independent* (1890–92). Actively identifying himself with social-betterment work, he became warden of the Robert Browning Settlement in 1894, and afterward initiated the conferences with Charles Booth (q.v.), in which the National Committee on Old Age Pensions (1898) originated. He was the convener of the Browning Hall Conference on housing and locomotion in 1901, and initiated Labor Week in 1910. He published: *Handbook on Young People's Guilds* (1889); *The Kingdom of God, a Plan of Study* (1894); *How Old Age Pensions Began to Be* (1909).

STEAD, William Thomas (1849–1912). An English journalist, born at Embleton, Northumberland. After a brief schooling he went into business, but in 1871 was appointed editor of the *Northern Echo* (Darlington). Here he remained until 1880, when he was called to be assistant editor, under John Morley, of the *Pall Mall Gazette*. He was editor of this paper from 1883 to 1889 and in the next year founded the *Review of Reviews* (monthly). He established similar publications in the United States (1891) and Australia (1894). As editor of the *Pall Mall Gazette*, a daily, he introduced American journalism into England, in the way of the interview, illustrations, and "extras," and in 1884 he compelled the Gladstone government to send Gordon to Khartum. No British newspaper before had attempted to control details of government policy. He became known as a vigorous opponent of social evils, a steadfast advocate of international peace, and, though patriotic, an apologist of Russia. His *The Truth about the Navy* (1884) led to the laying down of more ships in the following year. In 1885 his *The Maiden Tribute of Modern Babylon*, an exposure of legally permissible outrages upon women and children, landed him for a three months' term in Holloway Gaol, but it was followed by the enactment of the Criminal Law Amendment Bill. An active member of the British Society for Psychical Research, Stead conducted a journal called *The Borderland* (1893–97) which recorded spiritualistic experiences. In 1898 he started *War against War*, a weekly devoted to the opposition of the Anglo-Boer War. He was one of the victims of the *Titanic* disaster. His publications include: *The Truth about Russia* (1888); *The Pope and the New Era* (1889); *The Story that Transformed the World* (1890); *If Christ Came to Chicago* (1893); *The Labor War in the United States* (1894); *Satan's Invisible World: A Study of Despairing Democracy* (1897); *The United States of Europe* (1899); *Mr. Carnegie's Conundrum* (1900); *The Americanization of the World* (1902); *The Last Will and Testament of Cecil John Rhodes* (1902); *Peers or People* (1907). Consult Estelle W. Stead, *My Father* (London, 1913).

STEALING. See Larceny.

STEAM (AS. *stēam*, Fris. *stoame*, Dutch *stoom*, steam; of unknown etymology). Water in a gaseous condition. It is a dry, colorless gas with a specific gravity of 0.625 as compared with air at the same pressure. The white cloud of vapor which rises from boiling water and which is commonly called steam is a vapor composed of minute particles of water suspended in the air and formed by the condensation of the true steam gas coming in contact with the cool air. When water is subjected to the action of heat, it is converted into invisible steam gas. Though a change takes place in the physical condition of the substance, the chemical composition of the steam is in no way different from that of the water from which it was generated. If heat be applied to the bottom of a vessel containing water, the air contained in the water will first appear as little bubbles which rise to the surface. Then the water in immediate contact with the heated portion of the vessel will be converted into steam, which will form as bubbles on the bottom of the vessel, and these will rise through the liquid, but at the commencement of the operation they will be at once condensed by the cold upper layers of water. Finally, however, the water becomes heated through, when the bubbles rise to the surface and the steam exudes upon the air, and we have the phenomenon known as boiling. As the steam passes into the air, it is cooled and collects into small particles of water which are visible as a white cloud above the surface, and the phenomenon is called condensation. This is visible on calm surfaces of lakes or ponds which have been heated by the sun by day, and which keep on vaporizing after the lowered temperature of nightfall has begun. If all the particles of this white cloud were collected into one mass, there would be a volume of water equal to the volume of water in the original mass which had been converted into the steam forming the cloud. Boiling occurs only when the water in the vessel has reached a certain temperature. This temperature varies with the pressure. At the atmospheric pressure of 14.7 pounds at mean sea level, it is 212° F., but it would be somewhat less on the top of a high mountain and somewhat greater at the bottom of a deep mine. See HYPSOMETER; HYPSOMETRY.

The boiling temperature or boiling point of water thus varies with the pressure upon it. At a pressure of 5 pounds per square inch it is as low as 162.3° F., and at a pressure of 100 pounds per square inch it is as high as 327.58° F. Condensation takes place at any temperature lower than the boiling temperature.

To explain more fully the action of heat in the formation of steam, reference will be made to the accompanying diagrams. In Fig. 1 let the cylinder contain one pound of water at 32° F., and let the pressure of the atmosphere be represented by the weighted piston. Then, if heat be applied to the bottom of the cylinder, the temperature of the water will rise higher and higher until it reaches 212° F.; the piston will up to this point remain stationary except for the small expansion of the water. On continuing the heat the water shows no further rise in temperature, but steam begins to form and to force the piston upward as shown by Fig. 2, and this continues until the last drop of water is converted into steam and we have the condition illustrated by Fig. 3.

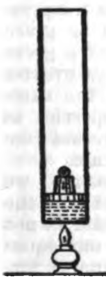
Fig. 1.

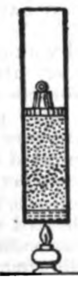
Fig. 2.

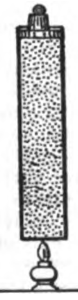
Fig. 3.

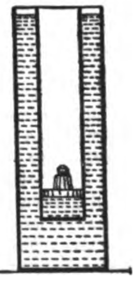
Fig. 4.

Before proceeding further, it must be noted first that no steam began to form until the water reached a temperature of 212° F.; hence this is evidently the lowest temperature at which steam will form under normal atmospheric pressure. Second, we must note that in the condition illustrated by Fig. 3 we have one pound of steam occupying the least possible volume at atmospheric pressure. In actual figures this volume is 26.36 cubic feet. Steam in this condition is known as *saturated steam*. If now we continue to heat the steam in the cylinder Fig. 3, its temperature will rise above that of saturated steam, and the piston will move upward, and we shall have *superheated steam*. If now we take the cylinder Fig. 3 and plunge it into a vessel of cold water, as shown by Fig. 4, the heat will be taken away from the steam and it will condense to water. When this water has cooled to 32° F., the whole heat taken away is exactly equal to the whole heat added during the operations illustrated by Figs. 1, 2, and 3.

The amount of this added and abstracted heat may now be considered. First, let us assume that the cylinder Fig. 1 has an area of one square foot and that it contains one pound of water. The height to which the water rises in the cylinder is 0.016 foot. The pressure on the piston from the air is 14.7 pounds × 144 square inches = 2116.8 pounds. Now on applying heat to the water it will at first gradually rise in temperature from 32° F. to 212° F. before evaporation commences. Then 212° − 32° = 180, or the number of heat units required to raise water from 32° F. to the boiling point at atmospheric pressure. Steam now begins to form and the piston to rise until all the water is converted into steam at a temperature of 212° F. This steam, as before stated, occupies a space of 26.56 cubic feet. The heat required to perform this operation is 966 units. Hence the total heat required first to raise the water from 32° F. to 212° F. and then to convert it into steam is 180 + 966 = 1146 units. It is quite clear how the heat required to raise the water from 32° F. to 212° F. has been expended, but it is not so clear how the 966° F. required to convert the water at 212° F. into steam at 212° F. has been expended. It will be observed that two things have happened in this last operation. First, the water has been converted into steam, which occupies 1660 times the space occupied by the water from which it was generated. Second, the piston has been raised from the surface of the water in Fig. 1 to the surface of the steam in Fig. 3. Therefore the heat has been expended in two ways: first, in overcoming the internal molecular resistance of the water in changing its condition from water to steam, and, second, in overcoming the external resistance of the piston to the increasing volume of the steam during formation. The first task performed is called the internal work of the steam, and the second task is called the external work. Now the share of the heat expended in each operation may be calculated as follows: The total heat expended is, as already stated, 1146 units. To raise the piston with a pressure on it of 2116.8 pounds through a height of 26.56 feet requires 56,179 foot pounds of energy. As the energy of one heat unit is 778 foot pounds, then 56,179 ÷ 778 = 72.2 heat units expended in raising the piston. Adding this to 180, the number of heat units required to raise water from 32° F. to 212° F., we have 252.2 units consumed in heating the water and raising the piston. This amount subtracted from the total heat expended gives 1146 − 252.2 = 893.8, which is the number of heat units expended in internal work. We can now summarize the distribution of the heat as follows:

In raising temperature of water..............	180 units
In doing internal work........................	893.8 units
In doing external work........................	72.2 units
Total..................................	1146.0 units

Having gone through the phenomenon of steam generation in detail, we can summarize some of the general facts that have been brought out. The temperature of the water gradually rises until it reaches the temperature at which steam is formed. This temperature will depend upon the pressure or the load on the piston. If this pressure is the normal atmospheric pressure of 14.7 pounds per square inch, steam begins to form at a temperature of 212° F.

As soon as 212° F. is reached steam will begin to form and the piston will steadily rise, but no matter how hot the fire may be, the temperature of both water and steam will remain at 212° F. until all the water is evaporated. We had one pound of water at 32° F. and at 14.7 pounds absolute pressure, and found that steam formed at a temperature of 212° F. and remained at that temperature. We added 180.9 B. T. U. (British Thermal Units), the heat of the liquid, to bring the water from 32° to the boiling point. To convert water at 212° into steam at 212°, we added 965.7 B. T. U. more. This quantity, known as the latent heat, or heat of vaporization, makes the total heat 1146.6 B. T. U. If we should measure the volume carefully after all the water was evaporated, we should find that there was just 26.56 cubic feet of dry saturated steam. We had one pound of water, and therefore must have one pound of steam, for none of it could escape; hence one cubic foot will weigh $\frac{1}{26.56} = 0.03765$ pound, which is known as the density of steam at 14.7 pounds absolute pressure, or 212° F. In the table of properties of saturated steam all these quantities are found in the order given and at the pressure of 14.7 pounds above vacuum.

Suppose now we place a weight of 85.3 pounds on the piston. The pressure is 85.3 pounds plus 14.7 pounds, or 100 pounds absolute. We shall now find that no steam will form until a temperature of 327.58° is reached. Starting with water at 32°, it will be necessary to add 298.9 B. T. U. before a temperature of 327.58° is reached, and also we must add 883 B. T. U. more to vaporize it, making a total heat of 1181.9 B. T. U. Under this greater pressure the steam occupies a volume of only 4.39 cubic feet, or one cubic foot of it weighs $\frac{1}{4.39} = 0.2278$ pound.

We have already seen that any change in the temperature of saturated steam produces a change of pressure, and that every change of pressure corresponds to a certain change in temperature. There are several properties of saturated steam that depend upon the temperature and pressure; and the values of all these different properties when arranged for all temperatures and pressures are called steam tables. The following are the principal items that are found in such tables:

(1) The absolute pressure in pounds per square inch; it is equal to the gauge pressure plus the atmospheric pressure of 14.7 pounds.

(2) The temperature of the steam, or boiling water, at the corresponding pressure.

(3) The heat of the liquid; or the number of B. T. U. necessary to raise one pound of water from 32° F. to the boiling point corresponding to the given pressure.

(4) The heat of vaporization, or the latent heat; this is the number of B. T. U. necessary to change one pound of water at the boiling point into dry saturated steam at the same temperature and pressure.

(5) The total heat; or the number of B. T. U. necessary to change one pound of water from 32° F. into steam at the given temperature or pressure. The total heat is evidently equal to the sum of the heat of the liquid and the heat of vaporization.

(6) The density of the steam, i.e., the weight in pounds of one cubic foot of steam at the given temperature or pressure.

(7) The specific volume, or volume in cubic feet of one pound of steam at the required temperature or pressure. Evidently the specific volume is equal to $\frac{1}{\text{density}}$.

All these properties have been calculated by means of various formulas which have been deduced from the results of actual experiment. They have been worked out and arranged in elaborate tables, such as those of Marks and Davis, *Steam Tables and Diagrams* (New York, 1909); G. A. Goodenough, *Properties of Steam and Ammonia* (ib., 1915); H. L. Callendar, *The Callendar Steam Tables* (ib., 1916).

We have seen that a saturated vapor contains just enough heat to keep it in the form of a vapor; if it loses heat it will condense. A superheated vapor is one that has been heated after vaporization; it can lose this extra heat before any condensation will take place. A vapor in contact with its liquid is saturated; one heated after removal from the liquid is superheated.

For saturated steam there is a fixed temperature for every pressure. If we know either the pressure or the temperature, we can find the other in the steam tables. For instance, if the gauge pressure of a boiler is 60.3 pounds and we wish to know the temperature, we simply add atmospheric pressure and turn to our tables and find it to be 307° (approximately).

With superheated steam the case is entirely different, for there is no longer the same direct relation between the temperature and pressure. In fact, the relation between temperature and pressure of superheated steam depends upon the amount of superheating. Superheated steam at 60.3 pounds' gauge pressure may have a temperature considerably above 307° F. At a given pressure the temperature and volume of a given weight of superheated steam are always greater than the temperature and volume of the same weight of saturated steam. The properties of superheated steam at given pressure are not constant, as is the case with saturated steam.

If superheated steam were a perfect gas, we could determine the relation of p, v, and t by the equation $pv = ct$; but superheated steam is not a perfect gas, hence we must modify our equation. Zeuner devised the following general formula for superheated steam:

$$pv = 0.6496\,t - 22.58\sqrt[4]{p},$$

in which p = absolute pressure in pounds per square inch, t = temperature in degrees F, v = volume in cubic feet.

Consult Wm. Kent, *Mechanical Engineers' Pocket-Book* (New York, 1916), and works mentioned under STEAM ENGINE.

STEAM CARRIAGE. See AUTOMOBILE; MOTOR VEHICLE.

STEAM ENGINE. A motor in which the expansive force of steam is employed as the medium for transforming the energy of heat into useful work. Ordinarily the steam acts upon a piston inclosed within a cylinder in such a manner as to be capable only of *reciprocating* motion, but in certain forms of engines it acts upon an inclosed piston or vane, which *rotates* around an axis. The rotary engine has the advantages of compactness and of being capable of applying its power directly, while the reciprocating engine has to have the rectilinear motion of the piston transformed into the rotary motion of a flywheel or shaft by an intermediate mechanism. These advantages of the rotary engine, except the turbine type, are, however, more than counterbalanced by its decided lack of economy in steam consumption, which has as yet prevented it from successfully competing commercially with the reciprocating engine.

Early History. The first instance of the use of steam as a motive power is generally assumed to have been the æolipile of Hero of Alexandria (q.v.). As early as 1543 a Spanish captain, named Blasco de Garay, is reputed to have shown in the harbor of Barcelona a steamboat of his own invention. A French engineer, Salomon de Caus, describes in 1615 a steam machine, which was merely a contrivance for forcing the water contained in a copper ball through a tube by applying heat. An Italian engineer, Giovanni Branca, invented, in 1629, a sort of steam windmill; the steam, being generated in a boiler, was directed by a spout against the flat vanes of a wheel, which was thus set in motion. See STEAM TURBINE.

In England the first successful effort was that of the Marquis of Worcester, who in 1663 describes a steam apparatus by which he raised a column of water to the height of 40 feet. The first patent for the application of steam power to various kinds of machines was taken out in 1698 by Thomas Savery. His engines were the first used and seem to have been employed for some years in the drainage of mines in Cornwall and Devonshire. The essential improvement in them over the older ones was the use of a boiler separate from the vessel in which the steam did its work.

To Denis Papin, a celebrated Frenchman, is due the idea of the *piston*.

The next great step in advance was made about 1705 in the "atmospheric" engine, conjointly invented by Newcomen, Calley, and Savery. In this engine, which is shown in Fig. 1, the previous inventions of the separate boiler and of the cylinder with its movable steam-tight piston are utilized, although in a new form. The "beam," which has been so largely in use in pumping engines, was used for the first time, and for the first time also the condensation of the steam was made an instantaneous process instead of a slow and gradual one. To one end of a beam moving on an axis, I, was attached the rod, N, of the pump to be worked; to the other, the rod, M, of a piston moving in a cylinder, C, below. The cylinder was placed over a boiler, B, and was connected with it by a pipe provided with a stopcock, V, to cut off or admit the steam. Suppose the pump rod depressed, and the piston raised to the top of the cylinder —which was effected by weights suspended at the pump end of the beam—the steam cock was then turned to cut off the steam, and a dash of cold water was thrown into the cylinder by turning a cock, R, on a water pipe, A, connected with a cistern, C'. This condensed the steam in the cylinder, and caused a vacuum below the piston, which was then forced down by the pressure of the atmosphere, bringing with it the end of the beam to which it was attached, and raising the other along with the pump rod. The cock was then turned to admit fresh steam below the piston, which was raised by the counterpoise; and thus the motion began anew. The opening and shutting of the cocks was at first performed by an attendant, but there is a legend that in 1713 a boy named Humphrey Potter devised a system of strings and levers by which the engine was made to work its own valves. In 1717 Henry Beighton invented a simpler and more scientific system of "hand gear," which rendered the engine completely *self-acting*.

The next essential improvements on the steam engine were those of Watt. The first and most important improvement made by Watt was the separate condenser, patented in 1769. He had observed that the jet of cold water thrown into the cylinder to condense the steam necessarily reduced the temperature of the cylinder so much that a great deal of the steam flowing in at each upward stroke of the piston was condensed before the cylinder got back the heat abstracted from it by the spurt of cold water used for condensing the steam in the cylinder. The loss of steam arising from this was so great that only about one-fourth of what was admitted into the cylinder was actually available as motive power. Watt, therefore, provided a separate vessel in which to condense the steam, and which could be kept constantly in a state of vacuum, without the loss which arose when the cylinder itself was used as a condenser. The principal improvements since have been either in matters relating to the boiler or in details of valve gear and of construction consequent on increased manufacturing facilities, together with more effective governing of speed and greater knowledge of the strength of materials.

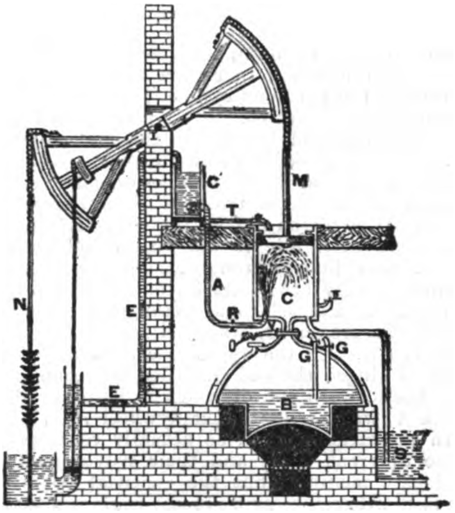

FIG. 1. NEWCOMEN'S ENGINE.

Analysis. The motor element of the engine is the cylinder and piston (Fig. 2). The cylinder, C, is a hollow cylinder of metal closed at both ends, except for small openings for the entrance and escape of steam and for the passage of the piston rod. Inside the cylinder is the piston P, a circular disk of metal fitting steam-tight and capable of movement lengthwise in the cylinder. The openings S_1 and S_2 provide for the admission of steam into the cylinder, and the openings E_1 and E_2 provide for the exhaust of steam from the cylinder. These passages are opened and closed by valves. These valves operate in pairs; when valves S_1 and E_1 are open valves S_2 and E_2 are closed and vice versa. If steam be admitted by opening valve S_1, its pressure forces the piston P to the opposite end of the cylinder. Valves S_1 and E_1 now close and valves S_2 and E_2 open, and steam entering at S_2 forces the piston to return and press, as it advances, the previous cylinderful of steam out of the exhaust port E_2. The repeated and alternate opening and closing of the two pairs of valves, as described, causes the piston to reciprocate back and forth in the cylinder. This motion is carried outside of the cylinder by means of the piston rod R. This is a cylindrical rod attached rigidly to the piston and passing out of the cylinder through a steam-tight orifice in the cylinder head. At its outer end the piston rod is attached to a rectangular piece, H, called the crosshead, which slides between two guides, GG. To the opposite end of the crosshead is hinged the rod S, called the connecting rod, the forward end of which is journaled to a crank K, which operates the flywheel W.

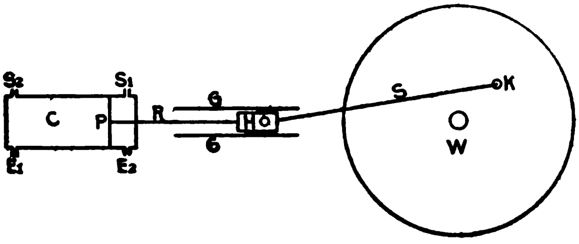

FIG. 2.

In the steam engine, as actually constructed, these different parts and their movements are variously modified, but the essential operating parts of all reciprocating steam engines are: the cylinder and piston; the valves and valve gear; the piston rod; the crosshead and guides; the connecting rod; the crank and crank shaft or flywheel.

The ordinary unit of measure of the work done by a steam engine is the horse power (q.v.). The whole of the theoretical horse power, however, is never available for useful work, owing to the friction of the moving parts and other causes.

Classification. Steam engines may be classified (I) according to the nature of their mechanism, (II) according to the manner in which the steam is used, and (III) according to the use to which the engine is to be put.

I. Reciprocating engines may be grouped according to the position of the axis of the piston into horizontal engines, vertical engines, and inclined or diagonal engines. Fig. 2 shows the position of the parts of a *horizontal engine*, i.e., an engine with the axis of the cylinder and piston horizontal. The advantages of such an engine are convenient access from the ground to all parts of the mechanism, distribution of the weight over a large area, and the location of the centre of gravity of the machine close to the foundation; its disadvantages are greater friction and wear of the cylinder owing to the fact that the piston is supported upon the bottom of the cylinder.

In the *vertical engine* the axis of the cylinder and piston is vertical; if the cylinder is carried by a frame above the crank shaft so that the piston rod extends downward, the engine is called an *inverted vertical engine;* and if the cylinder is below, with the piston rod extending upward to a crank shaft above, the engine is called a *direct vertical engine.* The advantages of the vertical engine are that the cylinder friction and consequent cylinder wear of the horizontal engine are largely avoided and that a comparatively small area of ground is occupied by the engine. Its disadvantages are that the weight of the piston, piston rod, crosshead, and connecting rod acts with the steam in one direction and against the steam in the other direction, thus producing unequal effort on the crank on alternate strokes, which has to be counteracted by special constructions; that the different parts of the mechanism are at different heights, requiring more attendants; that the centre of gravity of the machine is high, reducing its stability. The limited foundation area required for the vertical engines especially adapts it to places where room is scarce or expensive, as in steamships and city power houses. See STEAM NAVIGATION.

Inclined engines possess in a measure the advantages and disadvantages of both the horizontal and the vertical engine. In such engines the axis of the cylinder is at an inclination between the vertical and horizontal, and the cylinder is usually set below with the piston rod projecting diagonally upward to the crank shaft. They have been used chiefly in side-wheel steamboats of shallow draft and in ferryboats.

An engine in which the motion of the piston is transmitted by a connecting rod direct to the crank, as shown by Fig. 2, is called a *direct-acting engine.* As applied to pumps this term has a somewhat different meaning. (See PUMPS AND PUMPING MACHINERY.) In contradistinction to direct-acting engines we have *beam engines,* of which the engine shown by Fig. 1 is an early example. In the beam engine the connecting rod is journaled to one end of a beam rocking on a horizontal axis. To the other end of the beam is journaled a pitman rod which connects with the crank shaft. The engines for side-wheel steamboats are usually beam engines; and they are also used for pumping engines.

Besides the forms of engines mentioned there are various special forms, a few of which are sufficiently important to merit mention. The *oscillating engine* dispenses with the connecting rod, the piston rod connecting directly to the crank, and the cylinder is mounted upon suitable trunnions so that it can oscillate in conformation to the swaying of the piston rod in operating the crank. The *trunk engine* dispenses with the piston rod, the connecting rod being attached directly to the piston, which takes the form of a hollow cylinder closed at one end. The *back-acting engine* has the connecting rod extending back from the crosshead to a crank shaft back of the engine instead of extending forward as shown by Fig. 2.

II. The method in which the steam is used in the engine is also a basis for a scheme of classification. The fact that the same number of foot pounds of energy per minute may be secured by a small piston working at high speed or a larger piston working at a slower speed gives us our first classification, viz., *high-speed* and *low-speed* engines. The high-speed engine has the advantage of small dimensions and small weight for a given power, and, because the strokes are so frequent, of meeting variations in resistance more quickly than a slow-speed engine. Its disadvantages are its comparatively greater waste of steam, the greater wear of the moving parts, the greater danger of heating, and consequently the higher cost of construction and operation. Altogether, experience shows the slow or moderate speed engine to be superior to the very high-speed engine where circumstances permit its use. Between 600 and 800 feet per minute is regarded as a moderate piston speed, and over 900 feet per minute as a high piston speed. Referring to Fig. 2, it will be observed that the steam acts first against one side of the piston and then against the other side. Such an engine is called a *double-acting engine*. When the pressure of the steam is exerted against one side of the piston only, the engine is called a *single-acting engine*. The single-acting principle is utilized in the well-known Cornish engine for pumping and in certain high-speed rotative engines for electric light and power service. In the latter form of engine two cylinders are used which are coupled to separate cranks on the same shaft in order to secure continuous action. Two familiar forms are the Westinghouse and the Winans, and both are inverted vertical trunk engines. Owing to their single action and the omission of the connecting rod, these engines escape many of the disadvantages of the double-acting high-speed engine.

The Cornish single-acting pumping engine deserves particular notice because of its essentially peculiar steam-cylinder mechanism. It appears in two forms, the beam form and the direct-acting form. The beam Cornish engine has a vertical cylinder from whose top the piston rod extends, and has the usual connecting-rod connection with one end of a beam pivoted at the centre, to whose other end are attached the pump rods. The direct-acting Cornish engine has the cylinder located directly over the mouth of the shaft and the piston rod passing out of its bottom connects directly with the pump rods. This form of Cornish engine is usually called the Bull Cornish, from the name of its first adopter. In both forms of Cornish engine the action of the steam is simply to raise the heavy pump rods, whose weight in falling displaces the water to be pumped. The cylinder of the Cornish engine has three valves, one for the admission of steam, one for the exhaust of the steam, and an equilibrium valve, these being shown in Fig. 3 at *S*, *D*, and *E*, respectively.

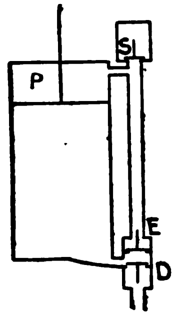

FIG. 3.

The cycle of operations is as follows. The pump rods being at the bottom of their stroke, the piston *P* of a beam Cornish engine will be at the top of the cylinder. The steam valve *S* and the exhaust valve *D* will be opened and the equilibrium valve *E* will be closed. The pressure of the steam drives the piston to the bottom of the cylinder, lifting the pump rods. When this operation has been completed, valves *S* and *D* are closed and valve *E* is opened. The opening of valve *E* permits the steam above the piston to flow freely beneath it, equalizing the pressure on the two sides of the piston and leaving it free to return to the top of the cylinder under the pull of the heavy pump rods. The valves of the Cornish engine may be worked by a special device called a *cataract*, when it is desired to have a pause or interval of some seconds between strokes. This consists of a weighted piston working in a cylinder, having a large intake valve and a small discharge valve, whose opening can be adjusted to various dimensions. During the working stroke of the pump this weighted plunger is lifted, drawing water into its cylinder through the large inlet valve. When the pump makes its return stroke the weighted plunger is released and gradually descends as its weight presses the water out of its cylinder through the small discharge valve. The main engine meanwhile is at rest. This return stroke of the weighted plunger at its end actuates the valves of the steam cylinder of the pump so as to cause another working stroke.

The third subdivision of engines according to the method of using the steam comprises expansive and nonexpansive working engines. To understand the nature of this subdivision it will be found convenient to refer to the diagram Fig. 4. In this diagram the full lines represent the cylinder, piston, and piston rod. Now if steam be admitted behind the piston it will force it forward to the position which it occupies in the diagram. The steam may be made to perform this operation in two ways, nonexpansively and expansively. When used nonexpansively the steam enters the steam port at boiler pressure, and as this port remains open until the piston has completed its stroke, boiler pressure is maintained behind the piston during the whole stroke. If we assume the broken line *ad* to represent the steam pressure in pounds per square inch and the broken line *dc* to represent the stroke in feet, then the work in foot pounds per square inch of piston area per stroke is represented by the dotted rectangle *abcd;* the pressure *bc* at the end of the stroke is the same as the pressure *ad* at the beginning of the stroke, and a cylinderful of steam at full pressure has to be exhausted in order to make the return stroke. When the steam is used expansively the steam valve is closed when the piston has reached some intermediate point, as *e*, called the point of cut-off, in its forward stroke, and no more steam is admitted into the cylinder. Full steam pressure is, therefore, maintained against the piston for the portion *ae* of its stroke, but afterward this pressure gradually decreases as the steam expands until at the end of the stroke it is represented by the line *cf*. The work done by the steam is represented by the area *aefcd*, which, as will be readily seen, is less than the area *abcd*, representing the work done when using the steam nonexpansively. The excess of energy in the early part of the stroke is normally stored in the flywheel and in the masses of the reciprocating parts to be given out towards the end of

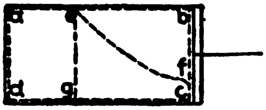

FIG. 4.

the stroke. When the steam is used expansively, however, the weight of steam at boiler pressure which is consumed at each stroke is represented by the rectangle whose base is *ae* and whose height is *ad*, as compared with the rectangle *abcd*, representing the weight of steam at boiler pressure consumed at each stroke in nonexpansive working. Evidently, from the diagram, the weight of steam used in proportion to the work done is less in expansive working than in nonexpansive working. This advantage has made the expansive-working engine practically universal where circumstances will permit.

The fourth subdivision of steam engines according to the method of using the steam comprises condensing and noncondensing engines. In a noncondensing engine the waste steam from the cylinder is exhausted into the air at air pressure, or 14.7 pounds per square inch. In the condensing engine it exhausts into a vacuum and is condensed into water. Thus, in a noncondensing engine the steam has to force the piston against a back pressure of 14.7 pounds per square inch, while in a condensing engine this back pressure is obliterated, with a consequent gain of 14.7 pounds per square inch in the effective working pressure of the steam. The practical advantage of the condensing engine may, therefore, be expressed by saying that it will give out the same power with a smaller cylinder and greater power with the same cylinder, as compared with a noncondensing engine. (See CONDENSER.) A fifth subdivision of steam engines according to the method in which steam is used comprises simple engines, compound engines, and multiple-expansion engines. In a simple engine the steam, after having done its work in forcing the piston through its stroke, is exhausted into the air or into a condenser. In a compound or multiple-expansion engine the steam, after having done its work in one cylinder, is exhausted into a succeeding cylinder of larger size, where it continues to perform work. The operation may be explained by the diagram, Fig. 5. Steam enters the cylinder *HP*, which is connected with cylinder *LP* by two passages *a* and *b* closed by valves, and here performs the work of driving piston P_1 to the front end of the cylinder. This steam, instead of being exhausted into the air or into a condenser to allow the return stroke of the piston P_1, is exhausted through the passage *a* into cylinder *LP*, where it acts to drive forward piston P_2. Were the size of the cylinder *LP* the same as that of the cylinder *HP*, it is evident that the propulsive effect of the steam on piston P_2 would be exactly counterbalanced by the back pressure on piston P_1, and, therefore, that there would be no increase, but rather a loss, in the work done. If, however, cylinder *LP* is made twice the diameter of cylinder *HP*, then the forward pressure on piston P_2 is greater than the back pressure on piston P, and a positive or working effect is obtained by the second use of the steam. A two-cylinder engine like Fig. 5 using steam as described is called a *compound* engine. Were the exhaust steam from the second cylinder to enter a third and larger cylinder and continue working, we should have a *triple-expansion engine.* If a fourth cylinder were added to the set we should have a *quadruple-expansion engine.* The expansive working of steam has not been successfully carried beyond four expansions. A tandem compound with the cylinders set vertical is called a *steeple engine.* When the cylinders are placed side by side, but some distance apart so as to allow space for a flywheel between them, the engine is commonly called a *cross-compound engine.* Modern marine engines for screw vessels are nearly always inverted vertical compound or multiple expansion engines. (See Plates under SHIP AND SHIPPING.) The arrangement of the cylinders of triple and quadruple expansion engines varies considerably. The great practical advantage of the compound or multiple-expansion engine is the economy resulting from the expansive use of steam, as indicated in discussing expansive and nonexpansive working engines.

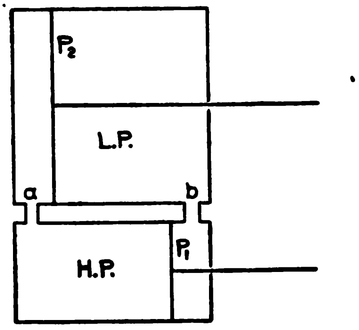

FIG. 5.

III. A very usual classification of steam engines is based upon the service or use to which the engine is to be put. It includes the following groups, *stationary engines*, *locomotive engines*, and *portable engines*. The first group or stationary engines include mill engines, power-house engines, pumping engines, blowing engines, air compressors, hoisting engines, and others. Locomotive engines include locomotives, marine engines, traction engines, steam road rollers, self-propelled fire engines, and others. Portable engines include a wide variety of engines, such as agricultural engines, so designed that the engine and boiler are self-contained and do not require a foundation or permanent structure of any kind.

Structural Details. The supporting frame of a steam engine is usually a structure of cast or forged iron or steel varying in shape to suit the form of engine of which it is a part. The working parts of an engine comprise the cylinder and piston, the valves and valve gear, the governor, the piston rod, crosshead, and connecting rod, and the crank shaft and flywheel. The function of the engine frame is to constitute a fixed link in a kinetic chain, and to perform this function it must be essentially rigid and strong. In a horizontal engine, as shown in Fig. 2, it will be evident that the duties of the frame are to support the cylinder *C* at one end, and the flywheel *W* at the other end, and to steady and align the transforming mechanism connecting these two parts. The frame of a vertical engine performs an exactly similar duty, but of course differs in construction to suit the different arrangement of the moving parts. Thus in an inverted vertical engine there is a broad base plate, on which the crank shaft is directly supported. From this base plate rises a columnar structure supporting the cylinders and guiding the reciprocating parts. Cast iron and cast steel are particularly adapted to furnish the rigidity and massiveness desired, and are, therefore, the materials commonly employed for engine frames. In certain classes of engines, such as the locomotive and the marine engine, where lightness combined with great strength is an essential, forged steel frames are used.

The engine *cylinder* is a barrel-shaped or box-shaped casting, with its interior bored out into the form of a perfect cylinder. The ends of this cylinder are closed by cover-like castings fastened by studs or bolts to the body. The front head has a circular orifice at the centre to allow for the exit of the piston rod, and where a tail rod is used a similar orifice is necessary in the back head. The barrel or body of the cylinder has one or more orifices for the admission and exhaust of the steam, and these orifices are covered by a boxlike chamber called the *steam chest,* inside of which work the *valves.* The body and often the ends of the cylinder casting are usually covered with a *lagging* or envelope of some material which is a poor conductor of heat and whose purpose is to prevent the condensation of steam in the cylinder by the loss of heat due to radiation from its outer walls. The *piston* is a circular disk of metal of sufficient strength to resist distortion by the steam pressure. In the edge of this disk are set rings of metal so arranged that they are constantly pressed outward against the walls of the cylinder, either by their own elasticity or by the elasticity of springs pressing against them from behind. These rings are called *packing rings,* and their function is to make the piston fit steam-tight in the cylinder and at the same time render its movement as free from friction as possible.

The function of the valves and valve gear is to control the admission and exhaust of the steam. The functions of the *valve* are both primary and secondary. The primary function is to admit the steam from the boiler to one side of the piston, while the exhaust steam filling the other end of the cylinder is permitted to escape with the least possible resistance. The secondary functions are to close the admission of steam at the point necessary to give the expansion desired and to close the exhaust orifice at such a point in the return stroke that a certain volume of steam shall be caught and compressed behind the piston to serve as an elastic cushion. It is necessary also that the opening of the inlets and outlets of the cylinder should be so timed with respect to the stroke of the piston that pressure may not be brought too soon against the piston head, nor the exhaust opened until the expanding steam has done its entire work for that stroke. The valves for admitting and distributing steam in an engine cylinder may open the ports which they control, either by lifting from their seats or by sliding upon their seats. When the engine is a double-acting one there must be provision to connect each end of the cylinder with the boiler and each end with the exhaust pipe. When the engine is single-acting it is only necessary to connect one end to the boiler and exhaust pipe alternately. Apparently the simplest arrangement would be to have four valves, as shown by Fig. 2, one at each end for steam, and one at each end for exhaust. This is the arrangement in the *Corliss engine.* An important type of engines makes use of a separate valve for admitting steam at each end, while the exhaust is controlled by a single valve for both ends. Such engines are called *three-valve engines.* Another arrangement is to have one valve for admitting steam to both ends and another controlling the exhaust for both ends. Such engines are called *two-valve engines.* A fourth class has one *single valve,* so designed as to perform the inlet and outlet functions for both ends.

The simplest form and also the most common form of single valve is the D-shaped *slide valve.* In the diagram, Fig. 6, *W* represents a portion of the top wall of the cylinder, *S* and S_1 being the steam ports to the two ends of the cylinder. At the top these steam ports open into the inclosed space *A*, *B*, *C*, *D*, which represents the steam chest. The valve proper is represented by *V*, which is operated by the rod *R* passing out through a suitable orifice in the forward end of the steam chest. The steam from the boiler is admitted into the space above the valve. It will be observed that in the position shown the valve exactly covers the ports *S* and S_1, and steam from the steam chest cannot enter the cylinder, nor can any steam contained in the cylinder escape. If the valve is moved either to the right or left of the position shown, both ports are immediately uncovered. If the movement be towards the right, port S_1 is opened to the live-steam space above valve *V* and port *S* is opened to the exhaust space *E* beneath the valve *V*. A reverse movement of the valve opens port *S* to the live-steam space and port S_1 to the exhaust space. The movement of the valve from "centre" to the right and back again to "centre" accomplishes the right-hand stroke of the piston; its movement from "centre" to the left and back again to "centre" accomplishes the left-hand stroke of the piston. These alternate right and left movements of the valve are accomplished by means of the rod *R* and an eccentric. (See ECCENTRIC.) When the valve is at "centre" the axis of the eccentric is at right angles to the flywheel crank, providing the valve is constructed, as shown, to cover exactly the steam ports, which is the construction for nonexpansive working of the steam. This is the simplest form of slide valve. To provide for the expansive working of the steam, its use as a compression cushion and other desirable variations in admission and exhaust, the construction of the valve and the position of the eccentric have to be modified in various ways, an analysis of which is a matter of considerable mechanical intricacy.

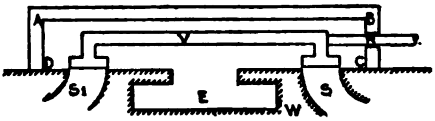

FIG. 6.

The train of mechanism by which the opening and closing movements of the valves are effected is called the *valve gear.* This varies in construction and operation. The precise character of the gear adopted in any case is determined partly by the form of valve and partly by the nature of the general problem presented for solution. In some cases it is merely required that a fairly good steam distribution shall be secured; in other instances a good method of expansion must be obtained; in still other cases the system must be capable of adjustment with a view to wise regulation of speed, and in all locomotive and marine engines easy and prompt reversal of the direction of motion is required. Of these the link motion invented by Howe in 1843, and first used on Stephenson's engines, is perhaps the most familiar, it being the gear very generally used, either as originally designed or in some modified form, on locomotives and marine engines. Fig. 7 shows the Howe link, or, as it is more commonly called, the Stephenson reversing link valve gear. The two eccentrics E and E_1 are set on the crank shaft S nearly at right angles to the crank C. These eccentrics carry two rods r and r_1 diverging from each other at a slight angle and with their forward ends connected by the slotted, curved link L. The valve stem V has a block or pin which connects it to the link by means of a sliding fit in the slot. If the link be lifted so that the rod r lies nearly in line with V, then the valve receives its motion merely as if driven directly by the single eccentric E; if the link be lowered so that rod r_1 lies nearly in line with V, then the valve acts practically as if driven by the single eccentric E_1. Now, eccentric E_1 being set for forward motion of the engine and eccentric E being set for backward motion, it will be seen that the movement of the link gives a ready means for reversing the engine. It does more than this, however, since by putting the link in intermediate positions between full forward and full backward gear the cut-off of the valve can be adjusted for expansive working of the steam. The train of levers v, w, x, y, and z in Fig. 7 shows the means of operating this link in an ordinary locomotive engine.

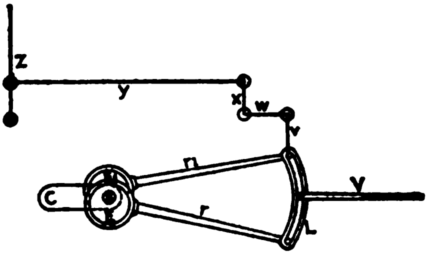

Fig. 7.

The *governor* of a steam engine is a device whose function is to regulate the energy developed in accordance with the load propelled. If the admission and pressure of the steam be constant, the speed will vary as the load varies; with a light load the speed will be high and with a heavy load it will be slow. These fluctuations in speed are always undesirable and may easily become dangerous. Governors act to regulate the energy in two ways, first by cutting off steam from the boiler as the speed increases, which amounts to a reduction in boiler pressure in the cylinder, and second by reducing the quantity of steam admitted into the cylinder. The first are called *throttling governors* and the second are called *cut-off governors*. Governors are also classified according to their method of action and according to their form. The most common form of governor is the fly-ball or pendulum governor, which may operate either by throttling or by cut-off action. The diagram (Fig. 8) shows a form of pendulum governor. The stem or shaft, S, is given rotary motion by means of a belt embracing the pulley, P. Keyed to the top of the shaft is the plate a, carrying, by means of the arms b and b_1, the heavy balls c and c_1, and hung to the arms b and b_1 are the arms d and d_1 which connect with the plate e, which is free to slide up and down the shaft S. The balls and their connecting arms revolve with the shaft, and because of the familiar law of centrifugal force they tend to fly apart as the speed of rotation increases and to come closer together as this speed decreases. As the balls fly apart, through increased speed, they lift the plate e, and this operates the train of levers x, y, and z in such a way as either to shut off steam from the boiler or from the cylinders. That is, as the speed increases the energy is decreased, and conversely as the speed decreases the energy is increased. In this way the energy is proportioned to the load at every instant, the exactness with which this proportion is maintained depending upon the sensitiveness of the governor.

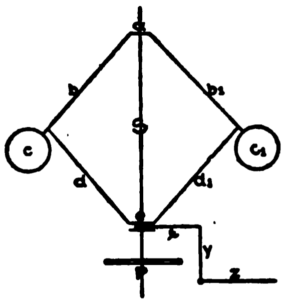

Fig. 8.

The *transmission mechanism* of a steam engine consists of the piston rod, the crosshead, and the connecting rod. The duty of the *piston rod* is to convey the energy developed by the piston outside of the cylinder so that it may be transmitted to the crank shaft or flywheel. At its inner end the piston rod is attached rigidly to the piston at its centre and at its outer end it is rigidly attached to the crosshead. The rod passes out of the cylinder through an orifice in its front end, this orifice being so constructed that it is steam-tight. It is due largely to the fact that a circular orifice is more easily made steam-tight than any other form that the piston rod is universally cylindrical in form. The *crosshead* is the connecting link which permits the rectilinear motion of the piston rod to be transformed into the swaying motion of the connecting rod. The manner in which it accomplishes this is clearly shown by Fig. 9, which is a section through a familiar make of crosshead. The piston rod coming from the right is rigidly attached to the crosshead by a threaded connection, while the connecting rod is connected by means of a horizontal pin, so that it can swing up and down. The top and bottom of the crosshead are planed smooth and fit a groove or track in the upper and lower guides. These guides are a part of the engine frame, and serve to prevent any vibration of the outer end of the piston rod due to the swaying motion of the connecting rod. The connecting rod is commonly a rectangular or cylindrical bar having at each end a circular bearing, one to embrace the crosshead pin and

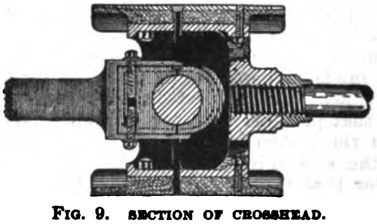

Fig. 9. Section of Crosshead.

the other to embrace the crank pin. Fig. 10 shows the construction described. The articles CRANK and FLYWHEEL describe the construction and functions of these parts of the engine's mechanism, and they will not be mentioned further. In concluding this section reference may be made to Fig. 11 as showing in a very plain manner the character and relation of the several structural details which have been described individually. In this engraving the different parts are designated by letters as follows: The engine frame, *A;* the cylinder, *B;* the piston rod, *C;* the crosshead, *D;* the connecting rod, *E;* the crank, *F;* the flywheel, *G;* and the governor, *H.*

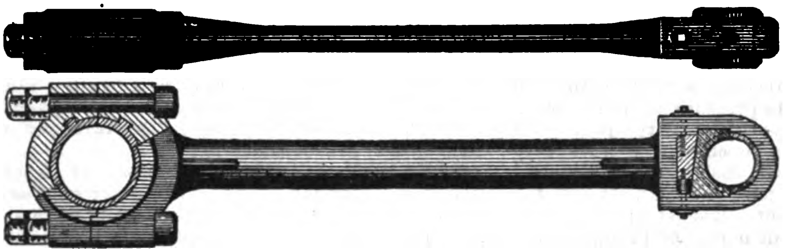

FIG. 10. CONNECTING ROD (TOP AND SIDE VIEWS).

The first practical use of importance to which steam engines were put was the pumping of water, and the *pumping engine* still remains one of the principal forms of the steam engine. (See PUMPS AND PUMPING MACHINERY.) The modern form of *mill engine* is the horizontal direct-acting flywheel engine, in which the power is taken from the flywheel and transmitted to shafting by means of belts. (See BELT; POWER, TRANSMISSION OF.) For mill engines of large size present practice favors compound engines; simple engines are used when the unit of power which is required is small. A horizontal simple engine of comparatively small size, which can be used for dynamo driving or other high-speed work, is shown by Fig. 11. A third type of stationary engine is the *hoisting engine* which in its smaller sizes combines a vertical steam boiler and a duplex horizontal or vertical engine in one machine. Such engines do not have a flywheel, but connect directly with a crank shaft which drives the drum upon which the hoisting rope is wound. Hoisting engines of larger size have separate boilers and often operate as many as eight separate drums. The largest sizes of hoisting engines are those used in raising ore from deep mine shafts. These mine hoists have capacities of from 2000 to 5000 horse power. Like the smaller sizes, they are either duplex vertical or duplex horizontal engines. A duplex engine consists of a right-hand and a left-hand engine, both of which couple to the same crank shaft. They are to be distinguished from cross-compound engines, which have a similar appearance structurally, by the important fact that each half of the machine is distinct from the other half so far as the use of the steam is concerned. In direct-acting mine hoists the drum or drums are mounted directly on the crank shaft; in general hoists the crank shaft drives a separate drum shaft by means of gearing. A fourth form of stationary engine is the *rolling-mill engine,* used for driving the trains of rolls in rolling mills. (See ROLLING MILL.) This is usually a horizontal simple engine of large size and especially sturdy construction. The largest stationary steam engines now

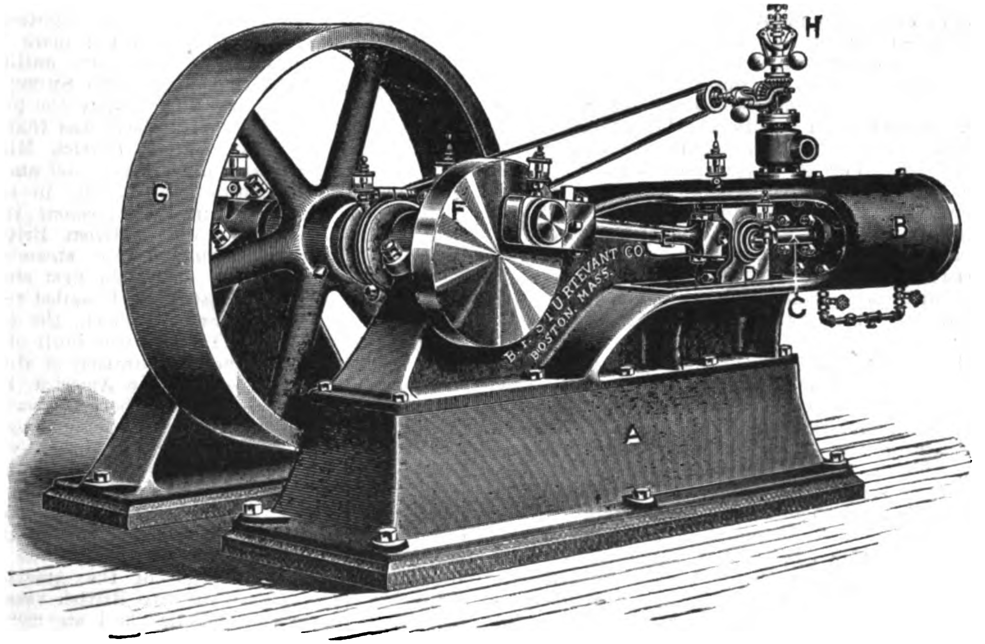

FIG. 11. SMALL HIGH-SPEED HORIZONTAL ENGINE.

used in any form are those employed for driving the generators of electric-power plants. The present limit of size in a single unit has been set at 10,000 horse power, which will have a low-pressure cylinder in the multiple expansion system of 110 inches diameter and six-feet stroke, or two low-pressure cylinders of about 84 inches diameter. These will often be arranged to have their exhaust steam drive low-pressure condensing steam turbines (q.v.). Modern engines are also operated where possible with superheated steam; i.e., steam carrying a temperature in excess of that due to its pressure, so as to diminish losses due to condensation in the process of expansion. Very notable economies have been secured in a combined design of engine and boiler, made in one unit, and known as the Locomobile arrangement. The steam is superheated by passing it in a coil of piping in the currents of hot gases from the furnace, and the short connections reduce losses between boiler and engine which are present in less compact arrangements. A design of engine cylinder has been advanced, in which the flow of the steam masses into the cylinder on admission and out of it upon exhaust is maintained with minimum changes of direction with their attendant losses. Such designs are called Uni-flow Engines. A sixth important form of steam engine is the steam-driven air compressor described in the article Air Compressor.

Engines other than stationary fall into one of two great classes, viz., locomotive engines for railways and marine engines for ship propulsion. The *traction engine* is essentially a locomotive engine designed to run on common roads, and the *portable engine* is practically a stationary engine and boiler plant of small size mounted on wheels so that it may be hauled from place to place. The growth and construction of the *locomotive engine* are described in the article Locomotive. *Marine engines* fall into two separate classes. For paddle-wheel boats the beam engine and the inclined engine are universally employed. For screw-propelled vessels the inverted vertical direct-acting engine is almost universal. (See Ship and Shipping, *Power Navigation.*) For a discussion of the theory of steam engines and heat engines in general, see Steam; Thermodynamics. For descriptions of special applications of steam engines, see Blowing Machines; Fire Engine; Motor Vehicle.

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STEAM ENGINEERING, Bureau of. One of the bureaus of the United States Department of the Navy. It was established by Act of Congress of July 5, 1862, and Benjamin F. Isherwood, engineer in chief of the navy, became its first chief. It has charge of all matters connected with the propelling and other machinery of naval vessels except such as may be specifically assigned to the bureaus of Ordnance and Construction and Repair. The propelling machinery (including boilers) is either designed by officers attached to the Bureau of Steam Engineering, or the design is passed upon and approved by the bureau before the construction or purchase is authorized. The chief of the bureau. who is also engineer in chief of the navy, is selected by the President from the line (i.e., executive) officers of the navy and has the rank of rear admiral while serving in this capacity. See Engineer, Naval; Navy, Department of the.

STEAMER DUCK, Loggerhead, or Racehorse. A very large duck (*Tachyeres cinerus*), numerous about the southern extremity of South America, so called on account of its peculiarity of rowing itself along the surface of the water at great speed. This is said to be due to the remarkable fact that this bird loses its power of flight when it reaches maturity.

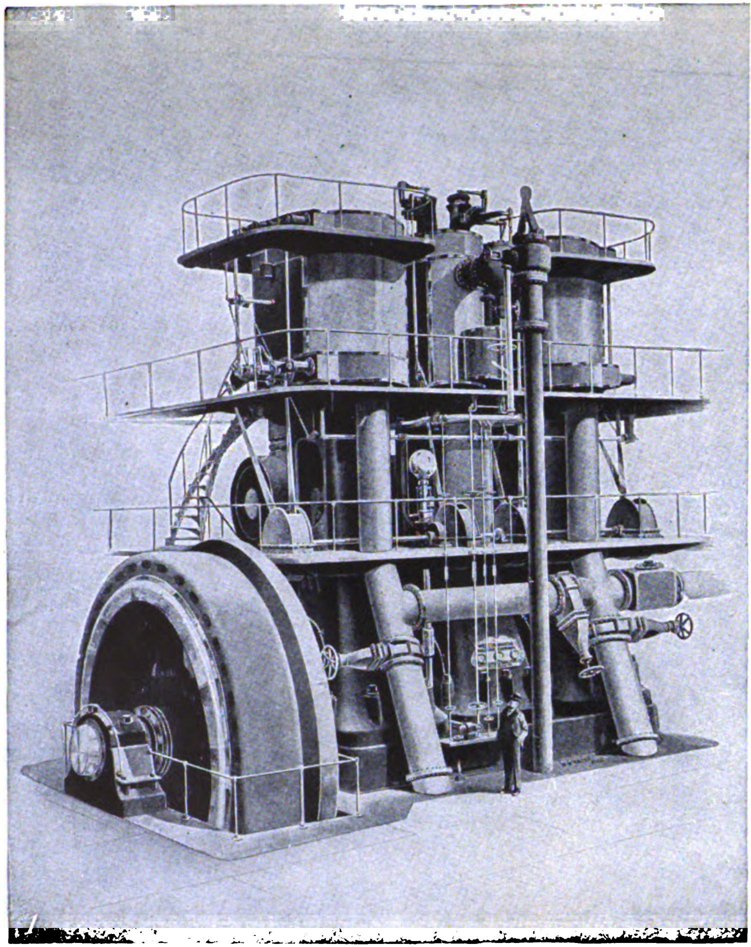
STEAM FITTING. The trade and business of fitting and setting the pipes, connections, valves, and fixtures required in a building for its heating or its steam machinery. It forms a distinct branch of the trades connected both with steam machinery and with building, though sometimes allied with the similar operations of gas fitting.

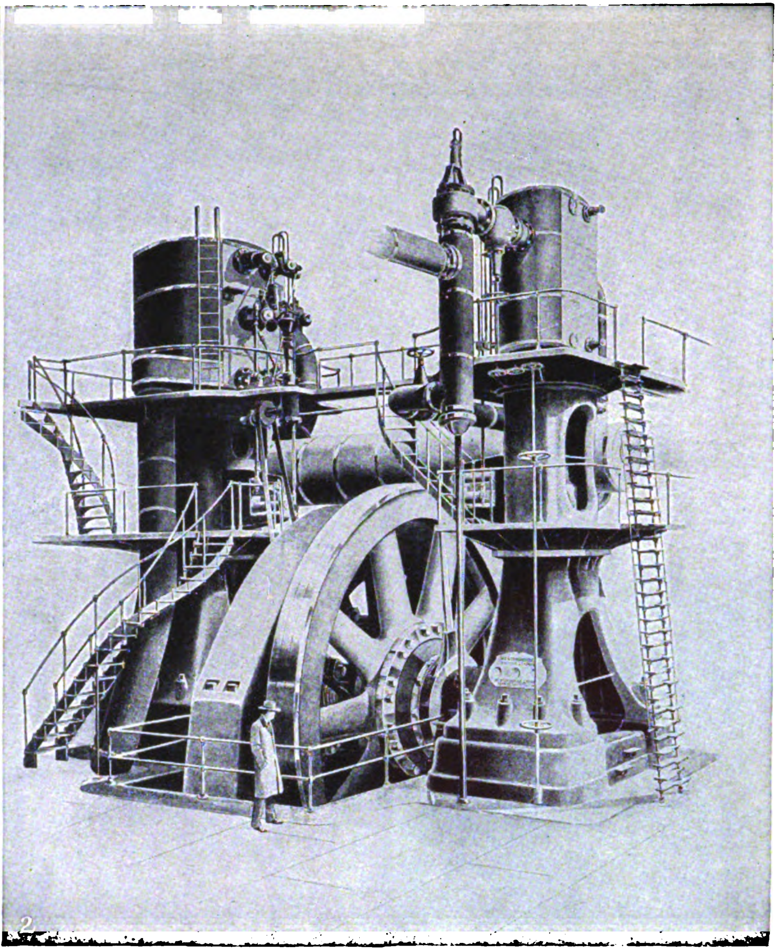
STEAM HAMMER. See Hammer.

STEAM HEATING. See Heating and Ventilation.

STEAM NAVIGATION. The earliest suggestion of steam navigation is believed to have come from Roger Bacon, and from the thirteenth century until the end of the eighteenth various schemes were proposed, the more important and significant of which are outlined under Shipbuilding and Ships and Shipping. Among the notable work which led to the practical development of the steamboat was that of John Fitch (q.v.) in America, Patrick Miller (q.v.) in Great Britain, and others, chief among whom was Robert Fulton (q.v.), who in 1807 made a successful trip in the *Clermont* from New York to Albany, while in Great Britain Henry Bell (q.v.) completed the steamboat *Comet* early in 1812, this being the first steam passenger vessel built in Europe. It sailed regularly between Glasgow and Greenock, the port at which it was built. To Bell, who built other boats in 1815, is due the inauguration of steam navigation in British waters. In America, Fulton was followed by John and Robert L. Stevens, the latter employing in the steamship *Phœnix* feathering paddle wheels, and by 1830 there were 86 steamers on the Hudson River and in Long Island Sound, in addition to a large number in service on the Great Lakes and in western waters. As discussed under Merchant Marine (q.v.) transatlantic steam navigation was inaugurated with the voyage of the American steamship *Savannah;* while two British vessels, the *Great Western*—a paddle-wheel steamer of 1340 tons, 450 horse power, with wheels 28 feet in diameter and 10 feet in breadth of face—and the *Sirius*, sailing in 1838, marked the beginning of regular transoceanic service.

By 1850 the steam tonnage of the United Kingdom had amounted to 168,474 tons, which increased as follows by decades: 1870, 1,112,934; 1880, 2,703,468; 1890, 5,042,517; 1900, 7,207,610; 1910, 10,442,719; 1915, 19,235,705.





VERTICAL STEAM ENGINES DIRECT CONNECTED TO ELECTRIC GENERATORS

1. 6,000 Horse-power Poppet Valve Westinghouse Cross-compound Engine.

2. 5,000 Horse-power Westinghouse-Corliss Cross-compound Engine.

In the United States the steam tonnage was as follows: 1830, 74,472; 1840, 202,339; 1850, 525,947; 1860, 867,937; 1870, 1,075,095; 1880, 1,211,558; 1890, 1,859,088; 1900, 2,657,797; 1910, 4,900,361; 1915, 5,943,810. See UNITED STATES, *Shipping*.

In the development of steam navigation the design, construction, and operation of boilers and machinery, so as to secure ever-increasing efficiency and economy, was ever the object. The screw propeller (q.v.), first used with success on the United States steamer *Princeton* about 1841, began to figure as a rival of the paddle wheel as a mode of propulsion. By 1843 nearly 30 vessels were fitted with screws, and in 1845 the American screw steamship *Massachusetts* sailed for Liverpool. The screw propeller at this early date could operate with greater efficiency, and with less space for machinery there was more room for cargo. By 1850 the screw propeller was firmly established on all except shallow and inland waters, and by 1870 its triumph for deep-sea ships was complete.

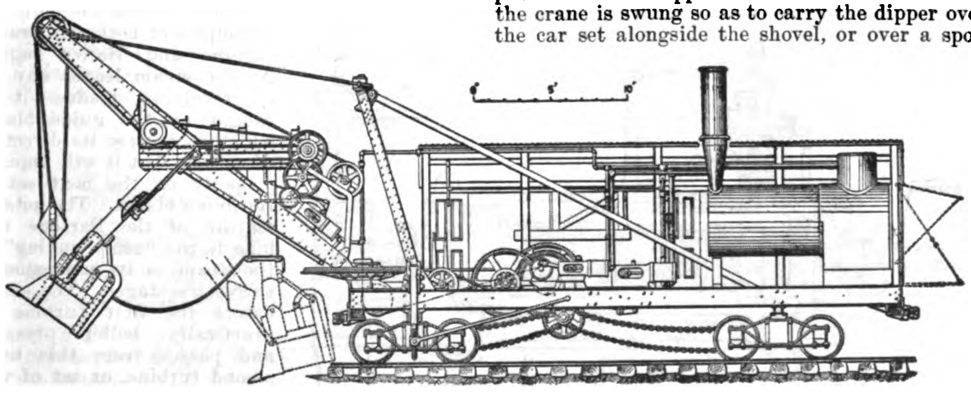
In Fulton's early experiments on the Seine the water-tube boiler was employed, and Col. John Stevens, in a small steamboat completed in 1804, also used a water-tube boiler which developed later into the sectional steam boiler. Soon the return-tubular boiler was evolved, and better construction was secured, so that greater pressure could be withstood and the operation of the engine rendered more efficient. The water-tube boiler (see BOILER and SHIPBUILDING) is now one of the most approved types, although its supremacy has been disputed by the fire-tube boiler now more commonly found on steamships.

In the navigation of steam vessels, in addition to the proper operation of the steamship, the economy of the voyage became of increasing importance. As consumption of coal was the largest single expense, economy must be secured not only in design and construction of the machinery, but also in the operation of the vessel; therefore the navigation of a steamship so that it would be remunerative to the owners, in addition to making safe and speedy voyages, required careful attention. The master of a modern steam vessel, while not usually a practical engineer, must have a moderate and accurate knowledge of steam engineering and at the same time be as good a navigator, both theoretically and practically, as was required in the old clipper-ship days. The training of young men for positions as officers in the merchant marine is an important matter, as no longer is it possible to secure properly qualified men from those forming the ordinary run of a working crew. Accordingly school ships or a system of cadet officers are maintained in most important maritime countries. See BOILER; NAVIGATION; PADDLE WHEEL; SCREW PROPELLER; and similar titles.

STEAM PUMP. See PUMPS AND PUMPING MACHINERY.

STEAMSHIP. See MERCHANT MARINE; SHIP AND SHIPPING.

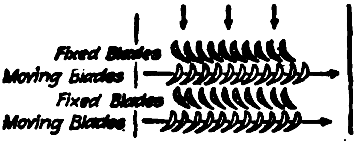
STEAM SHOVEL. A modified form of dredge adapted for excavating material on dry land, as in railway or canal construction. The steam shovel was invented in 1840 by an American named Otis, but it did not come into general use until about 1865. As will be seen from the accompanying outline drawing, the steam shovel consists essentially of a strong frame mounted on wheels to form a base to which the working parts are attached. The large majority of steam shovels are mounted on cars which run on temporary track, but smaller sizes are in use where ordinary wide wheels are employed. The digging mechanism of a steam shovel consists of a boom hinged to a mast or support at the front end of the car, and a dipper handle and dipper carried by the boom. The operating machinery consists of a main engine, which hoists the dipper and swings the crane, and of a thrusting mechanism for forcing the dipper into the earth. The operation begins with the dipper at the position shown by the dotted lines in the illustration. The engineman begins to hoist and thus swing the dipper upward along a curved path; at the same time the craneman by means of the thrusting mechanism forces the dipper into the earth so that a layer is scooped off the face of the bank and falls into the dipper. The depth of the cut is so regulated by the crane man that the dipper is just filled when at its topmost position. The dipper is then hauled back and the crane is swung so as to carry the dipper over the car set alongside the shovel, or over a spoil bank, and the latch is pulled, setting free the swinging bottom of the dipper, which falls open and empties the contents of the dipper. In actual operation these several movements are combined to a greater or less extent, and are accomplished by various devices. The various parts of the shovel, body, mast, boom, and dipper handles are constructed either of wood or steel, the latter material being most generally used for the heavier types of shovels. The dipper is always made of steel or iron plates, and



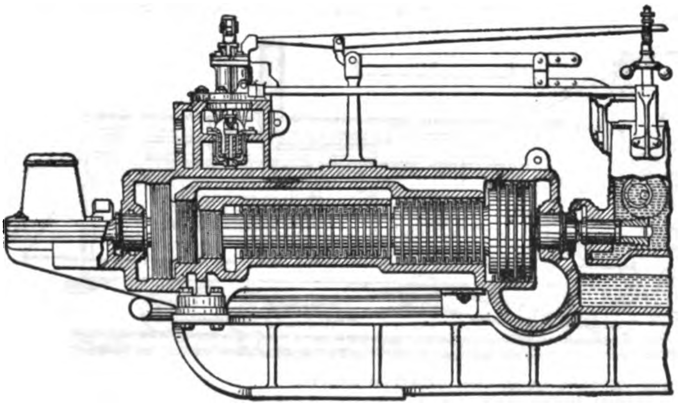
SECTION SHOWING MECHANISM OF STEAM SHOVEL.

its size or capacity varies from one to six cubic yards, but capacities of 1, 1½, 2, and 2½ yards are the ones most common. For digging blasted rock the front edge or lip of the dipper has steel teeth. The excavating capacity of steam shovels varies from 2400 cubic yards of sand to 600 cubic yards of loose rock per 10 hours, with a 2½ cubic-yard dipper, while one large steam shovel weighing 310 tons, with a 75-foot boom and a six cubic-yard dipper, had a capacity of 5800 cubic yards of material in eight hours.

The steam shovel found extensive application in the excavation of the Panama Canal, and is used with high efficiency in the removal of iron ore in the open mines of the Lake Superior region or for stripping the overburden of the shallow coal seams of Kansas and other Mid-western States. For information as to developments in steam-shovel design and operation the current files of the engineering press should be consulted as well as the technical reports of such works as the Panama Canal. The catalogues and other printed matter of the manufacturers of this class of machinery contain much information.



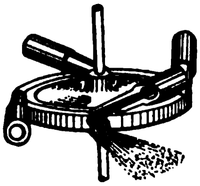
ACTION OF STEAM ON BLADES OF PARSONS'S TURBINE.



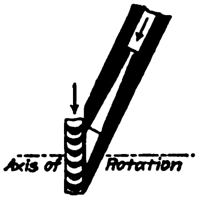
SECTION OF PARSONS'S STEAM TURBINE.

STEAM TURBINE. A form of prime motor in which the kinetic energy of expanding steam acts upon a wheel provided with vanes so as to cause rotation. The ordinary method of using steam to obtain power is to admit it into a closed cylinder, where it acts upon a movable piston. (See STEAM; STEAM ENGINE.) In this case work is performed by the static expansive force of the steam pressing against the piston; in the case of the steam turbine the work is developed by the kinetic energy of the particles of steam which are given a high velocity by reason of the steam expanding from one pressure to a lower pressure. In the æolipile (q.v.), or "Hero's steam engine," invented by Hero of Alexandria (q.v.), we have the germ of the steam turbine. The next steam turbine was invented by Branca in 1629 and consisted simply of a jet of steam impinging upon the vanes of a paddle wheel and blowing it around. Branca's device was the first impulse steam turbine. In 1784 Wolfgang de Kempelen was granted a patent for a reaction turbine and, in the same year, James Watt patented a steam turbine. In 1843 Pilbrow patented a steam turbine working on the same principle as the one later brought out by De Laval. None of these was of actual commercial value, nor was any vigorous attempt made to perfect them, because of the possibilities and the remarkable advances made in the reciprocating engine. Dr. De Laval, of Sweden, was the first to make a practical application of the steam turbine, in 1883, by attaching it to his cream separator. Mr. (later Sir) C. A. Parsons, of England, built his first turbine in 1884. These two notable inventors gave a new impetus to steam-turbine building, and many other forms have since been brought out. The first Parsons turbine developed 10 horse power at 18,000 revolutions per minute and proved entirely practical. This turbine consists of several successive turbine wheels, or rows of blades, on one drum or shaft within a concentric case having interior blades; the moving vanes or blades on the shaft are in circumferential rows projecting outwardly from the shaft and nearly touching the case, and the fixed blades on the casing are in similar rows, projecting inwardly from the case and nearly touching the spindle or shaft. This construction constitutes what practically amounts to a series of turbine wheels on one shaft, each one complete in itself, like a parallel flow or Jonval water turbine, through which the steam is forced to pass. The passageway in each successive turbine is also slightly larger than that in its predecessor, to allow for the increasing bulk of the elastic steam as it exerts its force on each turbine successively and expands with a consequent reduction of pressure. The steam in passing through the successive turbines transmits to each a rotative force, partly by impulse and partly by reaction, so that the Parsons turbine involves the germinal principles of both the Branca turbine and Hero's engine. As the steam leaves any set of revolving blades, it is caught by the guide blades which so reverse its direction of motion that it will impinge properly on the next set of revolving blades. The notable feature of the Parsons turbine is the "compounding" of the steam, or its expansion in successive stages. The steam enters the first turbine at practically boiler pressure and passes from this to a second turbine, or set of turbines, of larger diameter, and from the second to third turbine still larger in diameter. There is a drop in pressure at each stage but an increase in velocity, both of which are allowed for by the increase in diameter. The end thrust due to the pressure of the steam on the blades is balanced by having a series of disks at the end of the shaft where steam is admitted, equal in diameter to the successive turbine steps and connected to them by steam passages, as shown in the illustration. The disks are separated by a labyrinth packing. The revolving portion of the turbine is called the "rotor."

The De Laval turbine is a highly improved form of Branca's impulse turbine. Its rotor consists of a single wheel carrying suitably formed buckets and upon these steam from one or more nozzles impinges, the nozzles being at the side of the wheel and the buckets of such shape as to take advantage of both the impulse and the reaction. In this turbine the expansion of the steam takes place in the nozzle, hence the necessity for having this of the proper form. The outer edge of the buckets is shrouded by a steel ring which prevents the centrifugal escape of the steam. These turbines, especially in the larger sizes, are equipped with several nozzles. As the velocity of the steam issuing from the nozzle exceeds 2500 feet per second, they are essentially of very high speed, the smaller sizes running at 30,000 revolutions per minute and the larger sizes at 10,000 revolutions per minute. A gear and pinion are used to reduce the speed to reasonable working velocities.

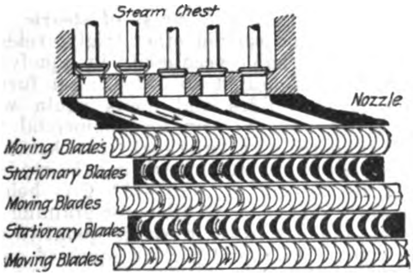


ACTION OF STEAM IN DE LAVAL'S TURBINE.



SECTION OF NOZZLE OF DE LAVAL'S STEAM TURBINE.

In the Curtis turbine, the rotor consists of a number of blade wheels set between stationary rings of guide blades, as in the Parsons, but differs from the latter in that the steam is admitted to the first turbine by a series of nozzles. The steam is expanded nearly to the exhaust pressure in the nozzles, so that few revolving wheels are required, and regulation is obtained by closing one or more nozzles. The shaft of the Curtis turbine is usually vertical and a special step bearing is provided to support the weight and the end thrust due to the steam pressure. The end of the shaft rests on a film of oil that is under pressure so that the rotor turns almost without friction.

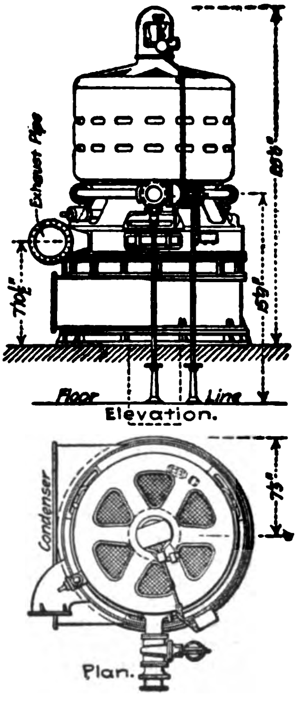


ACTION OF STEAM BLADES OF CURTIS'S TURBINE.

A turbine which is similar in design to the Pelton water wheel (q.v.) is called the Riedler-Stumpf turbine. It has buckets on the periphery of the rotor and a jet of steam from a rectangular nozzle impinges on these. As the steam leaves the buckets, it enters a passage in the casing by which it is led back to the rim of the rotor on which it acts a second time. These machines are built with horizontal or with vertical shafts. An impulse turbine which uses stage expansion is the Rateau, invented by Professor Rateau, of France.

The usual velocity of the tips of the rotating blades of the several makes of turbines is as follows: Parsons, from 100 to 150 feet per second at the high-pressure end and 300 to 350 feet per second at the low-pressure end; Curtis, about 420 feet per second; Rateau, 350 to 400 feet per second; and in the De Laval and Riedler-Stumpf turbines, peripheral velocities exceeding 1000 feet per second are used.

The commercial use of the steam turbine is at present restricted to a limited number of lines. It is peculiarly adapted to driving electric generators, because of the high speed of rotation, convenience, compactness, and ease of regulation, and it is extensively used for this purpose. The rotor and its attached generator can be brought up to speed without the resistance of the load. The turbine does not work well for slow speeds nor for heavy resistances to be slowly started from rest. Many of the large power stations have been equipped with turbine-driven generators, and turbines can be economically applied to utilize the energy in steam exhausted from large reciprocating engines in such plants. The steam turbine is also very desirable for propelling ships because of its simplicity, lightness, compactness, and almost entire absence of vibration. Its disadvantages are the high rotative speed, delicate adjustments required, gyroscopic action, and lack of reversibility. When a screw propeller is run at the high speed developed by a steam turbine, it has a tendency to form a hollow, or cavity, in the water. This tendency is decreased as the speed of the ship increases, so that the turbine is better adapted for fast than



CURTIS TURBINE OPERATING DYNAMO.

for slow vessels. The Parsons turbine was first used on the *Turbinia* as an experiment, and on a trial trip in 1897 this vessel made a speed of 34½ knots per hour. This wonderful performance induced the British Admiralty to build two torpedo destroyers, the *Viper* and the *Cobra*, the former making on her trial trip a speed of 36.58 knots. Since that time the marine turbine has been quite generally adopted for both naval and fast passenger vessels. An extra turbine is fitted to the propeller shaft, for driving the ship backward, and is run in a vacuum when the ship is going ahead. The small diameter of the propellers used with turbines permits the use of three, or even four, propellers. The greatest development of the steam turbine has been in the central electric station. Units of 10,000 kilowatt capacity before referred to have been succeeded by 20,000 and in 1915 by a 35,000 kilowatt-capacity machine for use in Philadelphia. The largest reciprocating unit yet found practical has 10,000 kilowatt capacity.

Gas Turbines. Many attempts have been made to build a turbine using as a motive power the gases obtained by burning or exploding a charge similar to that used in an internal-combustion engine. Such a turbine would use the energy of the fuel as directly as possible, and should be very efficient. Practically all the forms of turbines which are used with steam have been tried for gas turbines and proved unsuccessful. The gases are extremely hot and cause very rapid deterioration of the machine and do not seem to give up their heat energy in passing through the turbine. A small gas turbine, similar to the De Laval steam turbine, run at 19,000 revolutions per minute, developed three-brake horse power, but an expenditure of four horse power was required to compress the air for combustion; hence there was a loss of one horse power.

The large steam turbines are far more economical than the small ones and, when of more than 1000 horse power, are usually more economical than reciprocating engines. The economy is greatly increased by superheating the steam, and a very high vacuum, or a very low back pressure, must be maintained for the exhaust. There is no way of applying an indicator to the steam turbine so that the power delivered by the shaft, i.e., the brake horse power, is the standard for comparison. In turbines using nozzles, the shape of these has a great influence on the efficiency of the turbine.

Bibliography. Aurel Stodola, *The Steam Turbine, with Appendix on Gas Turbines*, English translation by L. C. Loewinstein (2d ed., New York, 1906); Stevens and Hobart, *Steam Turbine Engineering* (ib., 1906); Wilhelm Gentsch, *Steam Turbines*, English translation by A. R. Liddell (ib., 1906); L. G. French, *Steam Turbines: Practice and Theory* (ib., 1907); C. C. Thomas, *Steam Turbines* (4th ed., ib., 1910); Bauer and Lasche, *Marine Steam Turbines*, English translation by M. G. S. Swallow (ib., 1911); John Morrow, *Steam Turbine Design* (ib., 1911); R. M. Neilson, *The Steam Turbine* (4th ed., ib., 1912); J. A. Moyer, *Steam Turbines: A Practical and Theoretical Treatise* (2d ed., ib., 1914). See Shipbuilding, *Machinery*.

STEARIC (stē-ăr'ĭk) **ACID** (from Gk. *στέαρ*, *stear*, tallow), $C_{17}H_{35}COOH$. One of the solid fatty acids. It exists as a glyceride (stearin) in most fats, and is especially abundant in the more solid kinds, such as mutton suet. The stearic acid of commerce is a mixture of stearic and palmitic acids. Pure stearic acid may readily be separated from this by dissolving in hot alcohol and precipitating with a hot alcoholic solution of magnesium acetate, the precipitate being practically pure stearate of magnesium; in this reaction, one part, by weight, of magnesium acetate should be employed for every four parts of commercial stearic acid treated. Magnesium stearate thus obtained is decomposed by boiling with hydrochloric acid, and the stearic acid set free is further purified by recrystallization from alcohol. Pure stearic acid is a colorless crystalline substance having neither taste nor odor; it melts at 69.2° C. (157° F.), is insoluble in water, on which it floats, but dissolves in alcohol and ether, its solution reddening litmus. It may be distilled under diminished pressure. The only stearates soluble in water are stearates of the alkalies, whose solutions are frothy and form a lather, but on the addition of an excess of water separate into an acid salt, deposited in silky crystalline plates, and the free alkali, or more probably a basic salt, which remains in solution. (See Soap.) The stearates of the alkalies are soluble also in alcohol. Chloride of sodium (common salt) has the property of separating alkaline stearates from their aqueous solution. Free stearic acid has been found in decomposing pus and in the caseous deposits of tuberculosis. In adipocere and in fæces stearic acid occurs in the form of its calcium salt; in blood, chyle, and in serous fluids, in the form of sodium salts. See Candle; Fats; Oil; Soap.

STE'ARIN (from Gk. *στέαρ*, *stear*, tallow), or Tristearin, $C_3H_5(C_{17}H_{35}COO)_3$. One of the chief constituents of fats. It is considerably harder than palmitin (q.v.) and less soluble than both palmitin and olein, the other characteristic constituents of natural fats. Stearin may be obtained in a tolerably pure state from mutton suet by repeated crystallization from ether. The only way to obtain it chemically pure is by synthesis: first, anhydrous glycerin is heated with an equal weight of stearic acid, the product being a compound called monostearin; the monostearin, freed from the excess of glycerin, is then heated with a further excess of stearic acid, and the product, tristearin, is carefully freed from the excess of stearic acid. Like palmitin and certain other triglycerides, it presents a remarkable peculiarity in liquefying: it melts first if heated to 55° C.; on further heating it resolidifies and melts again when 72° C. is reached. Stearin for commercial purposes is prepared on a large scale from beef suet, lard, cottonseed oil, etc., by chilling the rendered product to 50°–60° F. (10°–15° C.), holding the mass for some time to allow for graining and then pressing carefully in small quantities in cotton bags. The liquid portion squeezed out is sold as oleo-oil and used in the manufacture of butterine. The oleostearin press cake is blended with olein from various sources and marketed as compound lard. Since the hydrogenation of oils has become an important part of the fat industry, a number of synthetic stearin compounds have appeared on the market.

STEARNS, Frederic Pike (1851–). An American hydraulic engineer, born at Calais, Me. He was employed in the city surveyor's office, Boston, in 1869–72; was identified with the construction and maintenance of the Boston water supply in 1872–80 and of the main drainage works in 1880–86; and served as chief engineer of the Massachusetts State Board of Health from 1886 to 1895, and of the Massachusetts Metropolitan Water Works from 1895 to 1907. Stearns was a consulting engineer to the Charles River Basin Commission in 1903–10 and to the New York Board of Water Supply after 1905, and a member of the board of consulting engineers for the Panama Canal in 1905–06. He was a member of boards that made reports on water supply for Baltimore in 1908–09, and for Winnipeg in 1913. In 1906 he was president of the American Society of Civil Engineers.

STEARNS, WILLIAM AUGUSTUS (1805–76). An American clergyman and educator, born at Bedford, Mass. He was educated at Harvard and at Andover, and was ordained in the Congregational ministry in 1831. In 1854 he became president of Amherst College. His publications include *Discourses and Addresses* (1855), and *A Plea for the Nation* (1876).

STE'ATITE. See SOAPSTONE.

STEB'BING, THOMAS ROSCOE REDE (1835–). An English naturalist. He was born in London and was educated at King's College, London, becoming a fellow of Worcester College, Oxford. In 1858–84 he was engaged in teaching, and thereafter devoted himself to literary and scientific pursuits. An important report was made by him on the Amphipoda of the *Challenger* expedition. He received a gold medal from the Linnean Society in 1908. He made a special study of crustacea, and besides contributing largely to reviews wrote: *Essays on Darwinism* (1871); *The Naturalist of Cumbrae, a True Story, Being the Life of David Robertson by his Friend* (1891); *A History of Crustacea* (1893); *Amphipoda Gammaridea of Das Tierreich* (1906); *Australian Amphipoda* (1910); *Marine Investigations in South Africa* (6 parts, 1900–12); *Cumacea of Das Tierreich* (1913); *Marine Investigations in South Africa* (1910–15).

STEB'BINS, GEORGE COLES (1846–). An American evangelistic singer. He was born at East Carlton, Orleans Co., N. Y., and studied music at Rochester, N. Y., Chicago, and Boston. He began his musical career in Chicago in 1869, and after directing Church music in Boston for two years took up evangelistic work under D. L. Moody in 1876. With Ira D. Sankey and James McGranahan he was joint author of many gospel hymns and selections for male chorus, male quartet, etc., and alone he prepared *The Northfield Hymnal* (1904).

STEBNITSKY, stĕb-nĭt'skĭ. See LIESKOV, NIKOLAI SEMIONOVITCH.

STECCHETTI, stĕ-kĕt'tē, LORENZO. See GUERRINI, OLINDO.

STED'MAN, CHARLES (1753–1812). An English military historian, born at Philadelphia. He was educated at William and Mary College and studied law. At the outbreak of the Revolutionary War he adhered to the crown. He served with the British at Lexington and Bunker Hill, later became commissary to the army of Sir William Howe, and later was with Cornwallis in the South. In 1783 he settled in England. He published a *History of the Origin, Progress, and Termination of the American War* (2 vols., 1794), which remains the best contemporary account of the Revolution from a British standpoint, and is of value for its military maps. It called forth from Sir Henry Clinton a reply: *Some Observations upon Mr. Stedman's History* (1794).

STEDMAN, EDMUND CLARENCE (1833–1908). An American poet, critic, and essayist, born at Hartford, Conn., and educated at Yale. In 1852 he entered journalism as editor of the Norwich (Conn.) *Tribune* and the following year he became editor of the Winsted (Conn.) *Herald*, on which he remained till 1855. He then went to New York and in 1859–61 was on the staff of the New York *Tribune*. At the outbreak of the Civil War he was sent to the front by the New York *World* as war correspondent, and there continued till 1863. As opportunity offered, he studied law and was for a time private secretary to Attorney-General Bates at Washington. In 1864 he was interested in constructing and financing the Union Pacific Railroad. From 1865 till 1900 he was a member of the New York Stock Exchange (a *History* of which he published in 1905–06, with A. N. Easton). He delivered the first Turnbull lectures on poetry at Johns Hopkins (repeated at Columbia and the University of Pennsylvania and was one of the original members of the American Academy of Arts and Letters. His chief volumes of verse are: *Poems, Lyrical and Idyllic* (1860); *Alice of Monmouth: An Idyll of the Great War* (1864); *The Blameless Prince* (1869); *Hawthorne and Other Poems* (1877); *Lyrics and Idylls* (1879); and *Poems Now First Collected* (1897). His critical works, *The Victorian Poets* (1875), *The Poets of America* (1885), *The Nature and Elements of Poetry* (1892), were supplemented by *A Victorian Anthology* (1895) and *An American Anthology* (1900). In 1911 appeared *Genius and Other Essays*. Stedman edited, with Ellen M. Hutchinson, *A Library of American Literature* (11 vols., 1888–90); and, with George E. Woodberry, the *Works of Edgar Allan Poe* (10 vols., 1895). After the death of Lowell, Stedman had perhaps the leading place among American poets and critics. Consult Stedman and Gould, *Life and Letters of Edmund Clarence Stedman* (2 vols., New York, 1910); also William Winter, *Old Friends* (ib., 1909).

STEDMAN, ELIZABETH CLEMENTINE (MRS. WILLIAM BURNET KINNEY) (1810–89). An American writer, a sister of William E. Dodge and the mother of Edmund Clarence Stedman (qq.v.). She was born in New York City and was married first to Edmund B. Stedman (died 1835), a Hartford merchant, and in 1841 to William Burnet Kinney (q.v.). She was contributor to the *Knickerbocker* and to *Blackwood's*. During a 14-years' stay in Europe she was a friend of the Brownings. She published *Felicita, a Metrical Romance* (1855); *Poems* (1867); and *Bianca Capello, a Tragedy* (1873).

STEED, H. WICKHAM (1871–). An English journalist and author. He was educated at Sudbury grammar school and at the universities of Jena, Berlin, and Paris. He was acting correspondent of the London *Times* at Berlin in 1896, and correspondent of the same journal at Rome in 1897–1902 and at Vienna in 1902–13. In 1914 he was appointed its foreign editor. He published: *The Socialist and Labour Movement in England, Germany, and France* (1894); *The Hapsburg Monarchy* (1913; 2d ed., 1914; French ed., 1914).

STEED'MAN, CHARLES (1811–90). An American naval officer, born at Charleston, S. C. He was appointed a midshipman in the navy in 1828, and served in the Mexican War at Vera Cruz and at Tampico. From 1847 to 1855 he was attached to the United States Naval Observatory at Washington, attaining the rank of commander in 1855; in 1859 he commanded the *Dolphin* in the Paraguay expedition. He was loyal to the Union during the Civil War, taking part in DuPont's attack and capture of Port Royal, and in the capture of the Savannah forts. In October, 1862, he captured Confederate batteries at the mouth of the St. John's River, Fla. In 1865 he commanded the Mediterranean squadron, and in 1866 was made a commodore. He commanded the Boston Navy Yard from 1869 to 1872, became a rear admiral in 1871, and was retired in 1873.

STEEDMAN, James Barrett (1818–83). An American soldier, born in Northumberland Co., Pa. In 1837 he settled in Ohio. In 1856–60 he was printer to Congress. He led the Fourth Ohio Volunteers at the battle of Philippi, became a brigadier general, and at Perryville brought up his troops just in time to fill a gap in the Federal battle line. At Chickamauga he led the vanguard of Granger's reserve corps to Thomas's aid on the second day. He served under General Sherman during the Atlanta campaign and then rejoined Thomas at Nashville. He resigned from the service in 1866 with the rank of major general of volunteers. During Johnson's administration he was collector of internal revenue at New Orleans, and in 1879 he was elected to the Ohio State Senate.

STEEL. See Iron and Steel; Metallography.

STEEL, Flora Annie (Webster) (1847–). An English novelist, born at Harrow. In 1867 she married and went to India, where she lived till 1889. She was for some time inspectress for the government and aided schools in the Punjab. While in India she published, in conjunction with Lieutenant Colonel Richard Temple, a collection of Punjab folk tales, under the title *Wide Awake Stories* (1884). After her return to England she wrote novels and short stories illustrative of Anglo-Indian life. Among her writings are: *Miss Stuart's Legacy* (1893); *Tales from the Punjab* (1894); *On the Face of the Waters* (1896); *Voices in the Night* (1900); *The Hosts of the Lord* (1900); *In the Guardianship of God* (1903); *Book of Mortals: A Record of the Good Deeds and Qualities of the Lower Animals* (1906); *King Errant* (1912); *The Mercy of the Lord* (1914).

STEEL CONSTRUCTION. See Bridge; Steel Skeleton Construction; Truss.

STEELE, shtā′le. A town in the District of Essen, Prussia, 4 miles east of Essen, on the Ruhr River. In the town are sandstone quarries, coal mines, gristmills, brickkilns, distilleries, breweries, gas works, and water works. Pop., 1900, 12,243; 1910, 14,487.

STEELE, stēl, Anne (1717–78). An English hymn writer, the daughter of a lay Baptist preacher living at Broughton in Hampshire. Her life mainly passed quietly in her native shire. In 1760 appeared her devotional *Poems*, reissued with additions, and a memoir by Dr. Caleb Evans (3 vols., Bristol, 1780). Many of her hymns are in common use. Consult her *Hymns, Psalms, and Poems*, edited with memoir by J. Sheppard (London, 1863).

STEELE, Daniel (1824–1914). An American Methodist Episcopal theologian, the father of Wilbur F. Steele. He was born at Windham, N. Y., and graduated from Wesleyan University in 1848. In 1850 he entered the ministry, joining the New England Conference of his church, and afterward held various pastorates. He was professor in Genesee College, Lima, N. Y., from 1862 to 1871, and in 1872 the first president of Syracuse University. In 1884–92 he held different chairs in Boston University School of Theology. He contributed to the Whedon series of Commentaries, and published *Love Enthroned* (1875); *Milestone Papers* (1878); *Half Hours with St. Paul* (1895); *The Gospel of the Comforter* (1897); *Jesus Exultant* (1899); *A Substitute for Holiness, or Antinomianism Revealed* (1899); *Half Hours with St. John's Epistles* (1901); *Steele's Answers* (1912).

STEELE, Joel Dorman (1836–86). An American educator, born at Lima, N. Y., and educated at Genesee College. He was severely wounded at the battle of Seven Pines. Afterward he was principal of the Newark, N. Y., High School in 1862–66, and of the Elmira Academy in 1866–72. In 1866 he published a popular text book entitled *Fourteen Weeks in Chemistry*. Its success led to a series of books, intended for terms of fourteen weeks: *Astronomy* (1868), *Natural Philosophy* (1869), *Geology* (1870), *Human Physiology* (1873), and *Zoölogy* (1875). With his wife, Esther B. Steele, he wrote a successful series of school histories known, from the publisher's name, as *Barnes' Brief Histories*. He bequeathed $50,000 to Syracuse University to found the Steele chair of theistical science.

STEELE, Sir Richard (1672–1729). An English essayist, playwright, and politician, born in Dublin. In 1684 he was sent to the Charterhouse School, where he formed a memorable friendship with Addison. In 1690 he was enrolled at Christ Church, Oxford, but he passed to Merton College (1691). In 1694 he left Oxford without a degree, and enlisted in the Life Guards. An elegy which he wrote on the death of Queen Mary (December, 1694), wisely dedicated to Lord Cutts, Colonel of the Coldstream Guards, led eventually to a captaincy (1702) in the regiment. "Finding the military life exposed to much irregularity," Steele wrote *The Christian Hero* (1701), a moral treatise for his own guidance. It was not taken seriously by his associates, and seems to have had little effect on its volatile author. He now wrote three comedies: *The Funeral* (1701); *The Lying Lover* (1704); and *The Tender Husband* (1703). Though rather too deliberate in their moral purpose, they contain much delightful wit. After some vain searches, it was said, for the philosopher's stone, he married (1705) a Mrs. Stretch, who owned an encumbered estate in Barbados. She died about a year after the marriage. In 1706 Steele became gentleman waiter to Prince George; in 1707 he was appointed gazetteer, and seems to have left the army. The two positions brought him £400 a year. He now secretly married Miss Mary Scurlock, of Llangunnor, in Wales, who figures as Prue in his curious letters. He took a house in Bury Street, and lived far beyond his means. The death of Prince George in 1708 put an end to his place at court, and three years later he lost his gazetteership. But he was appointed commissioner of stamps in 1710, a post with £300 a year. Meanwhile (April 12, 1709) had appeared the *Tatler*, a tri-weekly containing sketches and short essays on manners, written under the pseudonym of Isaac Bickerstaff. The periodical came to an end on Jan. 2, 1711, and was succeeded on March 1 by the more famous *Spectator*. Though the plan of these papers was Steele's, Addison had contributed to the *Tatler*, and Addison now became the more important figure. When the *Spectator* suspended publication on Dec. 6, 1712, Steele had written 236 papers and Addison 274. The *Guardian*, started March 17, 1713, was followed by several other short-lived periodicals, of which the most noteworthy is the *Englishman*. In these later undertakings Steele, a strong Whig, involved himself in political controversy, and was handled without mercy by Swift. He resigned his commissionership of stamps and entered Parliament, but he was expelled (March, 1714) for seditious libel contained in *The Crisis*, a pamphlet in favor of the Hanoverian succession. On the accession of George I Steele was again elected to Parliament (1715). He also secured the patent of Drury Lane Theatre (worth £1000 a year), for which he wrote his last comedy, *The Conscious Lover* (produced 1722). Broken in health, he passed his last years at Carmarthen, in Wales, where he died, and was buried there in St. Peter's Church.

Steele was improvident, generous, lighthearted. As a poet he won no place. His political pamphlets interest, but do not convince. His comedies are still read for wit and gayety in special scenes. As an essayist he has often been compared with Addison. The latter was a stylist. Steele composed off-hand with less attention to form. But he preceded Addison and thus became the father of the essay and sketch dealing with contemporary manners, which by Fielding was transformed into the novel. See ADDISON, JOSEPH.

Consult the excellent biographies of Steele by Aitken (London, 1889) and by Dobson, in "English Worthies" (ib., 1886); Thackeray, *English Humourists* (ib., 1853; new ed., New York, 1911); *The Spectator* (London, 1898); *The Tatler* (ib., 1899); and *Plays* ("Mermaid" series, ib., 1893), all admirably edited by G. A. Aitken.

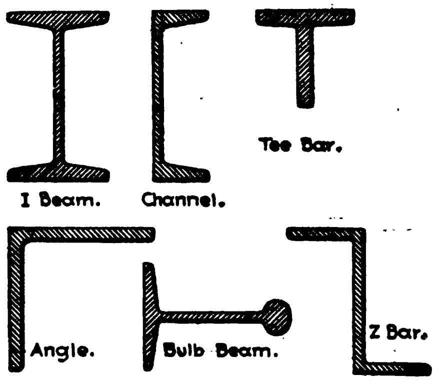
STEELE, SAMUEL BENFIELD (1849-). A Canadian soldier, born at Purbrook, Ontario, and educated at the British American Commercial College, Toronto. He studied at the Royal Military School there, served during the Fenian Raid in 1866, and with Colonel (afterward Field Marshal Viscount) Wolseley (q.v.) in the Red River expedition in 1870. He joined the Royal Northwest Mounted Police in 1873, becoming inspector (1878), superintendent (1885), and later commissioner of police. In the forces employed in the suppression of the second rebellion under Louis Riel (q.v.) in 1885, Steele commanded a body of cavalry and scouts. He commanded the Royal Northwest Mounted Police during the rush of miners to the Klondike in 1898 and during the organization of the Yukon Territory. On the outbreak of the South African War (q.v.) he was put in command of Strathcona's Horse, served with distinction through the war, and was promoted colonel; he returned to Canada in 1906, and administered the tenth and thirteenth military districts (1907-10). On the outbreak of the European War in 1914, Steele rendered assistance in organizing the Canadian troops in Manitoba. In December, 1914, he was promoted brigadier general, with rank of major general, and was appointed inspector general for western Canada.

STEELE, WILBUR FLETCHER (1851-). An American Methodist Episcopal theologian, son of Daniel Steele. He was born at Leominster, Mass. He graduated from Syracuse University (1872) and from Boston University School of Theology (1874), and studied at Berlin and Oxford. He entered the ministry in 1874. From 1881 to 1888 he was principal of Bennett Seminary in Greensboro, N. C.; from 1892 to 1899 was professor of biblical exegesis and acting dean of the Iliff School of Theology, Denver, and thereafter he was professor of biblical science in Denver University. While in North Carolina he secured the passage of the Savings Bank Law of the State.

STEEL ENGRAVING. See ENGRAVING.

STEELHEAD (from the color and hardness of the head), or HARDHEAD. The large sea trout or salmon trout of the Pacific Slope (*Salmo giardneri*). It is found in coastwise streams from Santa Barbara Co., Cal., northward nearly to Alaska. It reaches a length of 30 inches. See SALMON.

STEEL SHAPES. Structural steel produced by a rolling mill in certain fixed shapes such as angles, I bars, tees, bulbs, etc. These sections are limited only by the fact that they must in each case be of uniform section throughout the length of the piece, and the fact that the roller grooves cannot be wider at the bottom than the top. The more common standard shapes are plates, flats, squares, rounds, half-rounds, angles, channels, I beams, Z bars, T bars, trough shapes, rails, and bulbs. In structural work these direct shapes are riveted together to form the various compound shapes used for columns for buildings, bridge members, etc. For further information consult the various engineers' pocketbooks and the handbooks of Carnegie Steel Company, and other manufactures. See BEAM; ROLLING MILL.



STRUCTURAL STEEL SHAPES.

STEEL SKELETON CONSTRUCTION. In the words of municipal building codes, "A form of building construction wherein all external and internal loads and stresses are transmitted to the foundations by a rigidly connected framework of metal or reënforced concrete. The inclosing walls are supported by girders at each story."

Development. The employment of steel skeleton construction in the erection of tall buildings is due partly to the natural outcome of conditions imposed upon owners of property lying within the congested sections of large cities and partly to the introduction of new materials and devices. Neglecting the æsthetic considerations, the height of buildings has always been largely controlled by practical considerations of cost and utility, and until about 1870 these limited the height of buildings to five or six stories. Rapid increase in real-estate values made it unprofitable to keep low buildings on valuable ground, as high rents would have to be charged in order to derive a fair return from the investment, so that owners were obliged to erect taller buildings to provide more room and obtain more rent.

The first result of the increase in the height of buildings was the invention of passenger elevators (see **Elevator**), for tenants would not climb stairs above five or perhaps six stories. Elevators were employed in commercial buildings for the first time in 1868. Their gradual development and improvement in speed made vertical travel easy, and the erection of eight, nine, or 10 story buildings became possible, and the problem of making real estate profitable was thus temporarily solved. Later, these 10-story buildings, in which the cheapest offices rented for $2 per square foot of floor space, ceased to yield sufficient revenue in large cities owing to rapid rise in property values, so the building height had to be increased to 12 and 14 stories. It was soon discovered that these tall buildings, constructed with timber in the floors, stairs, and elevator wells, could not be controlled in case of fire. About 1880 many large cities made laws requiring buildings exceeding a stated number of feet in height (generally 85) to be fireproof, i.e., constructed with walls of brick, stone, iron, or other incombustible materials, with floors in which wooden beams were not used. All columns, girders, and stairs also must be non-inflammable. (See **Fireproof Construction**.) This gave great impetus to the manufacture of structural iron and steel.

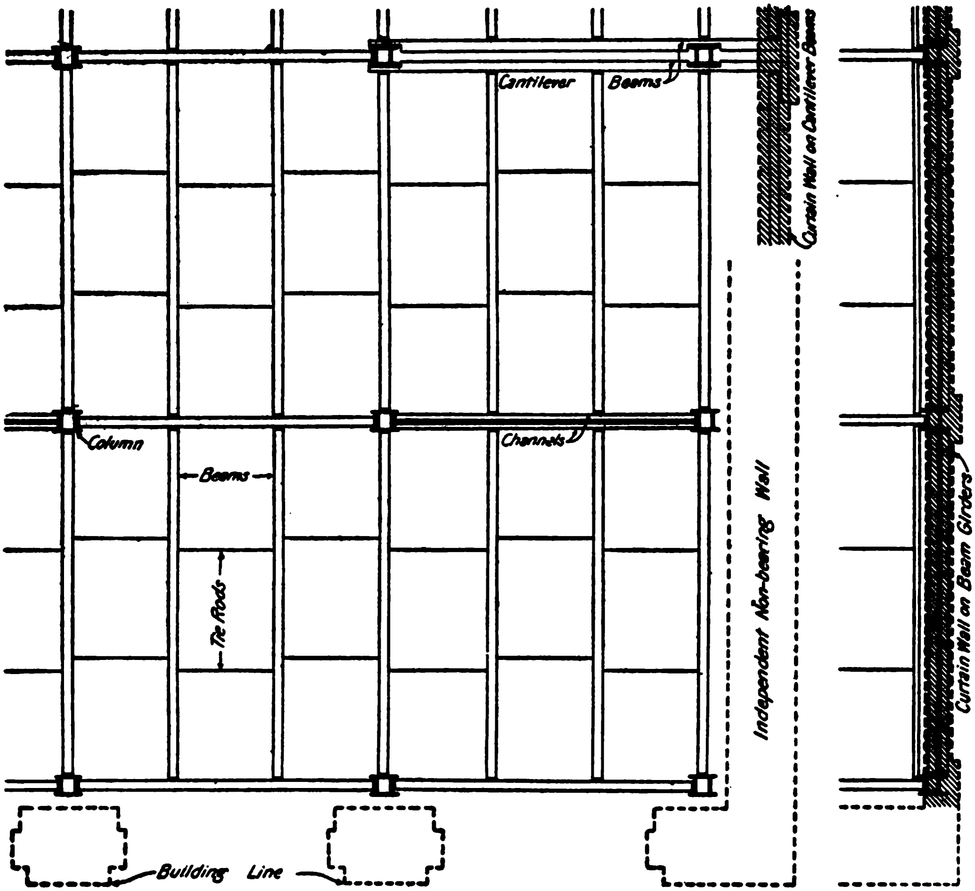

Cantilever Beams
Curtain Wall on Cantilever Beams
Column
Channels
Beams
Tie Rods
Independent Non-bearing Wall
Curtain Wall on Beam Girders
Building Line

Fig. 1. FLOOR PLANS OF TYPICAL SKELETON CAGE.

A new difficulty here presented itself. When buildings were erected over 10 stories in height, the outer walls and piers had to be made so thick at the base, in order to support safely the weight of the dead load of walls and floors and loads imposed thereon, that the valuable ground space occupied by them caused great loss of income—on a narrow lot little more than an entrance hallway would be left between side walls on the lower floors. It became necessary to make the piers thinner, and various devices were employed to reduce their size. First (about 1888), columns were built in to receive the ends of the beams and girders and thus relieve the piers of floor loads. Finally it was discovered, in 1890, that the pier thickness could be still further reduced by relieving the piers of the weight of the walls; supporting the four walls on girders set between the wall columns at every floor level. This led to the modern method of construction known as *Steel Skeleton Construction*. It consists of a complete and well-connected framework of steel capable of carrying not only the floors and the roof, but the outside walls and every other part of the building, and constructed with sufficient wind bracing to secure its independent safety under all conditions of loading and exposure.

The modern building constructed with a steel skeleton frame is quite a different structure from the old building with thick bearing walls. In the latter beams and columns were an adjunct to masonry work, but in the former the relation is reversed. The masonry walls are not needed for strength; they are divided into panels one story in height, and supported by the steel frame. As the walls carry no load, being merely a veneer or outside covering for the steel frame, commonly called "curtain walls," the different municipal codes permitted a reduction in their thickness. The saving in floor space resulting from the use of curtain walls may be seen from the following comparison. In a 12-story building, when the walls carry the floor loads they must be of the following thickness: 12th and 11th story, 16 inches; 10th and 9th, 20 inches; 8th and 7th, 24 inches; 6th and 5th, 28 inches; 4th and 3d, 32 inches; 2d and 1st, 36 inches. When curtain walls are employed, supported on the steel cage, they must be of the following thickness: 12th, 11th, 10th, 9th, 8th, and 7th story, 12 inches; 6th, 5th, 4th, 3d, 2d, and 1st story, 16 inches. This is a saving of over 3 feet in the width of a building. In a higher building the percentage saved is greater; this is one of the factors that has made the erection of 20-story buildings possible. If the Woolworth Building in New York City, the tallest commercial building in the world, had been erected in the old way, with bearing walls, they would have been required to be 10 feet, 4 inches thick. They are 3 feet, 8 inches thick.

Materials. It is not definitely known when and how iron was first used in the construction of buildings. Cast-iron columns and lintels have been in use for many years. The first wrought-iron beams and girders, which were of European manufacture, were imported into the United States about 1840, being used in connection with wooden beams. The first wrought-iron beams made in America were rolled at Trenton, N. J., in 1853, and the first steel beams were manufactured by Carnegie as late as 1885. Cooper Union in New York City, constructed about 1860, was the earliest structure in which iron beams were used throughout in the floor construction. Now buildings are entirely of steel, with riveted-steel columns and girders and rolled-steel beams, although cast iron is still used to some extent for columns and bases. Wrought iron has been entirely superseded by steel, which is not only stronger but cheaper, the manufacture of wrought-iron structural shapes having been abandoned in 1893. Continued improvements in the manufacture of steel have lowered the cost of production from about 20 cents per pound to one and one-half cents, the price in 1916, and, with the introduction of cheap structural steel, skeleton construction has come rapidly into use.

Advantages. The dimensions of the external piers cease to control the height of the building, which is now limited by the possibility of securing adequate foundations and by a consideration of the amount of floor space which could be devoted without too great a loss to a system of elevators of sufficient capacity to afford speedy access to all parts of the building. At the present writing 40-story buildings are not uncommon, rising to a height of 600 or 700 feet above the curb. The advantages that resulted in the very rapid introduction of steel skeleton construction were not only the opportunity afforded for greatly reducing the size of the piers, but the enormous facilities afforded for rapid construction, the steel frame being erected at the rate of one story every three or four days. Other advantages are the comparatively small amount of materials used, the proportionally small load upon the foundations, and the fact that, as the walls are supported at each story directly on the frame, the masonry can be built at any story independently of the masonry below it, as shown in the accompanying Plate.

Fabrication of Frame at Mill. All the members of a steel skeleton frame are prepared at the mill and shipped to the site ready for assembling. Rolled beams are used for floors, and the columns and girders are built up of plates, angles, channels, and other rolled sections (Fig. 4). These are cut to exact lengths at the mills and then either punched or drilled for the rivet and bolt holes required for assembling the different sections of a built-up member and for connecting the different members at the building. Drilled holes are superior to punched holes, as they can be accurately located and do not weaken or injure the material, but they are more expensive to make and are therefore confined to the connecting ends of members which are to be joined at the site and where a perfect alignment of rivet holes is necessary. After having been punched, the sections are assembled, the rivet holes being drilled or reamed out wherever the alignment is not perfect, and finally riveted together. The rivets are of mild steel usually ¾ inch, ⅞ inch, or 1 inch in diameter and are made with one head forged, the other being formed by the riveting machine. The rivet is first raised to a red heat, after which it is placed in the hole passing through the different sections to be joined. The machines used for riveting, operated usually by compressed air or hydraulic power, consist of two large arms, one of which holds the head of the rivet firmly against the member, and the other pressing in the opposite direction forces the sections closely together, while at the same time a ram moving in the direction of the axis of the rivet forces the hot metal to fill the hole, and forges the other head on the projecting end of the shank. This is known as "shop riveting" to distinguish it from "field riveting" which is done by hand at the building. As machine riveting is stronger and more economical than hand riveting, as much of it as possible is done at the shop and only the connection rivets are driven in the field.

Because of the danger of fracturing a casting under the blows of a punch and riveting machine, holes in cast-iron members must be drilled and the connections made by means of bolts. A bolted connection can never be made as stiff or as rigid as a riveted one, hence this is one of the reasons for not using cast iron in skeleton frame construction.

Prior to assembling, all steel sections are cleaned from rust, scale, and dirt, thoroughly dried, and then given one coat of linseed oil, metallic paint, or some other protective coating to preserve the metal from rust. After erection the entire frame is then given two or three additional coats. The members are now shipped to the building for erection.

Bases. If a heavily loaded column were to be placed directly upon a wall or pier of masonry, the weight would be distributed over such a small area that there would be danger of crushing the wall or pier. To prevent this it is necessary to place a bearing plate or base between the column and the masonry which distributes the weight over a larger area. Bases may be of cast iron, as shown in Fig. 4, or of steel, as shown in Fig. 2. Cast-iron bases, known as ribbed bases, consist of two flange plates, one supporting the column and the other resting on the masonry, connected by a core, or web, having vertical braces or ribs carried from the upper flange to the corners of the lower flange and to all sides, in order to stiffen the lower flange and prevent it from shearing or bending. These are generally used with masonry foundations. When the foundations consist of grillage beams (see FOUNDATION), the bases are generally of steel (Fig. 2), being composed of plates and angles riveted to the shell of the column.

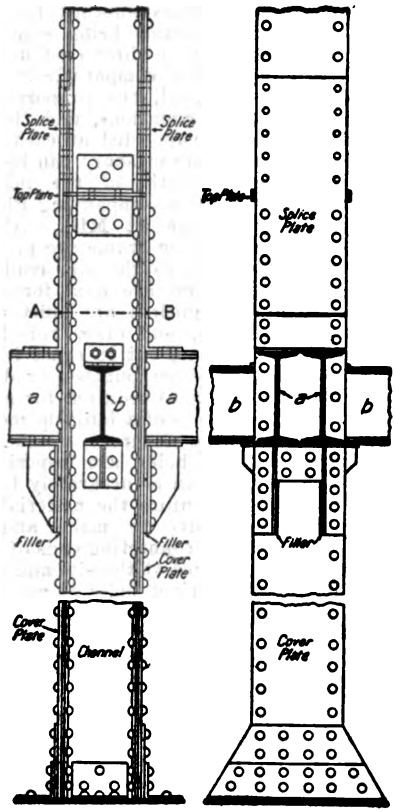
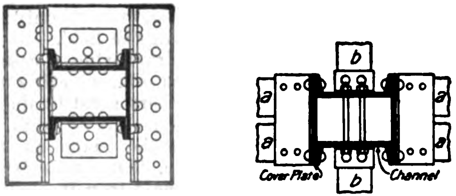


FIG. 2. BUILT-UP STEEL COLUMN.



Section of Base

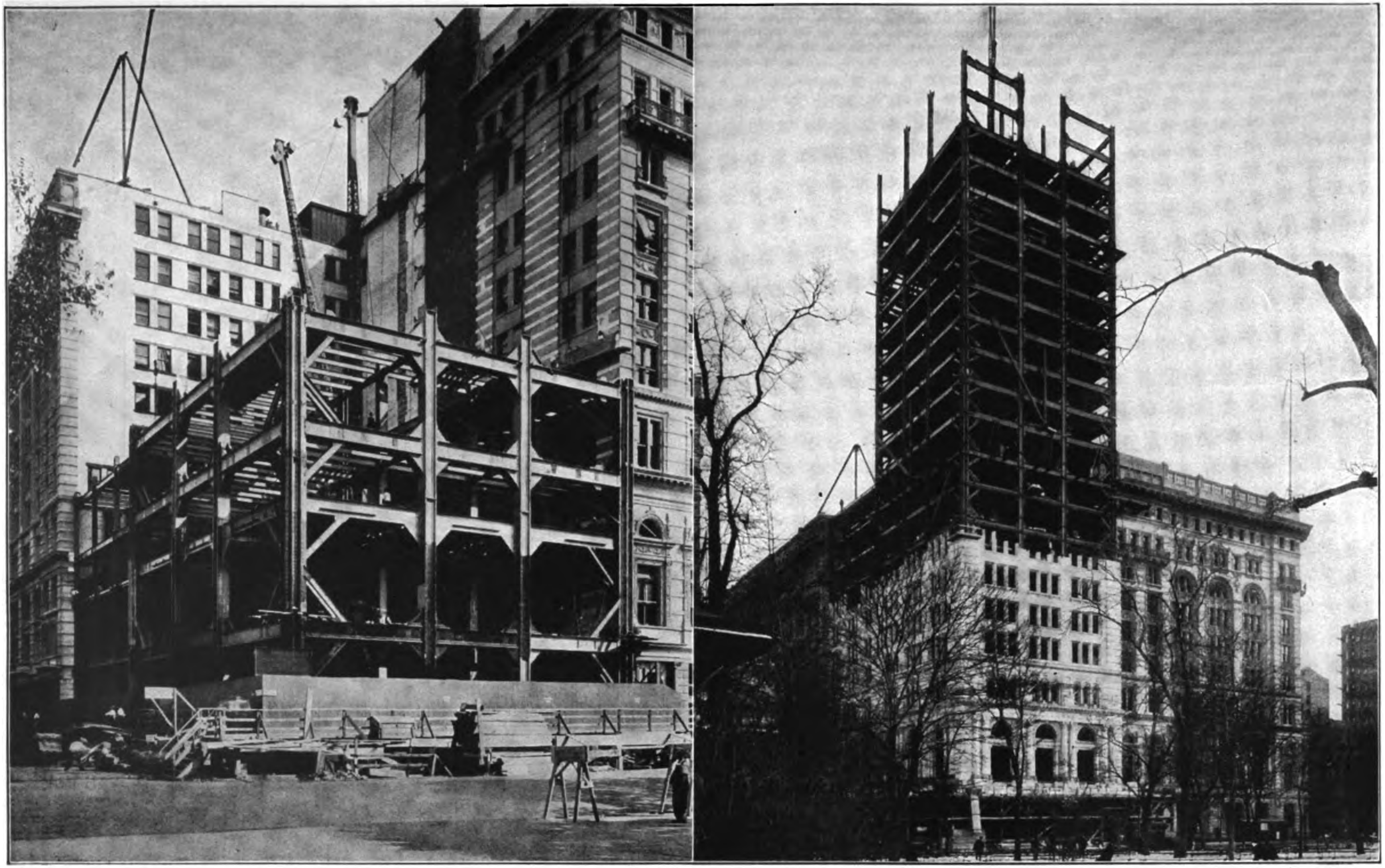
Section AB

FIG. 3. BUILT-UP STEEL COLUMNS—SECTIONS. (See Fig. 2.)

Columns. Both cast-iron and steel columns are used in skeleton frames. The most economical form of cross section for a cast-iron column is a hollow circle. This form is generally used for interior columns, but for exterior columns it is not so desirable, because it cannot be bonded into the walls so readily, nor does it present the same facilities for the design of the beam and girder connections, as some of the other forms of cross sections do. The next column in economy of cross section is the hollow square. It is generally used for wall columns, being easier to bond into the masonry than a circular section. The H-shape column ranks third in regard to economy of cross section. It is particularly well adapted for wall columns in skeleton construction because when built into brick walls the masonry fills all voids, the projecting flanges tie and anchor the walls to the frame, and, if placed perpendicular to the length of the wall, only the outside edges are near the outer face. Moreover, lugs and brackets for beam and girder connections can be cast upon such columns better than upon circular columns, especially for wide and heavy girders, and, finally, the column connections do not require projecting rims or flanges, which are often in the way on circular columns. As before mentioned, because of the impossibility of making riveted connections with cast-iron columns, they should not be used in skeleton frames subject to lateral vibration.

Steel or built-up columns are composed of standard rolled sections such as channels, plates, and angles riveted together, the various combinations being almost unlimited. Arranged in the order of their simplicity of construction, i.e., the number of rows of rivets they contain, they rank as follows in point of economy: I beam and Bethlehem H columns, no rivets; plate columns, composed of four angles riveted to a central web, two rows of rivets; channel columns (Fig. 2), composed of two channels riveted to side or flange plates, four rows; and box columns, composed of four plates and four angles riveted together with eight rows of rivets. There are other considerations, however, than economy of construction, which sometimes govern the selection of a column. Some of these are (*a*) the cost and availability of the material. In this respect I beams, channels, plates, and angles are the most economical sections. Patented sections, such as the Bethlehem, as a rule are not so economical. (*b*) The amount of labor required to assemble the column in the shop and to make the beam and girder connections at the building. In this respect the Bethlehem column probably leads. (*c*) The distribution of the material in the column so as to give the maximum strength with the least area of cross section. From this standpoint the channel and box columns are superior. (*d*) The facility with which connections may be made between the column and the beams and girders which it supports. In this respect, also, sections of an open construction such as the Bethlehem and plate and angle are superior to a closed section such as the channel and box column. Other minor considerations are the facility with which the thickness of the metal in the different sections composing the column can be reduced in order to meet the reduced loads of the upper floors. and, finally, the facility with which the

STEEL SKELETON CONSTRUCTION

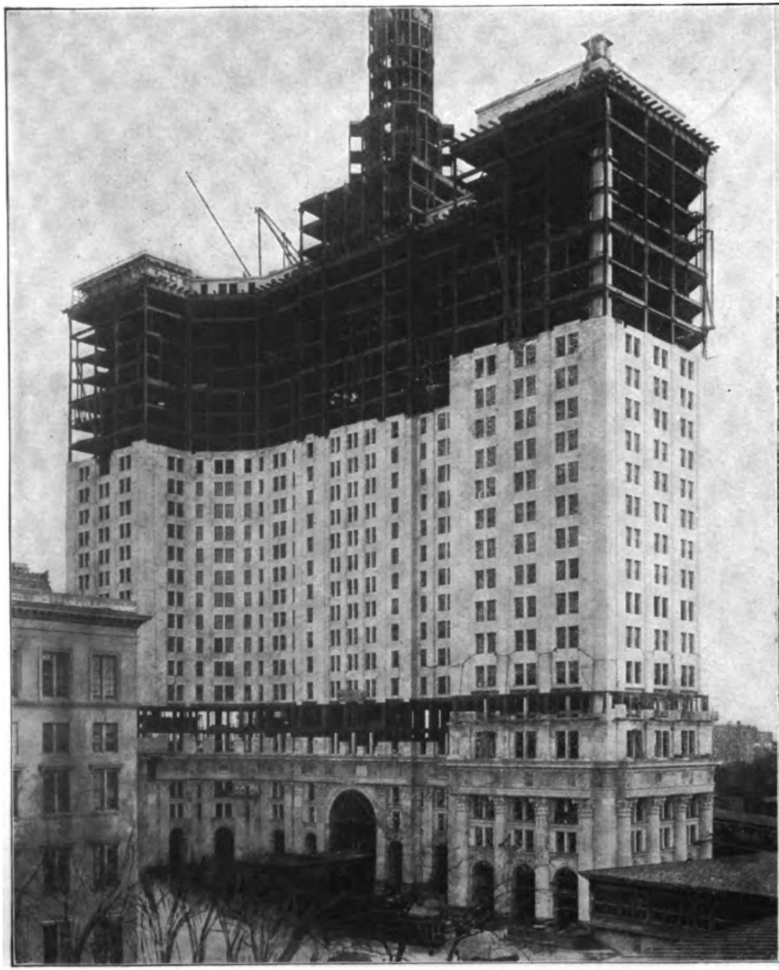


FRAME RISING FROM THE FOUNDATIONS

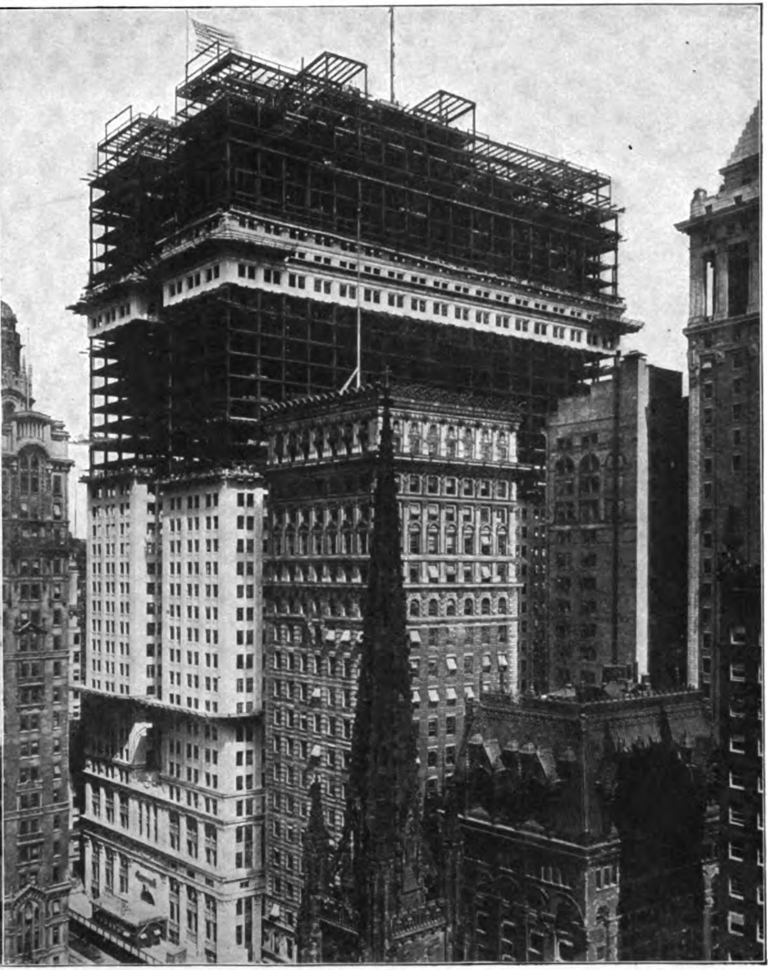
ENCLOSING CURTAIN WALLS STARTED

BUILDING A SKYSCRAPER— METROPOLITAN LIFE TOWER, NEW YORK

STEEL SKELETON CONSTRUCTION



NEW YORK MUNICIPAL BUILDING
STEEL FRAME COMPLETE AND PARTLY ENCLOSED WITH MASONRY



EQUITABLE BUILDING, NEW YORK
STEEL FRAME COMPLETE AND CURTAIN WALLS UNDER CONSTRUCTION

column can be fireproofed. (See FIREPROOFING.) Steel columns are always connected by means of splice plates and angles, as shown in Fig. 2.

Beams and Floor Construction. The floor construction of a skeleton building consists of a series of arches or slabs of concrete or terra cotta (see FIREPROOF CONSTRUCTION, Figs. 1–5) laid between steel I beams. The spacing of the beams depends upon the kind of arch used, but it may be said to average 5 feet for terra cotta and somewhat more for concrete. The arrangement of the floor beams is determined more or less by the size of the building, the floor loads to be carried, and the purpose for which the building is to be used. Generally the floor area is divided into a number of units about 15 by 20 feet in size and as nearly uniform as possible, as shown in Fig. 1. On lots 30 feet and less in width, no interior columns are used, and the floor beams rest upon transverse girders set between the wall columns, which are about 15 feet on centres. Beams 10 and 12 inches in depth are most frequently used, 8 inches being the minimum and 15 inches the maximum. In order to counteract the horizontal thrust exerted by the floor arches the beams are tied across from end to end by lines of tie rods, as shown in Fig. 1. Channels are frequently placed against the wall to receive the end of the arch sprung from the last beam, there being no corresponding arch on the other side and consequently no necessity for any flange. They are also employed in framing around openings, such as those for elevator and stair wells. Their general use, however, is not to be recommended, as they are a very difficult section to fireproof. Typical connections between beams and columns are shown in Fig. 4.

Girders. Girders are the members placed between the columns to support the ends of the floor beams. They may be single or double beam girders or built-up or riveted girders. Riveted girders are built up of plates and angles. They are known as plate girders when they have a single web, and box girders when they have two or more webs. Beam girders have been rolled to a depth of 36 inches, but from an economical standpoint a built-up girder is usually preferable where the span requires a greater depth than 20 inches. The reason for this is that the number and thickness of the flange plates used in a built-up girder may be varied at different parts of it in proportion to the stresses which come upon those parts. Whereas in a rolled beam the thickness of the webs and of the flanges is necessarily unvarying throughout, and if therefore these are thick enough to withstand the greater stresses, they are much too thick in those portions where the smaller ones occur, and consequently considerable material is wasted. Cantilever girders, as shown in Fig. 4, are sometimes necessary in tall and narrow skeleton buildings, to distribute the weight evenly over the footings, where building on the lot lines confines the offsets of the footing to one side. As such buildings are usually designed, the wall columns are placed 4, or at the most 8, inches from the outside face of the wall. On interior lots where the offsets in the footings can be made on one side only, most of the weight is brought on the extreme outer edge of the footing instead of being uniformly distributed, and the wall has a tendency to settle outwards. To prevent this tendency to settle unequally, the wall columns are supported on cantilever girders the shoe or base of which may be placed directly over the centre of the footing—thus insuring an equal distribution of the load. The cantilevers are usually balanced, as shown in Fig. 4. Beam and girder connections are also shown in Fig. 4.

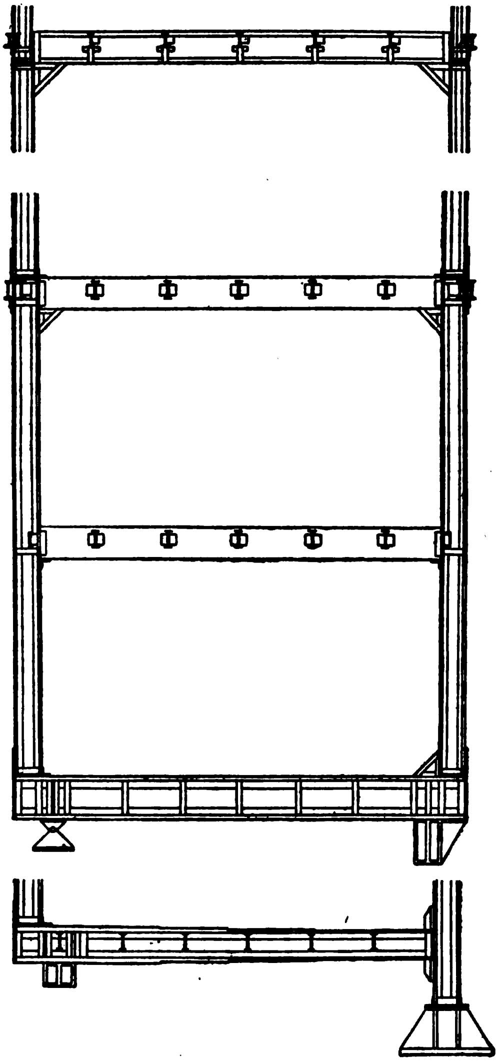


FIG. 4. FRAMING SECTION OF SKELETON CAGE.
Showing cantilever girders.

Wind Bracing. Buildings are always subject to lateral strains from the force of the wind, and, when these are great, they must be provided for, just as those produced by vertical loads. Until the advent of the skyscraper little attention was paid to that fact and there had been little occasion for it. The old buildings constructed of solid masonry walls braced by permanent partitions were not more than 10 stories high, and the strength and dead weight of the walls were sufficient to resist any overturning forces. In skeleton buildings their height is so great in comparison with their width, and they have been so deprived of the lateral stability due to solid walls and partitions, that some provision against wind effect is necessary. For buildings under 100 feet in height, provided the height does not exceed four times the average width of the base, no provision is necessary. For buildings not exceeding 120 feet in height, and in which the least width is two-thirds the height, sufficient rigidity may be obtained by using continuous column splices (Fig. 2), making the columns in two-story lengths, alternate columns breaking joints on alternate floors, making the girders as deep as practicable, and riveting the webs as well as both flanges to the columns by means of angles or brackets. Exposed buildings in which the height exceeds four times the width, or which are more than 120 feet high, should have some definite form of wind bracing. There is the greatest diversity of practice in regard to bracing, largely on account of peculiar conditions of every building. The height, width, shape, and exposure of the structure, as well as the character of the inclosing walls, determine the amount of wind pressure to be resisted, while the details of the construction and the planning of the various floors will decide upon the type of bracing to be used. There are three distinct systems of wind bracing: first, sway bracing; second, knee bracing; and, third, portal-arch bracing.

In the sway-brace system several rows of columns are braced by means of diagonal rods placed between the floor levels, forming a vertical truss from cellar to roof. The columns become the upper and lower chords of the truss, and the floor beams the struts; after having been designed for static loads the columns and beams would then have to be designed for the additional stresses of the truss. The sway-bracing system is undoubtedly the cheapest and best system of wind bracing, when the division of the building by partitions will admit of its use. Partitions have to be placed wherever these trusses are, and it frequently happens that partitions are not wanted in just those particular places. The best-planned building leaves each floor one great loft to be subdivided by light interchangeable partitions to suit the tenant's wishes.

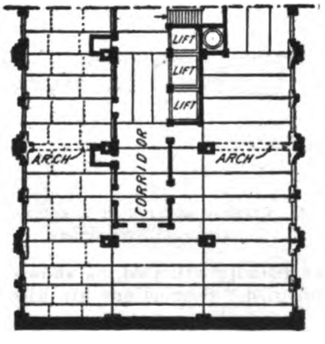


Fig. 5. PORTAL TYPE OF WIND BRACING—HALF PLAN.

In the second system of wind bracing (shown in Fig. 4 and also in the accompanying Plate) the frame is stiffened by means of triangular braces called "knees" or "gussets" riveted to the columns and girders at all floor levels. Wall columns are braced longitudinally as well as transversely. This system of bracing possesses a great advantage over the first, insomuch that it requires no special provisions in planning. It is seldom necessary to make these knees more than 4 feet in depth, so their projection below the girders may be concealed by coves or brackets. The disadvantage of this system is that it is not so economical as the first, because it produces heavy bending moments in both the columns and girders, and also on account of the increased amount of labor necessary to make the connections at the building.

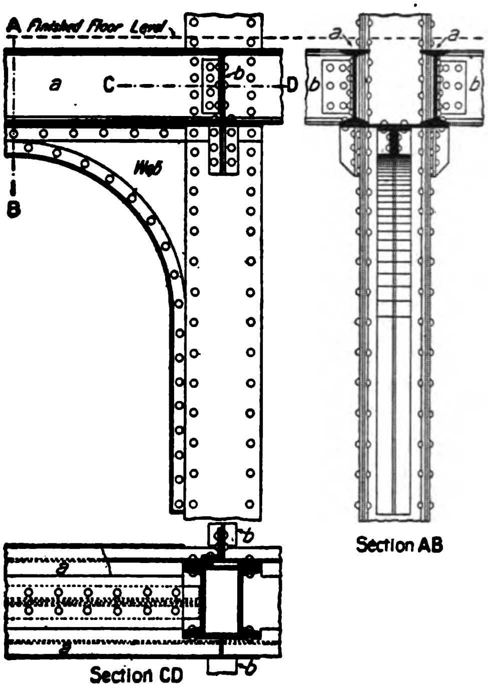


Fig. 6. PORTAL TYPE OF WIND BRACING—DETAIL.

The third system of wind bracing is the portal-arch system (Figs. 5–7), which is used in the place of sway rods, where conditions as to corridors, doors, etc., prohibit the crossing of such spaces. This consists in riveting a steel arch to the columns and girders at the weak parts of the building, the arches being placed between hall columns wherever possible so as not to interfere with the arrangement of the partitions. This system is not so economical as sway bracing, but it is generally considered more effective and cheaper than the knee-brace system, because it produces practically no bending moment in the columns. The knee-brace system, however, seems generally to be preferred.

Disadvantages of Skeleton Construction. There are several serious objections to the modern system of steel skeleton construction. Among them are the danger of corrosion and the difficulty of protecting the metal frame from fire, as the safety of the structure depends upon the preservation of the frame. Most steel frames are built permanently into the walls with no provision for their preservation excepting that afforded by paint and other protective coating and the 4 or 8 inches of masonry through which heat and moisture can readily penetrate.

The dangers incurred in this form of construction are corrosion from exposure to the weather, from leakage from gas, water, and other pipes; electrolysis; and expansion caused by exterior conflagrations.

Conclusion. In addition to these structural disadvantages, high buildings are a menace to life and health and they cause congestion of thoroughfares. That they are a menace to life has been proved over and over again by the many disastrous fires that have taken place, notably that on Washington Place, New York City. The building itself was damaged hardly at all, yet 140 occupants lost their lives in a vain effort to escape from the burning building. It is unquestionable that the freedom to erect skyscrapers results in the cutting off of light and air, and thereby has a damaging effect upon the health of the population. Narrow streets are turned into cañons, and dark rooms by the thousand have been created, and in these human beings are compelled to work under artificial light.

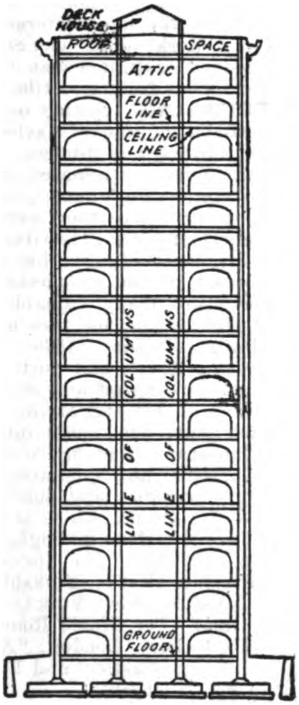


Fig. 7. PORTAL TYPE OF WIND BRACING—SECTION.

All these considerations have resulted in the passage of laws limiting the height of buildings in Washington, Baltimore, Boston, and Chicago, and if social or economic conditions in the future do not soon lead to a reduction in the height of buildings in other cities, they also will be forced to follow the example of those above.

Bibliography. The *Engineering News* (New York, weekly), *Architecture* (ib., monthly), and architectural magazines carry many articles on skeleton construction. Among the books which may be consulted are: Wm. H. Birkmore, *Skeleton Construction in Buildings and the Planning and Construction of High Office Buildings* (New York, 1898); Henry Jackson Burt, *Steel Construction* (Chicago, 1914); handbooks of the Bethlehem, Carnegie, and Cambria steel companies; J. K. Freitag, *Architectural Engineering* (New York, 1907); Kidder, *Architect's and Engineer's Pocket Book* (ib., 1916); M. S. Ketchum, *Steel Mill Buildings* (ib., 1908). See FIREPROOF CONSTRUCTION; FOUNDATION.

STEELTON. A town in Algoma District, Ontario, Canada, on the Canadian Pacific and the Algoma Central and Hudson Bay railways (Map: Ontario, R 14). It has manufactures. Pop., 1911, 3936.

STEEL'TON. A borough in Dauphin Co., Pa., 3 miles southeast of Harrisburg, on the Pennsylvania and the Philadelphia and Reading railroads (Map: Pennsylvania, H 7). It has a public library. It is known for its steel interests, the extensive works of the Pennsylvania Steel Company being here. Other establishments are brickyards, a flouring mill, and machine shops. Pop., 1900, 12,086; 1910, 14,246; 1915 (U. S. est.), 15,337.

STEEL WOOL. An abrading material used as a substitute for sand, glass, or emery paper for abrading or coarsely polishing wood or metal work. It is composed of sharp-edged threads of steel, which curl up like wool or excelsior.

STEELYARD. See BALANCE.

STEEN, stān, JAN (c.1626–79). One of the foremost Dutch genre painters. He was born at Leyden, where he entered the university in 1646, and two years later helped to found the painters' guild. He is said to have studied at Utrecht with Nicolas Knupfer and then at The Hague with Jan van Goyen, whose daughter he married in 1649; but neither master exercised much influence on his art. From 1649 to 1654 he lived at The Hague; then he leased a brewery at Delft for seven years. In 1661–69 he resided at Haarlem, and from then until his death at Leyden, where he obtained a license for a tavern in 1672. His frequent change of residence was due mainly to financial straits, which prompted him also to keep a tavern. The view which represents him as dissolute and dissipated is exaggerated, for during his short life he painted more works than any other genre master. Unlike others who confined themselves to a single phase of Dutch life, Steen depicted every phase, with never-failing though somewhat coarse humor, sometimes ironical but always good-natured. He painted a few religious and historical subjects and some also of most excellent technique representing high life; but he usually depicts the lower and middle classes: village surgeons, artisans, beggars; scenes of child life, for which he has unusual sympathy, particularly when he paints his own family; festivals, domestic life, tavern and love scenes. Some were repeated, such as the "Doctor's Visit," of which he painted 47 versions (Amsterdam, The Hague, Leipzig, Munich, St. Petersburg, etc.); "A Merry Company" (Amsterdam, The Hague, Buckingham Palace, National Gallery, London, St. Petersburg), and "Bad Company" (Louvre, Berlin, etc.). Some of his early subjects show the influence of Frans Hals: but his best reproductions belong, for the most part, to his Haarlem period. His works are particularly numerous at Amsterdam, which has the well-known "Eve of St. Nicholas" (a favorite subject), "The Rustic Wedding," several family scenes, and many others; at The Hague are "The Menagerie," "The Painter's Family," "The Oyster Party," etc.; others are at St. Petersburg, Berlin, Munich, Vienna, Cassel ("Twelfth Night"), Brunswick ("The Marriage Contract"), the Louvre, Buckingham Palace, the National

Gallery, London, and in many English private collections. He is represented also in some American collections—three examples are in the Metropolitan Museum, New York. His art is characterized by amazing power of invention, skillful composition, good color and lighting; but the drawing in some of his paintings is sketchy and superficial. These were probably "pot boilers," necessitated by his financial condition. In his work the story-telling element is always in evidence, often to the detriment of artistic excellence. Consult: *Masters in Art*, vol. vi (Boston, 1905), containing an exhaustive bibliography; Hofstede de Groot, *Catalogue of Dutch Painters*, vol. i (London, 1908); Wilhelm Bode, *Great Masters of Dutch and Flemish Painting* (New York, 1909).

STEEN, stān, Johannes Wilhelm Christian (1827–1906). A Norwegian educator and statesman, born in Christiania. Educated at Tromsö and Christiania, he was for years a teacher and rector of schools. He entered politics as an advocate of liberalism and nationalism and almost continuously from 1859 to 1900 was a member of the Storthing, where by reason of his conspicuous ability and learning he soon became a leader, President of the Odelsthing and President of the Storthing. When Johan Sverdrup became head of the government (1884), Steen was the liberal party's recognized leader. In 1891 he was called upon to form a new ministry, in which he became Minister of State, but the consular question caused its retirement (1893). In 1898 he formed his second ministry, which was succeeded by that of Blehr (1902).

STEENKERKE, stān′kĕr-ke, or **STEENKERKEN**. A village in the Province of Hainault, Belgium, on the Senne, 19 miles southwest of Brussels. It is noted for the disastrous defeat of the Dutch and English troops under William of Orange, who here attacked the French army commanded by Marshal Luxembourg, Aug. 3, 1692.

STEENSTRUP, stān′strup, Johannes Christoffer H. R. (1844–). A Danish historian and literary scholar, born at Sorö, son of J. J. S. Steenstrup. He was educated at Copenhagen University, where he became professor in 1882. His most important works include: *Normannerne* (4 vols., 1876–82); *Danske og Norske Riger paa de britiske Oer i Danevældens Tidsalder* (1879–82); *Vore Folkeviser fra Middelalderen* (1891; Eng. trans. by E. G. Cox, *The Mediæval Popular Ballad*, 1914); *Danmarks Riges Historie* (1896–1907), with Erslev and others. Steenstrup came to be considered the most versatile Danish historian of his time.

STEENSTRUP, Johannes Japetus Smith (1813–97). A Danish scientist, born in Thy and educated in Copenhagen. His *Geognostisk-geologisk Undersögelse af Skovmoserne Vidnesdam og Lillemose* (1841) became the classical work on peat bogs, and his *Om Forplantning gjennem vekslende Generationsrækker i lavere Dyreformer* (1842) established the alternation of generations in the hydroids, especially in trematode worms. Steenstrup was professor of zoölogy at Copenhagen University from 1845 to 1885. He studied the shell mounds discovered by Worsaae, concluded that they dated from the Stone age, and gave to them the name *kjökkenmöddinger*, or kitchen middens (q.v.). No other Danish scientist has had so wide a range—zoölogy, geology, archæology. He was the father of J. C. H. R. Steenstrup.

STEENSTRUP, Knud Johannes Vogelius (1842–1913). A Danish geologist, distinguished especially for his scientific explorations in Greenland. From 1894 he was a member of the Royal Greenland Commission. Between the years 1871 and 1899 he made nine voyages to West Greenland to study the geology of Godthaab, Ivigtut, Uminak, Frederikshaab, etc. Apart from his many valuable memoirs on geological subjects, the most interesting of his publications is a work on the old Scandinavian ruins in the district of Julianehaab (1885). He received many honors from scientific societies.

STEEPLECHASING. Racing over a course selected by reason of the obstacles, such as fences, hedges, hurdles, and ditches. It is popularly supposed to have originated in the hilarious spirit of excited fox hunters, taking a bee line from the point where they were to a distant village church steeple. The Grand National Steeplechase of Liverpool, established in 1839, is the great event of the steeplechase year in England. There are many valuable stakes in America contested during the race meetings.

STEER, Paul Wilson (1869–). An English landscape, figure, and portrait painter. He was born at Birkenhead and studied at the Gloucester School of Art and at the Beaux-Arts under Cabanel, but was most influenced by Manet. His landscapes and figure subjects are treated in an original and spontaneous manner, with fine color harmonies and sunlight effects. Good examples of his work, which is to be found in various public collections in England, Ireland, and Australia, include: "The Golden Valley" (1903); "Richmond Castle, Yorkshire" (1903, Metropolitan Museum, New York); "Chepstow Castle (1905) and "The Music Room" (1906), both in the Tate Gallery, London; "At the Window" (1909); "Corfe Castle," and his own portrait in the Uffizi, Florence.

STEERING. That branch of practical navigation which involves the actual control of the direction of a moving vessel. Steering usually involves the manipulation of the helm, or rudder, tiller, and necessary adjuncts, as described under Helm. In addition the effect of sails, paddle wheels, screws, etc., must be considered, and sea, currents, winds, and other conditions taken into account, these varying from time to time, and different types of vessels requiring different methods. A twin-screw steamer, e.g., will steer differently from one with a single screw, having a greater power of manœuvring. The steering of a vessel depends upon the course followed. Consult Knight, *Modern Seamanship* (3d ed., New York, 1903). See Navigation; Rules of the Road; Sailings.

STEERING ENGINE. See Machinery; Shipbuilding.

STEERSMAN. See Helm.

STEE′VENS, George (1736–1800). An English Shakespeare commentator, born at Poplar. He was educated at Eton and at King's College, Cambridge, but left the university without a degree (1756). Inheriting a small fortune from his father, a director of the East India Company, he was able to give his time to the study of Shakespeare. He reprinted 20 plays from the quartos (4 vols., 1766), edited, with frequent advice from Dr. Johnson, an edition of Shakespeare (1773), which was revised by Isaac Reed (q.v.) (1785), and, in conjunction with Reed, brought out a new edition (15 vols., 1793).

STEEVENS, George Warrington (1869–1900). An English journalist, born at Sydenham and educated at the City of London School and at Balliol College, Oxford. In 1893 he joined the editorial staff of the *Pall Mall Gazette.* In 1897 he became a special correspondent of the *Daily Mail,* visiting in succession the United States, Greece, Egypt, India, Rennes (the scene of the trial of Dreyfus), and South Africa. His letters to the *Daily Mail* were republished under the titles *The Land of the Dollar* (1897), *With the Conquering Turk* (1897), *Egypt in 1898* (1898), *With Kitchener to Khartum* (1898), *In India* (1899), *The Tragedy of Dreyfus* (1899), and *From Cape Town to Ladysmith* (1900). The last volume, left incomplete, was edited by Vernon Blackburn. Before his connection with the *Daily Mail* he had published *Naval Policy* (1896) and the clever *Monologues of the Dead* (1896). He died of enteric fever at Ladysmith, then (1900) besieged by the Boers. He was the most famous war correspondent of his time. Consult the memoir in vol. i (1900) of the *Memorial Edition* of Steevens's writings, edited by Street and Blackburn.

STEFAN-BOLTZMANN (stā′făn-bôlts′män) **LAW.** See Radiation.

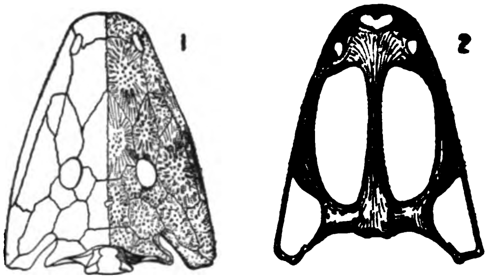
STEFÁNSSON, stā′făns-sôn, Vilhjálmur (1879–). An Arctic explorer of Icelandic descent, born at Gimli, Manitoba, Canada. Educated in the universities of North Dakota and of Iowa (A.B., 1903), he studied anthropology in the graduate school of Harvard University, and for two years was an instructor there. In 1904 and 1905 he made archæological researches in Iceland. He wintered (1906–07) with the Eskimo of Mackenzie Delta, returning alone across country via the Porcupine and Yukon rivers. With Dr. R. M. Anderson he undertook (1908–12), under the auspices of the American Museum of Natural History, New York, the ethnological survey of the Central Arctic coasts of the shores of North America. By journeys of nearly 1000 miles Stefánsson explored the coasts of Coronation Gulf and the adjacent regions, discovering tribes unknown to whites—the so-called blond Eskimo of Victoria Land. For the Government of Canada he took command of an expedition (1913–16) to explore the regions west of Parry Archipelago. His main ship, the *Karluk,* was beset and sank, part of her crew perishing. (See Polar Research.) Absent at the time from the *Karluk,* he resumed his explorations by sledge over the Arctic Ocean, leaving Collinson Point, Alaska, in April, 1914, with a supporting sledge that turned back 75 miles offshore. With two men and six dogs he journeyed over the moving ice pack for 96 days, living largely by his rifle on polar game. Stefánsson located considerable parts of the continental shelf north of Alaska and west of Banks Land. After reaching Banks Land, he subsisted on land game until autumn, when his party reached the *Mary Sachs,* one of his ships which had reached southwestern Banks Land. By a spring sledge journey, in 1915, he discovered new land north of Prince Patrick Island, near the 78th degree of north latitude, and extending west from 116 degrees west longitude. This coast was skirted for about 100 miles, the land being mountainous and rugged, its western terminus not reached. The exploration of the land later occupied Stefánsson's energies. The more important of his writings are: *My Life with the Eskimo* (1912); *Stefánsson-Anderson Expedition, 1909–12, Preliminary Ethnological Report* (Anthropological Papers, American Museum of Natural History, New York, 1914).

STEFFANI, stā-fä′nē, Agostino, Abbate (1655–1730). An Italian composer and statesman, born at Castelfranco, Venetia. He studied music in Venice and under Ercole Bernabei (c.1620–87) in Munich, where he became organist in 1675 and director of the Elector's chamber music in 1681. He took holy orders (1680), was appointed court kapellmeister at Hanover (1688), and brought out his Italian operas with great splendor in the garden of Schloss Herrenhausen. He is remembered for his numerous chamber duets, set to Italian texts, which are models. His compositions are preserved in manuscript in the royal library, London; of the few that appeared in print, may be mentioned: *Psalmodia Vespertina,* for eight voices (1674); *Sonate da camera a due violini, alto e continuo* (1679); *Duetti da camera a soprano e contralto* (1683); and *Janus Quadrifons,* motets with basso continuo for three voices. In 1710 he resigned his post in favor of Handel, and was made Privy Councilor by the Elector Palatine and Bishop in partibus of Spizza, Dalmatia, by the Pope.

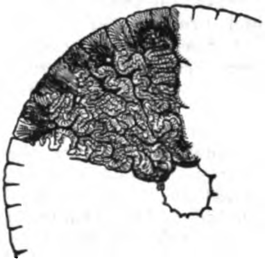
STEFFENS, stĕf′enz, (Joseph) Lincoln (1866–). An American author and editor, born at San Francisco, Cal. He graduated at the University of California in 1889, studied sociology in Germany and France, and was on the staffs of the New York *Evening Post* (1892–98) and the *Commercial Advertiser* (1898–1902). He was managing editor of *McClure's Magazine* in 1902–06, and in 1906–11 was associate editor of the *American* and *Everybody's* magazines. He became widely known for the "muck-raking" type of article, intended as an exposure of corrupt political and economic conditions. His writings include: *The Shame of the Cities* (1904); *The Struggle for Self-Government* (1906); *Upbuilders* (1909); *The Least of These* (1910).

STEGANOPODES, stĕg′ȧ-nŏp′ō-dēz (Neo-Lat. nom. pl., from Gk. *στεγανόπους, steganopous,* web-footed). A group of birds within the Ciconiiformes, characterized by having all four toes "totipalmate," or connected by a common web, also a more or less developed gular pouch. The skull is desmognathous and the wing is aquintocubital. The neck is without apteria; the tongue is rudimentary. The Steganopodes are cosmopolitan, aquatic piscivorous birds of large size. About 60 species are known, of which half are cormorants (q.v.).

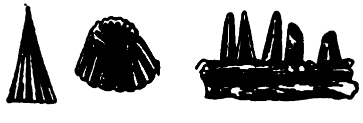
STEG′OCEPHA′LIA (Neo-Lat. nom. pl., from Gk. *στέγειν, stegein,* to cover + *κεφαλή, kephalē,* head). The name proposed by Cope to designate a well-defined order of fossil amphibia, found in strata from the Lower Carboniferous to the Upper Trias. They are distinguished from other amphibians by a dermal armor of overlapping bony scales which usually protects the ventral, and in some cases the dorsal surface. The group is important as representing the earliest and most primitive tetrapoda or four-footed vertebrates adapted to at least partial land-living habits, and breathing by means of lungs. The majority of stegocephalians are salamander-like or lizard-like in form, with a long tail, flattened head, and two pairs of limbs. The presence of gills in the young and grooves for sensory mucous canals on the skull bones of some forms proves an aquatic habit. A carnivorous diet is indicated by the conical pointed teeth.



SKULL OF A STEGOCEPHALIAN.
1, plates of roof of skull (*Capitosaurus*); 2, palatal view (*Cyclotosaurus*).



LABYRINTHODONT TOOTH-STRUCTURE.
Cross section of labyrinthodont tooth, showing the folded structure.



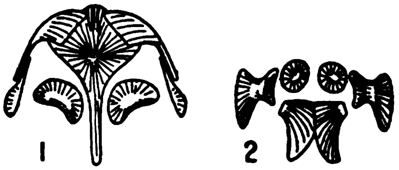
STEGOCEPHALIAN TEETH.

The dermal armor, the most distinctive feature of the group, consists chiefly of bony scales, arranged in regular rows on the ventral surface, but scattered or wanting on other portions of the body. Three large plates, one median and two paired, on the pectoral region, represent the interclavicle and the clavicles. The skull, of flattened triangular form, is characterized by a solid roof of paired plates of dermal bone, and the cranial roof is always pierced by five openings — the paired nares and orbits, and the median opening for the pineal body, which may have served as a light-perceiving organ. The teeth are simple hollow cones in the smaller Paleozoic genera, but in many of the later types the dentine and cement exhibit a system of extremely complicated folds—hence the name Labyrinthodontia often applied to these forms. The vertebral column presents widely divergent conditions in different types, as regards the nature and degree of ossification of the centra. As a rule the Paleozoic genera have the notochord largely persistent, the vertebral column thus remaining permanently in the larval condition, while the large Triassic labyrinthodonts have well-developed centra. The limbs are known for but few forms, and in these they do not differ remarkably from those of modern urodeles. The hind foot is always pentadactyl, but in the forefoot (except in *Keraterpeton*, *Melanerpeton*, and a few related forms) the number is reduced to four, the fifth or outer digit probably being the one lacking. In any attempt to trace the phylogenetic relationships of vertebrate classes the Stegocephalia are of the greatest importance, since it is in this group only, with its solid skull roof, that we find on the one hand a close approximation to the Paleozoic bony fishes, and on the other to the most generalized Permian reptiles, the Cotylosauria. See Reptile.

The classification is as follows: A.—Suborder Leptospondyli. Small animals, usually salamandriform, occurring in the Carboniferous and Permian. The suborder is divided into three families: (1) Branchiosauridæ; (2) Microsauridæ; (3) Aistopodidæ, the serpent-like footless forms. *Dolichosoma*, which attained a length of three feet, and *Ophiderpeton* are the best-known forms.

B.—Suborder Ganocephala or Temnospondyli. The most familiar type is *Archegosaurus decheni* from the Lower Permian of Germany, a species which attained a length of four feet. *Cricotus* and *Eryops*, from the North American Permian, measure 4 to 6 feet.

C.—Suborder Labyrinthodontia or Stereospondyli. The true labyrinthodonts are clearly differentiated by the form of the teeth, which have the dentine infolded in a more or less complicated manner, and by the vertebræ, which are completely ossified, with biconcave centra sometimes perforated for the passage of the constricted notochord. The maximum development of the group is attained in the Trias, chiefly of Europe. The genera *Labyrinthodon*, *Capitosaurus*, *Trematosaurus*, and *Mastodonsaurus*, from the European Trias, are all enormous animals, the last named, with a skull four feet in length, being the largest amphibian known. Consult: Woodward, *Vertebrate Palæontology* (London, 1898); K. A. von Zittel, *Text-book of Palæontology*, Eng. trans. by C. R. Eastman (New York, 1903); H. R. Knipe, *Evolution in the Past* (London, 1912).



LIMB GIRDLES IN STEGOCEPHALIA.
1, pectoral arch; 2, pelvic arch of *Discosaurus*.

STEG′OSAU′RUS (Neo-Lat., from Gk. στέγειν, *stegein*, to cover + σαῦρος, *sauros*, lizard). A Jurassic dinosaur of most peculiar appearance. Fossil skeletons are found in Wyoming and Colorado. It was from 25 to 30 feet long, had a very small head, highly arched back, short fore and long hind legs, and heavy long tail. The great bulk of the hinder part of the body depended for its nervous control upon a ganglion in the neural cavity of the sacrum, and this ganglion was of a size several times greater than the brain in the head, which latter is by comparison very small. Consult C. W. Gilmore, *Osteology of the Armored Dinosauria* (Washington, 1914). See Dinosauria.

STEIER, shtī′ẽr. A town of Upper Austria. See Steyr.

STEIN, stīn, Sir (Mark) Aurel (1862–). A British Orientalist and archæologist, born at Budapest, Hungary. He studied at Vienna and Tübingen, and at Oxford and London. In 1888 he was appointed registrar of the Punjab University and principal of the Oriental College at Lahore, India, and in 1899 principal of the Calcutta Madrasah. In 1900 he was deputed by the Indian government to conduct archæological explorations in Chinese Turkestan. The first results of his discoveries are published in his *Preliminary Report* (1901). On his return from Turkestan he became inspector of education in the Punjab. From 1906 to 1908 he was engaged in archæological explorations in Central Asia and west China, for which he received the Royal Geographical Society's gold medal in 1909. In 1909 he was transferred to the Archæological Department of India. He was created K. C. I. E. in 1912 and received honorary degrees from Oxford and Cambridge. Among the more important of his publications are a critical edition of Kalhana's *Rājataranginī, or Sanskrit Chronicle of the Kings of Kashmir* (Bombay, 1892), together with an English translation and commentary on the same (2 vols., 1900); *The Sand-buried Cities of Khotan* (1903); *Ancient Khotan* (2 vols., 1907), a report of his explorations; *Ruins of Desert Cathay* (2 vols., 1912), a narrative of his expedition.

STEIN, shtīn, Charlotte von (1742–1827). A celebrated court lady to the Duchess Amalia of Saxe-Weimar, wife of the court equerry. She was an intimate friend of Goethe from 1775 to the time of his Italian journey (1786), by which he won emancipation from his love for her. To her he addressed the *Briefe aus der Schweiz* (1779), which are among the classics of travel, and a multitude of love letters, first published in 1848, and best edited in the Weimar edition of his *Works* (1886). Her letters to Goethe are supposed to have been destroyed. After Goethe's union with Christiane Vulpius there was an estrangement between him and Frau von Stein, gradually overcome later on. Consult: Höfer, *Goethe und Charlotte von Stein* (Stuttgart, 1878); Düntzer, *Charlotte von Stein* (ib., 1874); Erich Schmidt, *Charakteristiken*, vol. i (2d ed., Berlin, 1902); W. Bode, *Charlotte von Stein* (ib., 1910).

STEIN, Heinrich Friedrich Karl, Baron vom (1757–1831). A Prussian statesman. He belonged to an old Franconian family, and was born at Nassau. He studied at Göttingen, entered the Prussian civil service, and in 1784 was at the head of the Department of Mines for Westphalia. In 1786 he visited England and made a study of its institutions, utilizing his experiences in his guidance of Prussian affairs. In October, 1804, he entered the Prussian ministry as chief of imposts, manufactures, and commerce. He introduced reforms in his department, particularly by abolishing restrictions on internal trade; but was hampered in his endeavors by the spirit of Prussian conservatism. In 1807 he was dismissed from office by the King for his refusal to accept the post of Minister of Foreign Affairs under the existing system of government, but the Peace of Tilsit opened the eyes of the sovereign to the wisdom of Stein's policy, and he was recalled, with the approbation of Napoleon, who had as yet no idea of the ability and patriotism of the Minister. Seeing that, from a military point of view, Prussia was powerless, he set about developing her internal resources by a series of reforms, the principal of which were the abolition of serfdom, with indemnification to territorial lords; subjection of the nobles to manorial imposts; promotion in the state service by merit alone; and the establishment of a modern municipal system. While he was paving the way for German unity, the Prussian army was being reorganized by Scharnhorst and Gneisenau (qq.v.). As the result of a letter criticizing Napoleon's policy, which came to the knowledge of the French Emperor, Stein was obliged to resign (Nov. 24, 1808), and retired to Austria. In danger of being surrendered by Austria to Napoleon, Stein was summoned in 1812 to Russia by the Emperor Alexander, and counseled as to the coalition of the German states against Napoleon. After the battle of Leipzig, in 1813, Stein became head of the council for the administration of the reconquered German countries, as well as of the territory which France had annexed west of the Rhine. He was a leader in all the military diplomacy of that stirring time up to the congresses of Vienna and Aix-la-Chapelle. After his retirement from political life he devoted himself to the promotion of German science and art and formed the society for the study of early German history whose publications are celebrated as the *Monumenta Germaniæ Historica*. He died at Kappenberg (Westphalia) June 29, 1831. Consult: Seeley, *Life and Times of Stein* (London, 1879); Pertz, *Leben des Freiherrn vom Stein* (1885).

STEIN, Lorenz von (1815–90). A German political scientist, born at Eckernförde, in Schleswig. He studied law and philosophy at Kiel and Jena; became a professor in Kiel in 1846; and from 1855 till 1885 was professor of political science at Vienna. He published important works on economics and theory of government: *Geschichte des französischen Strafrechts* (1846–48); *System der Staatswissenschaft* (1852–56); *Lehrbuch der Volkswirtschaft* (1858; 3d ed., 1887); *Lehrbuch der Finanzwissenschaft* (1860; 5th ed., 1885–86); *Verwaltungslehre* (1865–84); *Die Frau auf dem Gebiet der Nationalökonomie* (1875; 6th ed., 1886).

STEINAMANGER, shtī'nȧ-mäng-ẽr (Hung. *Szombathely*). The capital of the County of Eisenburg (Vas), Hungary, 68 miles south of Pressburg (Map: Hungary, E 3). It has a beautiful modern cathedral, a fine county building, and a theological seminary. Important state railway workshops are located here, two factories for agricultural machinery and steam flour mills. Steinamanger is on the site of the Roman *Sabaria*, and has ruins of a triumphal arch, amphitheatre, and aqueduct in the vicinity, with many remains in the local museum. Pop., 1900, 24,751; 1910, 30,947.

STEINBACH, Erwin von. See Erwin von Steinbach.

STEINBOK, stīn'bŏk (Ger., stone-goat), or **STEINBUCK**, stīn'buk. 1. The European ibex (q.v.). 2. In South Africa, by transference, the Dutch name (also "steenbok") for the small antelopes of the genus *Nanotragus*, specifically the widespread *Nanotragus campestris*, which abounds in open or thinly wooded and hilly places from the Cape to the Zambezi River. It is of an indeterminate reddish hue, about 24 inches tall, long-necked, with short, erect, forward-curving ringed horns, is exceedingly swift and active, and skillful in hiding. Other species of the genus are the oribi, grysbok, and royal antelope (qq.v.), with still others in Zanzibar and Abyssinia. Consult Zoölogical Society of London, *Proceedings* (London, 1900).

STEINDORFF, shtīn'dôrf, George (1861–). A German Egyptologist, born at Dessau. He was educated in the Gymnasium in his native town and later (1881–84) in the universities of Berlin and Göttingen. In 1885 he became an assistant in the Berlin Museum, and five years later was appointed privatdocent in the University of Berlin. In 1893 he was called to Leipzig and in 1904 became regular professor of Egyptology and director of the Egyptian collection. From 1899 to 1912 he was actively engaged in work in Egypt. His publications are numerous. Among them may be cited: *Koptische Grammatik* (2d ed., 1904); *Das Kunstgewerbe in Alten Aegypte* (1898); *Die Blütezeit den Pharaonreichs* (1900); *Das Grab des Ti* (1913).

STEINER, stīn′ẽr, Bernard Christian (1867–). An American librarian and political scientist, born at Guilford, Conn., and graduated from Yale in 1888. From Johns Hopkins he received the Ph.D. degree in 1891. He was appointed librarian of the Enoch Pratt Free Library at Baltimore in 1892; was an associate in history at Johns Hopkins from 1894 to 1911; and later was dean and professor of constitutional and of public law at the Baltimore Law School. Among his publications are: *Education in Connecticut* (1893); *Education in Maryland* (1894); *Citizenship and Suffrage in Maryland* (1895); *Institutions and Civil Government of Maryland* (1899).

STEINER, shtīn′ẽr, Jakob (1796–1863). A Swiss mathematician, born at Utzenstorf, near Solothurn. He studied at Heidelberg, gave private instruction in Berlin, and in 1834 was made assistant professor in the university and member of the Academy of Sciences. Steiner's chief work is the *Systematische Entwicklung der Abhängigkeit geometrischer Gestalten* (1832; in the Ostwald Classics, 1896). He also wrote *Die geometrischen Konstruktionen ausgeführt mittels der geraden Linie und eines festen Kreises* (1833; in the Ostwald Classics, 1895). His *Vorlesungen über synthetische Geometrie* (3d ed., 1887) and his *Gesammelte Werke* (1881–82) appeared posthumously. Consult Graf, *Der Mathematiker Jakob Steiner von Utzenstorf* (Bern, 1897).

STEINHAUER, stīn′hou-ẽr, Henry Bird (1804–85). A Canadian clergyman and missionary. He was born, of full-blooded Chippewa Indian parents, in the Ramah Indian settlement at Lake Simcoe, Ontario, and was named for a member of a German family who adopted and educated him. About 1840 he went to the Canadian Northwest with Rev. James Evans, a Methodist missionary, and settled at Norway House, where he remained for 15 years as an interpreter and assisting Evans in his invention of the Cree syllabic characters. He was ordained a Methodist minister in 1858, when he removed to Whitefish Lake and established the Methodist mission there. He translated almost the whole of the Old Testament, and the greater part of the New Testament, into the Cree language.

STEINHEIL, shtīn′hīl, Karl August (1801–70). A German physicist and astronomer, born at Rappoltsweiler, Alsace. He studied law at the University of Erlangen, and astronomy at Göttingen and Königsberg. He became professor of physics and mathematics in the University of Munich; later entered the Austrian government service, organized and perfected the telegraph system in that country, and brought about the Austrian-German Telegraph Association; performed a similar service for Switzerland; and in 1852 returned to Munich. In 1854 he founded an establishment for making superior optical and astronomical instruments, where the great telescopes of the observatories of Upsala, Mannheim, Leipzig, Utrecht, etc., were made, and where he began the making of the photograph objectives since known by his name.

Steinheil devised an electromagnetic telegraph, in 1836 constructed the first printing telegraph, and in 1838 discovered the possibility of leading back the current through the ground. He invented the electrical clock, constructed an excellent pyroscope, and made the first daguerreotype picture in Germany. He also established the laws of electrotypy, and constructed several optical instruments. Consult Marggraff, *Karl August Steinheil und sein Wirken* (Munich, 1888).

STEINHEIL, Marguerite (1869–). A French woman, the protagonist in a bewildering *cause célèbre*. Of a family of rich manufacturers of Beaucourt, she married the artist, Adolphe Steinheil; went with him to Paris; made a place for herself in the society of the French capital; and drew about her distinguished people in the worlds of art, letters, and politics. Her own circumstantial accounts of her intimacy with President Faure have not been generally regarded as above suspicion. She was, however, connected, at least by gossip, with the mystery attending the President's sudden death. Subsequently she became the centre of a ghastly tragedy—the murder of her husband and her mother, Mme. Japy, on the night of May 30–31, 1908. She was accused of the crime but, after a dramatic trial, was acquitted. To her friends she was the "Tragic Widow," the scapegoat of a situation involving political complications in which people of high position at home and exalted personages abroad were scandalously entangled. To her enemies she was an audacious and wanton adventuress, the "Black Panther" of a hostile press. After her acquittal, Mme. Steinheil lived quietly in England, where she wrote *My Memoirs* (New York, 1912), a book of varied and extraordinary interest, at once autobiography and *apologia*. Despite the trial and the *Memoirs*, the reason for the perpetration of the crime of which she was accused, and the identity of the perpetrators of it remained a mystery.

STEINITZ, shtīn′ĭts, Wilhelm (1836–1900). A German chess master, born in Prague, Bohemia, and educated at the Vienna Institute of Technology. In 1866 he defeated Anderssen in a contest for the world's championship. At the London tournament of 1872 he won every game, and in 1873, at Vienna, he secured the Kaiserpreis of 2000 florins. After defeating Blackburne in England, he withdrew from active tournament play, but the increasing success of Zukertort, whom he had defeated in 1872, forced him back into the field. At a tournament in London (1883) Zukertort defeated him for first place, but at a second match in 1886 Steinitz won from his great rival with 10 to 5 games won and 5 drawn. He defended his title in 1889 at Havana against Tchigorin, but lost the championship in 1894 to Lasker, who again defeated him in 1897. Steinitz was the first to see the value of a steady development of position with an accumulation of minute advantages over the more dashing and open game. After 1883 he lived in the United States, and (1885–91) was editor of the *International Chess Magazine*. He published *Book of the Sixth Chess Congress of 1889* and *The Modern Chess Instructor* (1889).

STEINLE, shtīn′le, Eduard von (1810–86). A German historical painter. He was born in Vienna, the son of an engraver, and studied there at the academy and under Kupelwieser. From 1828 to 1834 he worked in Rome under the influence of Veit and Overbeck. Having been commissioned to decorate the castle chapel at Rheineck he settled at Frankfort in 1843, and in 1850 was appointed professor at the Städel Institute. Steinle's religious paintings are executed in the manner of the Nazarenes (see Pre-Raphaelites) and, while distinguished by finished grace and beauty of line, contain nothing original. The most important are the frescoes in the cathedral at Cologne (1843–46); in St. Mary's at Aix-la-Chapelle, in St. Ægidius at Münster, in Strassburg Cathedral (1877–80), and in Frankfort Cathedral, where he designed and in part executed the entire decoration (1880–85). He also painted many religious canvases, particularly Madonnas. But Steinle is most attractive in his paintings inspired by fairy tales and other imaginative subjects, in which he reveals a refined sense of color and much poetic fancy; such as "The Warder" (1858) and "Loreley" (both in the Schack Gallery, Munich). Notable also are his cycles in water colors and sepia, such as the "Legend of St. Euphrosyne," Brentano's "Fairy Tale of the Rhine" and "Parsifal" (Pinakothek, Munich). Consult: Steinle's *Briefwechsel* (Freiburg, 1897) and Steinle's *Gesammt Werk* (Munich, 1910), both edited by A. M. von Steinle; also the monographs by Wurzbach (Vienna, 1879), Valentin (Leipzig, 1887), and Popp (Mainz, 1906).

STEINLEN, stăN′lăN′, Théophile Alexandre (1859–). A French draftsman, illustrator, lithographer, and painter. He was born in Lausanne, Switzerland, and was mainly self-taught. About 1872 he went to Paris, and first made a name with his humorous and original drawings for the *Chat Noir,* and other periodicals. He also became widely known as one of the creators and greatest masters of poster design, cats being his favorite subject. Famous examples of his posters are "Pure Sterilized Milk of the Vingeanne"; "Exposition at the Bodinière"; and "Yvette Guilbert." A more sombre side of his art found expression in admirable lithographs, many of which appeared in the anarchist journal *La Feuille,* in etchings, dry points, and sketches of Parisian life of the lower classes, and in his illustrations for Anatole France's *Crainquebille,* Jean Richepin's *Chanson des gueux* (1910), Descarve's *Barabbas* (1913), and other works. In all of these Steinlen reveals himself as a personality of great social as well as artistic significance. He is a master of rapid methods of expression and a draftsman of great suppleness and remarkable accuracy. Consult the complete illustrated catalogue of his works by Crauzat (Paris, 1913), and *Steinlen and his Art* (London, 1911).

STEINMANN, shtīn′män, Gustav (1856–). A German geologist and paleontologist. He was born at Brunswick, and was educated there and at Munich. In 1877 he became an assistant at the Geological-Paleontological Institute of Strassburg, where he was privatdocent in 1880–85. He served as professor at Jena in 1885–86 and at Freiberg from 1886 to 1906, and thenceforth was professor and director of the Geological-Paleontological Institute at Bonn. He made three great journeys of investigation to South America in 1882–84, in 1903–04, and in 1908, besides his travels in Europe. In addition to contributions to scientific publications, Steinmann wrote: *Elemente der Paläontologie* (1890), with L. Döderlein; *Geologischer Führer der Umgebung von Freiberg* (1890), with F. Gräff; *Paläontologie und Abstammungslehre am Ende des 19. Jahrhunderts* (1899); *Ueber die Ausbildung der naturwissenschaftlichen Lehrer an den Mittelschulen* (1899); *Einführung in die Paläontologie* (1903; 2d ed., 1907); *Die geologischen Grundlagen der Abstammungslehre* (1908).

STEINMETZ, stīn′mĕts, Charles Proteus (1865–). An American electrical engineer. He was born at Breslau, Germany, where he was educated, studying also at Zurich, Switzerland, in 1888–89. In 1893 he became consulting engineer for the General Electric Company, and after 1902 was also professor of electrical engineering at Union University. He served as president of the American Institute of Electrical Engineers in 1901–02. A Socialist, in 1915 he was chosen president of the Schenectady Common Council. Steinmetz published: *Theory and Calculation of Alternating Current Phenomena* (1897; 4th ed., 1908); *Theoretical Elements of Electrical Engineering* (1901; 4th ed., 1915); *Theory and Calculation of Transient Electric Phenomena and Oscillations* (1909; 2d ed., 1911); *General Lectures on Electrical Engineering* (1908; 4th ed., 1910); *Radiation, Light, and Illumination* (1909; 2d ed., 1911); *Electric Discharges, Waves, and Impulses* (1911); *Engineering Mathematics* (1911; 2d ed., 1915).

STEINMETZ, shtīn′mĕts, Karl Friedrich von (1796–1877). A Prussian field marshal, born at Eisenach. He fought in the wars against Napoleon, and against Denmark in 1848; became lieutenant general in 1858, and in the campaign against Austria of 1866 won great distinction as commander in chief of the Fifth Army Corps, by his victories at Nachod, Skalitz, and Schweinschädel. At the beginning of the Franco-German War he was made commander in chief of the First Army. Owing to self-confidence, he engaged in disputes with other commanders and the general staff. At Gravelotte (q.v.), he was deprived of his command because he almost caused a disaster by refusing to clear the way for Prince Frederick Charles, who he thought was trying to gain fame and glory at his expense. In September, 1870, Steinmetz was appointed Governor-General of Posen and Silesia, and in April, 1871, he was made general field marshal.

STEINSCHNEIDER, shtīn′shnī′dĕr, Moritz (1816–1907). A German bibliographer and Orientalist, born at Prossnitz, Moravia. He studied at Prague, Vienna, Leipzig, and Berlin, and taught at Prague and after 1845 at Berlin, where from 1869 to 1890 he was principal of the school for Jewish girls. The most important of his publications are *Catalogus Librorum Hebræorum in Bibliotheca Bodleiana* (1852–60), *Catalogus Codicum Hebræorum Bibliothecæ Academiæ Lugduno-Batavæ* (1858), and lists of the Hebrew manuscripts in the Royal Library of Munich (1875; 2d ed., 1895); in the Hamburg Library (1878); and in the Berlin Royal Library (1878–97). He wrote *Hebräische Uebersetzungen des Mittelalters* (1859–64, 69–81); an article in Ersch and Gruber's *Encyklopädie,* translated by Spottiswoode as *Jewish Literature from the Eighth to the Eighteenth Centuries* (1857); *Arabische Uebersetzungen aus*

dem Griechischen (1891–96); *Die arabische Litteratur der Juden* (1902); *Europäische Uebersetzungen aus dem Arabischen bis Mitte des siebzehnten Jahrhunderts* (1905); *Geschichtsliteratur der Juden in Druckwerken und Handschriften*, part i (1905). Consult the *Festschrift zum 80. Geburtstage M. Steinschneiders* (Leipzig, 1896).

STEINTHAL, shtīn'täl, HEYMANN (1823–99). A German philosopher and philologist, born at Gröbzig, in Anhalt, and educated at Berlin, where he became privatdocent in 1850 and assistant professor in 1863. After 1872 he lectured on the philosophy and history of religion at the school of Judaism in Berlin. He was an admirer of Wilhelm von Humboldt (q.v.), on whose methods he wrote a number of works. With Lazarus he edited from 1860 to 1890 the *Zeitschrift für Völker-Psychologie und Sprachwissenschaft*, and his works include: *Der Ursprung der Sprache* (1851; 4th ed., 1888); *Die Entwickelung der Schrift* (1852); *Geschichte der Sprachwissenschaft bei den Griechen und Römern* (1863; 2d ed., 2 vols., 1889–91); *Die Mande-Negersprachen, psychologisch und phonetisch betrachtet* (1867); *Abriss der Sprachwissenschaft* (1871; 2d ed., 2 vols., 1881–93); *Allegemeine Ethik* (1885); *Zu Bibel und Religions-Philosophie* (1890–95). In 1906 a volume of posthumous essays, entitled *Ueber Juden und Judentum*, was edited and published by Karpeles. Consult Achelis, *Heymann Steinthal* (Hamburg, 1898), and the memorial article by his widow, "Wie Steinthal und Lazarus Brüder werden," in the *Jahrbuch für jüdische Geschichte und Literatur* (1900).

STEINWAY, stīn'wâ, HEINRICH ENGELHARD (1797–1871). A German-American piano manufacturer, originally named Steinweg, born at Wolfshagen, Harz Mountains. He began to manufacture guitars and zithers in Brunswick, and finally undertook the making of pianofortes. In 1850 he went to New York City with his four sons—Charles, Henry, William, and Albert—leaving the German business to his oldest son, Theodor. In 1853 they established the firm of Steinway & Sons. See PIANOFORTE.

STEINWICK. See STEENWIJCK.

STEJNEGER, stī'ne-gēr, LEONHARD (1851–). An American naturalist. He was born in Bergen, Norway, and graduated at the University of Christiania in 1871. Ten years later he came to America. In 1889 he became curator of reptiles at the United States National Museum in Washington and in 1911 head curator of biology. He prepared the greater part of the fourth volume of the *Standard Natural History, Birds* (1885); *Poisonous Snakes of North America* (1893); *Report of the Rookeries of the Commander Islands* (1897); *The Asiatic Fur Seal Islands and Fur Seal Industry* (1898); *The Herpetology of Porto Rico* (1904); *The Herpetology of Japan* (1907); *The Origin of the So-called Atlantic Animals and Plants of Western Norway* (1907).

STE'LE (Neo-Lat., from Lat. *stela*, from Gk. *στήλη*, *stēlē*, post). In vascular plants the central cylinder of the stem or root in which the vascular cylinder appears. It is invested by the cortex.

STEL'LA. 1. The name applied by Sir Philip Sidney in his sonnets, entitled *Astrophel and Stella*, to Penelope Devereux, Lady Rich. 2. The name given by Jonathan Swift (q.v.) to Esther Johnson.

STELLARTON, stĕl'är-ton. A town in Pictou County, Nova Scotia, Canada, on East River, and on the Intercolonial Railway, 2 miles from New Glasgow (Map: Nova Scotia, H 5). It is the centre of a coal-mining and industrial district. Pop., 1901, 2335; 1911, 3910.

STELLENBOSCH, stĕl'len-bōs. A town of the Cape Province, South Africa, 31 miles by rail east of Cape Town (Map: Cape of Good Hope, D 9). After Cape Town it is the oldest settlement of the colony, having been founded by Huguenot refugees about 1681. It is the headquarters of the Dutch Reformed church in South Africa and possesses its theological seminary. Victoria College is the nucleus of a South African Dutch university, and the town also contains a school of mines, an agricultural college, a school of music, and other educational institutions. Pop., 1911, 10,764 (5346 whites).

STEL'LITE. See COBALT.

STELVIO (stĕl'vē-ō) **PASS** (Ger. *Stilfser Joch*). A lofty Alpine pass leading across the Ortler group of Tyrolese Alps on the boundary between Tirol and Italy, 68 miles southwest of Innsbruck (Map: Italy, C 1). The carriage road passing through it is the highest in Europe, being 9055 feet above the level of the sea. It forms part of the great road extending between Milan and Innsbruck, and was completed by the Austrian government in 1820–24, at an expense of $1,500,000.

STELZLE, stĕlts'le, CHARLES (1869–). An American Presbyterian minister and sociologist, born in New York City. He worked as a machinist and studied industrial problems in 1885–94, and held pastorates in Minneapolis and New York until 1903. He was then for 10 years superintendent of the department of church and labor of the Presbyterian church and also of the department of immigration in 1908–10. In 1910 he organized the Labor Temple, New York, of which he was superintendent until 1912. In 1915 he became connected with the National Anti-Saloon League. Stelzle with J. E. McAfee (q.v.) and others were leaders in the attempt to bring about readjustments in the church to meet modern economic conditions. His writings include: *The Workingman and Social Problems* (1903); *Christianity's Storm Centre, a Study of the Modern City* (2d ed., 1907); *Principles of Successful Church Advertising* (1908); *The Church and Labor* (1910); *American Social and Religious Conditions* (1912); *The Call of the New Day to the Old Church* (1915).

STEM (AS. *stemn*, OHG. *stam*, Ger. *Stamm*, stem; connected with OIr. *tamon*, stem, and ultimately with Eng. *stand*). In general, stems of plants are axes distinguished from roots by bearing leaves or leaflike organs. Although there are stemlike structures among the thallophytes and bryophytes, it is only among vascular plants (pteridophytes and spermatophytes) that real stems appear.

Stems may be variously classified. By duration, they are annual or perennial; by structure, herbaceous or woody; by direction, erect, decumbent, prostrate, climbing, etc. Perhaps one of the most important classifications is upon the basis of character of foliage organs produced, as follows: *Foliage-bearing stems*, which generally give style to the whole plant body, are the most conspicuous, since they display green leaves, and are necessarily aërial. As a consequence, they are inclined to branch, and the leaf-bearing joints are well separated. *Scale-bearing stems*,

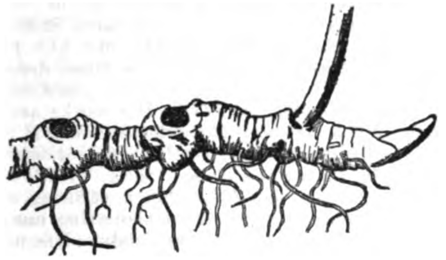


FIG. 1. UNDERGROUND STEM OF SOLOMON'S SEAL.

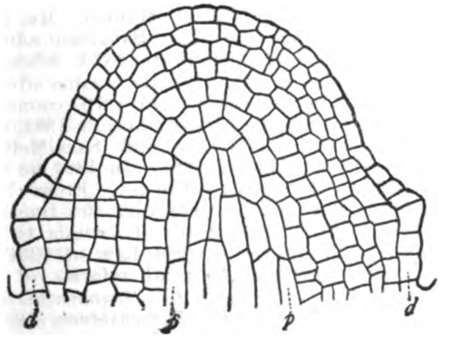


FIG. 2. LONGITUDINAL SECTION THROUGH APEX OF STEM. Showing dermatogen (*d*), plerome (*p*), and between them the periblem.

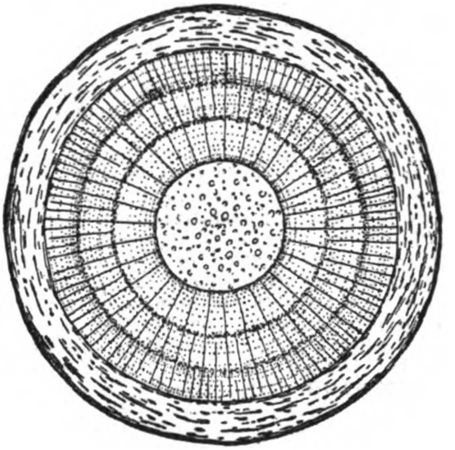


FIG. 3. CROSS SECTION OF A DICOTYLEDONOUS STEM. Showing pith, three growth rings, and cortex.

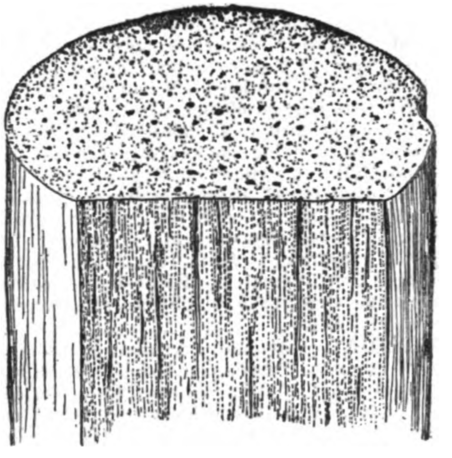


FIG. 4. CROSS AND LONGITUDINAL SECTION OF CORN STEM. Showing the monocotyledonous structure.

which bear the comparatively small and colorless (not green) leaflike bodies (scales), may be subterranean or aërial, and the joints may be so near together that the scales overlap, as in the aërial scale bud of shrubs and trees, or the subterranean budlike structures called bulbs, whose scales and stem become gorged with reserve food. Other prominent subterranean types are tubers (potato), comparatively short, thick stems, with much reduced and not overlapping scales, and the more slender rootstocks and rhizomes (Fig. 1). *Stems bearing flower parts* are very much modified, and constitute the so-called flowers of angiosperms (q.v.). The most essential classification of stems is on the basis of their anatomical structure (see below). (For structural details of stems, see HISTOLOGY; MORPHOLOGY OF PLANTS.) Certain broad outlines must be presented here as a basis of the most fundamental classification. At the tip of the stem there is a single apical cell (some pteridophytes) or a group of apical cells, which by their power of continuous division increase the stem in length and give rise to all the tissues. Just behind this growing tip the three great regions begin to be defined (Fig. 2). On the outside is a layer of cells (dermatogen) that gives rise to the epidermis. In perennial stems that increase in diameter the epidermis is sloughed off on the older parts, and the region beneath develops a cork tissue of greater or less thickness, which constitutes the bulk of the bark (q.v.). Within the dermatogen is a zone consisting of several layers of cells (periblem) that gives rise to the cortex. Within the periblem is a central solid cylinder of cells (plerome) that gives rise to the stele, characterized by developing the vascular or woody bundles. The arrangement and character of the woody bundles developed in the stele determine the three general and most fundamental types of vascular stems. In the dicotyledon and conifer types (Fig. 3) the woody bundles are arranged in a hollow cylinder surrounding a central pith. Around the woody tissue of perennial stems there is developed a layer of actively dividing cells, the cambium, that adds a new outer zone of woody tissue each growing season, in cross section giving the appearance of concentric annual rings. This power of increasing in diameter is one of the prominent features of these stems. In the monocotyledon type (Fig. 4) the woody bundles are scattered irregularly through the stele, as in the cornstalk and palm, so that there is no defined central pith region. Such stems show no annual increase in diameter. In the pteridophyte type usually a single large woody bundle of peculiar structure appears in the stele, in such a way that there can be no annual increase in diameter.

The primary function of the stem is to develop foliage leaves and display them to the air and sunlight, and also to act as a great conducting region between the root system and the leaves. (See CONDUCTION.) Subsidiary functions are vegetative propagation (as in horizontal ground stems); the storage of foods (as in bulbs and tubers); and the manufacture of foods, as in leafless stems, such as *Equisetum* and the cacti.

Among the external factors which influence stem development, light and moisture are perhaps most important. In general, light is thought to retard stem development, as seen when stems grown in full light are compared with those grown in weak light and in the case of tubers. In some cases, however, as in the cacti, light has been found to favor stem development. Experiments seem to show that much of the so-called influence of light is due to a moisture influence.

STEM GIRDLER. A horn-tail fly (*Phylloeous flaviventris*) which with its ovipositor girdles the twigs of currant bushes and deposits an egg below the cut. The resulting larva bores downward into the pith, which it devours, with the adjacent woody portion of the stem. In the autumn it spins its cocoon in the burrow, transforms to a pupa in the following spring, and shortly after emerges. An allied species (*Phylloeous integer*) works similarly in willows. See Willow Insects.

STEMMING. The material employed for confining a charge of explosive in a bore hole. The process or operation of forcing the stemming into place and compacting it is styled tamping or ramming. In guns, wads are used as stemming. In blasting various plastic or pulverulent materials, which, being mobile, can by tamping be forced to take the form of the bore hole, are used. It is important, and in coal and bitumen mining essential, that no combustible material such as coal dust shall be used as stemming. The most satisfactory of all materials for this purpose is moist fire clay. Properly tamped stemming, by enabling an explosive to develop its maximum energy under the conditions of its explosion, promotes safety and economy in mining and quarrying. Recent precise investigations show that the use of the most efficient stemming materials may increase the useful energy of a shot in blasting 93 per cent, while the use of the least efficient material may increase that energy 60 per cent. This increase is the more certain if a "Renfort" or "Booster" be employed in firing the charge. Consult Munroe and Hall, "A Primer on Explosives for Coal Miners," *Bulletin 17, Bureau of Mines* (Washington, 1911); Snelling and Hall, "The Effect of Stemming on the Efficiency of Explosives," *Tech. Paper 17, Bureau of Mines* (ib., 1912); Munroe and Hall, "A Primer on Explosives for Metal Miners and Quarrymen," *Bulletin 80, Bureau of Mines* (ib., 1915).

STENDAL, shtĕn′däl. A town in the Province of Saxony, Prussia, on the Uchte, 36 miles north-northeast of Magdeburg (Map: Germany, D 2). It has a fifteenth-century late Gothic cathedral restored in 1893. There are railway repair shops, and factories for iron furniture, cloth, gilt cornices, agricultural implements, and sugar. Stendal, founded in the twelfth century, was the capital of the Altmark of Brandenburg. Pop., 1900, 22,081; 1910, 27,263.

STENDHAL, stäɴ′dȧl′. The name assumed by Marie Henri Beyle (1783–1842), a French novelist remarkable for keen analysis of character. Though never popular, Stendhal has been much read and admired by Flaubert and the Naturalistic school, and by the later psychologic novelist Bourget. Stendhal was born at Grenoble. At seventeen he entered the service of Bonaparte. After Napoleon's downfall he resided in Italy. In 1821 he was expelled by the Austrians and returned to Paris. In 1831 he became French Consul General at Civitavecchia. In the age of Chateaubriand Stendhal sympathized with Voltaire. In the day of the Romantic carnival he was practicing the restless dissection of character that marks the work of Taine and Bourget. Hardly one of his books could have paid the expense of printing, and of his now admired essay on love (*De l'amour*) it is said that 17 copies were sold in 11 years. Nisard, literary historian of his time, does not name him. To-day he takes his place among the "great French writers." His works are collected in 24 volumes (five posthumous). They begin with a book of Italian travel and an essay *De la peinture en Italie* (1817); *De l'amour* follows in 1822, with a striking essay on *Racine et Shakespeare*, participating much in the contention of the Romanticists. His novels were *Armance* (1827), *Le rouge et le noir* (1831), *La chartreuse de Parme* (1839). Here he analyzes the forms of restlessness into which the fall of Napoleon had thrown a generation trained to a life filled with emotion. The novels are realistic studies of social types, but types of energy and passion. His great creation is Julien Sorel, the criminal hero of *Le rouge et le noir*, whose career, founded on fact, is a breviary of hypocrisy, though the Fabrice of *La chartreuse de Parme* is hardly inferior. Skillful in the dissection of motive, Stendhal's novels are inferior in style to his posthumously published *Vie de Napoléon* (1876).

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STENGEL, shtĕng′el, Hermann G. L., Baron von (1837–). A German statesman, born at Speyer and educated at Munich. He held various minor offices in the Bavarian administrative service from 1862 to 1876, when he became Minister of Finance. He became adviser to the Auditing Department in 1879, councilor to the Bavarian Minister of Finance in 1881, and plenipotentiary of Bavaria and Saxe-Meiningen to the Bundesrat in 1884. In 1894 he was promoted to Ministerial-Director. From 1903 to 1908 Stengel was Secretary of the Imperial Treasury and plenipotentiary of Prussia to the Bundesrat. With the Stengel Law of 1904 he began the important financial reforms of his administration. He wrote *Die Grundentlastung in Bayern* (1872) and *Die Börsensteuer* (1881).

STENHAMMAR, stän′hȧm-mȧr, Wilhelm (1871–). A Swedish composer and pianist, born at Stockholm. At the conservatory of his native city he studied under Andersson and Sjögren, and then went to Berlin for further study under H. Barth (1892–93). In 1898 he became conductor of the Philharmonic Society of Stockholm, and two years later second conductor of the Royal Opera. He grew to be one of the most prominent of modern Swedish masters, distinguished for vigor of thematic invention and masterly employment of folk melodies. His works include the operas *Tirfing* (1898) and *Das Fest auf Solhaug* (1899), the choral works with orchestra *Prinsessan och Svennen* and *Snöfried;* an overture, *Excelsior;* a Symphony in F; a concerto for piano in B flat minor; string quartets; piano pieces; songs.

STEN'NIS, The Standing Stones of. A name applied to two circles of stone pillars on two headlands in the Loch of Stennis, Scotland.

STENO, stā'nō, Nicholas. See Stensen, Niels.

STEN'OCAR'DIA. See Angina Pectoris.

STENOGRAPHY. See Shorthand.

STENOTYPE. See Shorthand.

STENSEN, stăn'sĕn, Niels, or (Latinized) Steno, Nicholas (1638–86). A Danish anatomist, physiologist, and geologist; also a bishop. He was born and educated as a Protestant at Copenhagen, but in 1667 accepted Roman Catholicism. In 1660–63 he lived at Amsterdam and Leyden, in 1666 became head of a hospital in Florence and physician to the Grand Duke of Tuscany, and the year 1669 he spent in Paris. From 1672 to 1674 he was again in Copenhagen. In anatomy he discovered the excretory duct (Steno's duct) of the parotid gland (1661) and the muscular nature of the heart; in physiology he criticized the errors of his contemporaries, especially the theories of Thomas Willis (q.v.); further, he emphasized the mechanical nature of the muscles; in geology he wrote on geological formations and on fossils. In 1675 he became a priest and gave up his scientific studies. After 1677, as vicar apostolic, he labored zealously among the northern missions. Among his theological works was *Prüfung der Reformatoren* (1678). Consult his *Life* by Plenkers (Freiburg, 1844) and *Jörgensen* (Copenhagen, 1884).

STENTOR (Lat., from Gk. Στέντωρ). In Homer's *Iliad*, a Grecian herald in the Trojan War. His voice was as loud as that of fifty other men together. His name is preserved in the adjective "stentorian."

STENTOR. A species of monkey. See Howler.

STENZLER, stĕnts'lĕr, Adolf Friedrich (1807–87). A German Orientalist, born at Wolgast and educated at Greifswald, Berlin, Paris, and London. In 1833 he became professor at Breslau, where also until 1872 he was assistant librarian. He edited, with Latin versions, the *Raghuvamça* (1832) and the *Kumâra Sambhava* (1838) of Kalidasa; with German translations, Yâjnavalkya's *Book of Laws* (1849) and *Indische Hausregeln* (4 vols., 1864–78; containing the *Açvalâyana* and the *Pâraskara*); as well as a useful *Elementarbuch der Sanskritsprache* (1868; 7th ed. by Pischel, 1902).

STEPHAN, shtĕ'făn, Heinrich von (1831–97). A German administrator. He was born at Stolp in Pomerania, entered the Prussian postal service in 1848, and was rapidly promoted until in 1875 he became Postmaster-General of the German Empire, having under his control the telegraph lines as well as the mails. In 1877 he assumed charge of the national printing offices. He introduced many internal reforms, invented the postal card, and brought about the formation of the Postal Union. He published *Geschichte der preussischen Post* (1859) and *Das heutige Aegypten* (1872).

STEPHANITE, stĕf'an-īt (named in honor of Archduke Stephan). A mineral silver sulphantimonite which crystallizes in the orthorhombic system. It has a metallic lustre and is iron black in color. It occurs in veins with other silver ores, especially in Freiberg, Bohemia, in Hungary, Mexico, Peru, and in the United States at the Comstock lode in Nevada and at various localities in Idaho.

STEPH'ANUS, or **ÉTIENNE,** â'tyĕn'. A famous French family of printers and scholars.—Henricus (c.1460–1520), the founder of the establishment with which the family is identified, set up a press in Paris in 1501. His publications, about 120 in number, of which only one was in French, were mostly scientific.—His second son, Robertus (1503–59), had a good classical training and on his father's death carried on the business. In 1531 his *Thesaurus Linguæ Latinæ* began to appear, and in 1539 he was appointed royal printer to Francis I. In 1551, after the King's death, he was forced to leave Paris for Geneva, where in the same year he published the Greek New Testament, with his verse divisions, which are still in use. His various editions of the Bible, in Hebrew, Greek, Latin, and French, several works of the Genevan reformers, a *Dictionnaire français-latin* (1539–40 and 1549), French and Latin grammars, and a work on pedagogy, the first book from his press (1526), are the more important titles in a list of nearly 400, all of which are marked by wonderful typographical clearness and accuracy.—His son Henricus the Younger (1528–98), after three years in his father's establishment in Geneva, in 1554 became independent. From his extensive travels he brought back valuable collections of classical manuscripts. But his scholarly enthusiasm in launching the editions of Plato (1578), and the *Thesaurus Linguæ Græcæ* (1572), which were so long the source of all Greek lexicons, outran his business prudence. The great printing house was nearly ruined, and his later works were printed by others. Thirty first editions of Greek authors constitute a claim to renown second only to that won by the *Thesaurus.*—His son Paulus (1566–c.1627) succeeded him, edited Euripides (1602) and Sophocles (1603), and in 1602, implicated in the Escalade (see Geneva), had to leave Geneva.—His eldest son, Antonius (1592–1674), momentarily renewed the glories of the house of Paris, but eventually died in the Hôtel Dieu, old, blind, and poor. Consult Renouard, *Annales de l'imprimerie des Etienne* (2d ed., Paris, 1843), and Feugère, *Essai sur la vie et les œuvres de Henri Etienne* (ib., 1853). For Robert's work in connection with the Greek New Testament consult Scrivener, *Introduction to the Textual Criticism of the New Testament* (3d ed., London, 1883).

STEPHEN, stē'ven. The first Christian martyr. He was chosen first among the seven deacons whose selection is related in Acts vi, and the account of his martyrdom is in the following chapter. His execution does not seem to have had the sanction of the Roman authorities and therefore was illegal. The authenticity of the speech in chapter vii has been questioned, but, on the whole, there does not seem to be valid reason for doubting that the account is trustworthy. St. Stephen's Festival is celebrated in the Roman Catholic and Anglican churches on December 26. His relics were believed to have been discovered at Jerusalem in 415, and a minor festival on August 3 commemorates this event. Consult the commentaries on Acts vi and vii; also A. C. McGiffert, *The Apostolic Age* (New York, 1897); and for the discovery of the relics, Lagrange, *Saint Etienne et son sanctuaire à Jérusalem* (Paris, 1894).

STEPHEN. The name of nine popes. Some lists of popes enumerate 10 Stephens. The confusion arises from the fact that another of the name was elected immediately before Stephen II, but died four days after, before he had received episcopal consecration, and is therefore not properly called Pope.—Stephen I, Saint, Pope 254–257. The chief interest of his pontificate lies in the controversy over the validity of baptism by heretics, in which Stephen declared, in opposition to Cyprianus (q.v.), that baptism, no matter by whom administered, was valid if the proper matter and form were employed. (See Heretic Baptism.)—Stephen II, Pope 752–757. During his pontificate occurred the Donation of Pepin (q.v.). Consult Schnüren, *Die Entstehung des Kirchenstaates* (Cologne, 1894), and L. M. O. Duchesne, *The Beginning of the Temporal Sovereignty of the Popes* (London, 1908).—Stephen III, Pope 768–772, a Sicilian by birth. He held a synod at the Lateran in 769, supported by the sons of Pepin, at which an attempt was made to exclude secular influence in papal elections, and a decree passed against the Eastern Iconoclasts.—Stephen IV, Pope 816–817. He was closely allied with the Emperor Louis the Pious, whom he crowned at Rheims.—Stephen V, Pope 885–891.—Stephen VI, Pope 896–897. The most striking event of his pontificate is characteristic of the darkness of the times. Urged on by the faction to whom he owed his elevation, Stephen had the body of his predecessor Formosus disinterred, and after the formality of a trial and condemnation stripped of its sacerdotal robes and thrown into the Tiber. Stephen himself was soon imprisoned by a popular uprising and died in prison. Consult H. K. Mann, *Lives of the Popes*, vol. iv (London, 1910).—Stephen VII, Pope 929–931, during the period when Theodora and Marozia held sway in Rome.—Stephen VIII, Pope 939–942, while Marozia's son Alberic II held the temporal power and restricted the Pope to purely spiritual functions. He was able, however, by threats of excommunication to reduce to obedience the rebellious vassals of Louis IV of France.—Stephen IX, Pope 1057–58, Frederick by baptism, son of Gozelon, Duke of Lorraine. He was made a cardinal and chancellor of the Roman church by his cousin, Leo IX. As Pope he followed his German predecessors in zeal for reform, but died in less than a year. Consult Will, *Die Anfänge der Restauration der Kirche im 11. Jahrhundert* (Marburg, 1864), and H. K. Mann, *Lives of the Popes*, vol. vi (London, 1910).

STEPHEN (c.1097–1154). King of England from 1135 to 1154. He was the third son of Stephen, Count of Blois and Chartres, by Adela, daughter of William the Conqueror, and was thus the nephew of Henry I of England. He was brought over to England at an early age and became a favorite with his uncle, who bestowed on him large estates and obtained for him in marriage the hand of Matilda, heiress of Count Eustace of Boulogne. Henry's only son having died in 1120, the King sought to secure the crown for his daughter Matilda, widow of Henry V of the Holy Roman Empire, and Stephen was among the first of the great barons to take the oath of fealty to Matilda. Nevertheless, on the death of Henry I in 1135, Stephen hastened from Normandy to England, seized the royal treasure, and was crowned King at Christmastide. Revolts in the south and west occurred in 1136, and though these were speedily suppressed, they broke out anew in the following year. In 1138 David I of Scotland invaded England in support of the claims of his niece Matilda, but he was badly beaten in the battle of Northallerton (q.v.). Robert, Earl of Gloucester, half brother of Matilda, also rose in rebellion, but was for the time defeated. Stephen, however, foolishly entered into conflict with the Church, whose cause was espoused by his own brother, Henry of Winchester, the papal legate. While the quarrel was in progress, Matilda and Robert of Gloucester landed in England, towards the end of 1139, and began a civil war which lasted for 14 years and plunged England into utter misery. The nobles took advantage of the civil strife to make themselves virtually independent, and their castles, which Stephen had unwisely permitted them to build up, became mere robber strongholds and places of terror for the unhappy peasantry. In 1141 Stephen was taken prisoner at the battle of Lincoln and was deposed by a Church council, Matilda being chosen Queen. She soon alienated her supporters by her harsh government, and Stephen, who had been released in exchange for Robert of Gloucester, was declared the lawful King by a second Church council and was crowned on Christmas Day. In 1148 Matilda left England; Robert of Gloucester was now dead, and the struggle was henceforth carried on by Henry, the son of Matilda and Geoffrey Plantagenet, Count of Anjou, who in 1151 succeeded his father and later by his marriage to Eleanor of Aquitaine, the divorced wife of Louis VII of France, became one of the richest princes in Europe. Stephen's son, Eustace, died in 1153, and in November of the same year Stephen and Henry concluded the Treaty of Wallingford, by which the former remained King, while the succession was vested in Henry. Stephen died Oct. 25, 1154. Consult: Kate Norgate, *England under the Angevin Kings*, vol. i (London, 1887); T. H. Round, *Geoffrey de Mandeville* (ib., 1892); William Stubbs, *Constitutional History*, vol. i (6th ed., Oxford, 1897); id., *The Early Plantagenets* (5th ed., London, 1903).

STEPHEN, George. See Mount Stephen, Baron.

STEPHEN, Henry John (1787–1864). An English jurist, brother of Sir James Stephen. He was born at St. Christopher's, West Indies, studied for a time at St. John's College, Cambridge, and in 1815 was called to the bar. His legal treatises have given him a permanent place among English jurists. In 1824 appeared his *Treatise on the Principles of Pleading in Civil Actions* (9th ed., 1867), which is a model of form and clearness, and was styled by Kent "the best book that was ever written in explanation of the science." He also published a *Summary of the Criminal Law at its Present State* (1834) and *New Commentaries on the Laws of England* (4 vols., 1841–45; 15th ed., 1908).

STEPHEN, Sir James (1789–1859). An English historian and official, born in London and educated at Cambridge. From 1836 to 1847 he was Undersecretary of State for the Colonies and so influential in that capacity as to be popularly dubbed "Mr. Oversecretary Stephen." In 1847 he was made a K.C.B. and Privy Councilor. It was he who in 1833 prepared the bill abolishing the slave trade. From 1849 to 1859 he was professor of modern history at Cambridge, and from 1855 to 1857 professor also at East India College, Haileybury. He was the brother of Henry John Stephen and the father of Sir James Fitzjames Stephen and of Sir Leslie Stephen (qq.v.). His writings include: *Essays in Ecclesiastical Biography* (1849; new ed., with memoir, 1907), his chief work; *Lectures on the History of France* (2 vols., 1852); and *Desultory and Systematic Reading* (1853).

STEPHEN, Sir James Fitzjames (1829–94). An eminent English jurist and writer on legal subjects, born in London, the son of Sir James Stephen and the brother of Sir Leslie Stephen. He was educated at Trinity College, Cambridge, and was admitted to the bar at the Inner Temple in 1854. He was recorder of Newark-on-Trent in 1859–69, and was legal member of the Legislative Council of the Governor-General of India in 1869–72, doing much to consolidate, abbreviate, and simplify the Indian law of crimes and of evidence, it being due to his efforts that the Indian Evidence Act was passed in 1872. He returned to England in 1872 and employed his time until 1875 in the work of codifying the law of evidence and criminal law of England. He was appointed professor of common law to the Inns of Court in 1875, and in 1879 was appointed a judge of the Queen's Bench Division of the High Court, which position he held until 1891, when he was disabled by nervous trouble resulting in insanity. His greatest work was his *History of the Criminal Law of England* (1883). It is the best work upon the subject for the period it covers, although marked by a certain bias due to his peculiar temperament. His *Digest of the Law of Evidence* (1876) is widely used in England and the United States. He also published: *Essays of a Barrister* (1862); *Liberty, Equality, and Fraternity* (1873); *Digest of the Criminal Law* (1877); *A View of the Criminal Law in England* (1863). Consult Leslie Stephen, *Life of Sir James Fitzjames Stephen* (London, 1895).

STEPHEN, James Kenneth (1859–92). An English verse writer, son of Sir James Fitzjames Stephen, born in London. He graduated from King's College, Cambridge, in 1882; in 1884 was called to the bar at the Inner Temple; and in 1888 was appointed clerk of assize for the South Wales Circuit. Two years later he resigned to return to Cambridge as tutor. In the meantime he had contributed to the *St. James's Gazette* and had conducted (1888) a weekly journal called the *Reflector*. The year before his death Stephen published two slender volumes of light verse, *Lapsus Calami* and *Quo, Musa, Tendis?* which met with instant success. In the verse of his day there was nothing cleverer than some of the parodies, as those on Browning, Wordsworth, Clough, Whitman, and especially Kipling. Other poems reveal him a keen critic of contemporary life. A collected edition of his poems appeared in 1896. Consult A. C. Benson, *The Leaves of the Tree* (New York, 1911).

STEPHEN, Katherine (1856–). An English educator. She was the eldest daughter of Sir James Fitzjames Stephen (q.v.), and was educated at a private school at Brighton and at Bedford College, London. She was librarian of Newnham College, Cambridge, 1887–1910, vice principal, 1892–1911, and in the latter year was appointed principal. From 1903 she was chairman of the Cambridge Training College for Women. She published *French History for English Children* (1899) and *Three Sixteenth-Century Sketches* (1904).

STEPHEN, Sir Leslie (1832–1904). An English biographer and critic, son of Sir James Stephen and brother of Sir James Fitzjames Stephen (qq.v.). He was born in London, Nov. 28, 1832, and was educated at Eton, at King's College, London, and at Trinity Hall, Cambridge, where he graduated in 1854 (M.A., 1857) and where he remained as fellow and tutor until 1864. He had taken orders in the English church, but his reading gradually bred clear-cut convictions which caused him to leave it. In 1864 he went to London and engaged in literary work, writing much for leading periodicals. In 1865 he published *Sketches from Cambridge*, reprinted from the *Pall Mall Gazette*, and in 1871 became editor of the *Cornhill Magazine*, the reputation of which he maintained by securing such contributors as Stevenson, Hardy, and Henry James. He resigned this post in 1882 to undertake the editorship of the *Dictionary of National Biography*, which, though ill health forced him to hand the management over to Sidney Lee (q.v.) in 1891, will always be a monument to his scholarship and judgment. He wrote nearly 400 of the articles himself, including Addison, Burns, Byron, Carlyle, Coleridge, Dickens, George Eliot, Fielding, Gibbon, Hume, Johnson, Milton, Pope, Scott, Swift, Thackeray, and Wordsworth. Practically all his work on the *Dictionary* was excellent, but his type of mind and literary method achieved happier results, perhaps, with the eighteenth-century subjects. His first wife, a daughter of W. M. Thackeray, died in 1875, and three years later he married Julia Prinsep, widow of Herbert Duckworth. For a year (1883) he held the Clark lectureship in English literature at Cambridge. In addition to biography and literature Stephen showed a keen interest in philosophy and ethics. In this field he was utilitarian and fortified his position with an irony, a subtlety of thought, and a trenchantly critical method that won him high regard among literary men and scholars at the expense, perhaps, of popularity. He was an agnostic, and scorned the Broad Church party as a halfway house where intellectual lucidity could not comfortably dwell. Leslie Stephen died in London, Feb. 22, 1904. His works include: *Hours in a Library* (three series, 1874–76–79), able and impartial criticisms about which there plays a delightful humor; *The History of English Thought in the Eighteenth Century* (1876; new ed., 1902); *Essays on Freethinking and Plain Speaking* (1879); *The Science of Ethics* (1882), widely used as a textbook; *Life of Henry Fawcett* (1885); *An Agnostic's Apology* (1893); *Life of Sir James Fitzjames Stephen* (1895), his brother; *Social Rights and Duties* (1896); *Studies of a Biographer* (1898); *The English Utilitarians* (1900); *English Literature and Society in the Eighteenth Century* (1904); and, in the "English Men of Letters Series," lives of Johnson, Swift, Pope, Hobbes, and George Eliot. Stephen was knighted in 1902. In 1907 appeared, in 10 volumes, his *Collected Essays*. Consult F. W. Maitland, *Life and Letters of Leslie Stephen* (New York, 1906), an admirable biography, and *Dictionary of National Biography*, second supplement, vol. iii (ib., 1912).

STEPHEN BÁTHORY. See BÁTHORY.

STEPHEN DUSHAN, dōō′shăn (c.1308–55). Czar of Servia from 1331 to 1355. Profiting by the disorders in the Byzantine Empire, he took possession of a large part of Macedonia and of northern Greece. He extended his sway over most of Albania, Bulgaria acknowledged his overlordship, and he defied Louis the Great of Hungary. Stephen was great as ruler, soldier, and lawgiver. In 1346 he had himself crowned Emperor (Czar) of the Servians and Greeks. In 1349 an independent patriarchate was instituted for Servia. Under Stephen there was for a brief period a great Slavic realm in southeastern Europe. Speedy disruption followed his death. He is a national hero to the Servians.

STEPHEN FORMATION. The name given by Walcott to beds of limestone and shale found at Mount Stephen in British Columbia. The rocks are particularly notable for the variety and remarkable preservation of their fossils, which belong to the very remote period of Middle Cambrian time. Over 90 genera have been recognized, mostly crustaceans, and among them the ancestral forms of the trilobites. They also include representatives of medusæ, holothurians, and brachiopods, of which the structures are shown to the minutest details. Among some of the notable forms are Marrella, Molaria, Naraoia, Notostraca, and Ottoia (qq.v.). Consult Walcott, "Cambrian Geology and Paleontology," in *Smithsonian Museum Collections,* vol. liii, no. 1, and vol. lvii, nos. 2, 6, 12 (Washington, 1908, 1912).

STEPHEN-LIÉGEARD, stȧ′fäɴ′-lyȧ′zhär′, FRANÇOIS EMILE (1830–). A French poet, born at Dijon. He became a lawyer and held governmental positions. His work, reminiscent of Lamartine, was crowned seven times by the Floral Academy of Toulouse and three times by the French Academy. He was decorated by various foreign governments and was made an Officer of the Legion of Honor. He wrote: *Les abeilles d'or* (1859); *Le verger d'Isaure* (1870); *Une visite aux monts maudits* (1872); *Livingstone* (1876), a poem; *Les grands cœurs* (1882); *Au caprice de la plume* (1884); *La côte d'azur* (1887); *Rêves et combats* (1892); *Les saisons et les mois* (1899); *Pages françaises* (1902); *Les Boers* (1902); *Aimer* (1906); *Brins de laurier* (1909).

STEPHENS, stē′venz, ALEXANDER HAMILTON (1812–83). An American statesman and Vice President of the Confederate States, born in Taliaferro Co., Ga., Feb. 11, 1812. His boyhood was one of toil, with occasional attendance at "old-field" schools. A society for the education of young men for the Presbyterian ministry became interested in him and provided him with the means for education. He graduated first in his class in 1832 from Franklin College, now the State University. He taught school awhile, and after three months' study of law without a tutor was admitted to the bar at Crawfordville, his county town, at the age of 22. At 24 he was elected to the State Legislature, and after five years there was sent as a Representative to Congress. He remained from 1843 until he voluntarily retired in 1859. Here he advocated the annexation of Texas, but opposed the war with Mexico. He ardently supported the Compromise Measures of 1850 and advocated the passage of the Kansas-Nebraska Bill of 1854.

In 1861 he became Vice-President of the Confederate States and remained so while that government lasted, though not wholly in accord with its policy. He headed the Confederate Commission that met President Lincoln and Secretary Seward at Hampton Roads in February, 1865, to confer upon terms of peace. (See HAMPTON ROADS CONFERENCE.) After the fall of the Confederacy he was imprisoned in Fort Warren, Boston harbor, for six months in 1865. Elected to the United States Senate in 1866, he was refused a seat and did not reënter official public life until 1873, when he became a member of the House of Representatives, from which he again voluntarily retired in 1882. In the fall of that year he was elected Governor of Georgia and died in the executive mansion, Atlanta, March 4, 1883, leaving a creditable record as statesman, orator, and writer.

Stephens was independent of party. Until 1855, though he had not been in accord with the Whig party, he generally acted with it because he preferred its policy to that of the Democrats. Later he acted with the Democrats, opposed the Know-Nothing party, and supported Douglas for the presidency in 1860. While he rejected as fallacious and inconsistent the doctrine of nullification, he believed in the right of secession, but was opposed to that policy in 1861. Though devoted to the Union, he, however, believed his ultimate allegiance due to his State; and on secession he went with the State. Besides editing the Atlanta *Daily Sun* from 1871 to 1873, he published: *A Constitutional View of the War between the States* (2 vols., 1868–70)—perhaps the ablest statement of the South's position in regard to the doctrines of State sovereignty and secession; *The Reviewers Reviewed* (a reply to his critics); and *A School History of the United States* (1872). Consult: Cleveland, *Alexander H. Stephens in Public and Private, with Letters and Speeches* (Philadelphia, 1866); Johnston and Browne, *Life of Alexander H. Stephens* (ib., 1878; new ed., 1883); W. P. Trent, *Southern Statesmen of the Old Régime* (New York, 1897); Lewis Pendleton, *Alexander H. Stephens* (Philadelphia, 1908).

STEPHENS, H(ENRY) MORSE (1857–). An American historian, born in Edinburgh, Scotland. He graduated at Balliol College, Oxford, in 1880, became a staff lecturer on history to the Oxford Extension Delegacy in 1891, and in 1892 was chosen lecturer on Indian history at Cambridge University. He was professor of modern European history at Cornell University from 1894 to 1902, when he became professor of history and director of university extension at the University of California. In 1915 he was president of the American Historical Association. His writings include: *History of the French Revolution* (2 vols., 1886–92); *Portugal* (1891), in the "Story of the Nations Series"; *Albuquerque and the Early Portuguese Settlements in India* (1891); *Revolutionary Europe, 1789–1815* (1897; 7th ed., 1907), in the "Periods of European History Series"; *Modern European History, 1600–1890* (1899). He also edited *Principal Speeches of the Statesmen and Orators of the French Revolution* (1891) and, in collaboration with G. B. Adams, *Select Documents of English Constitutional History* (1901).

STEPHENS, JAMES (1825–1901). An Irish agitator and Fenian leader, born in Kilkenny. After participating in the Young Ireland rising of 1848, he fled to Paris. In 1853 he instituted the foundation of the Irish Republican Brotherhood, commonly known as the Fenian Society (q.v.). His system depended on complete preparation of the people. A favorable opportunity was to be awaited when England should be embroiled abroad. By 1863, in point of view of numbers and revenue raised, the organization had assumed formidable proportions, but from that time dates its decline. The rising in the autumn of 1865 was an ill-timed affair delayed from the preceding spring, and the leaders were arrested. Stephens escaped from Dublin Castle, sacrificing his lieutenants, and proceeded to the United States, devoting his energies to pacifying and uniting the branch of the society there, but in 1867 he was formally deposed.

STEPHENS, James (?–). An Irish poet and novelist. While a poor boy and without education he wandered all over Ireland, nearly starved in Belfast, and finally after learning typewriting and stenography became a clerk in a solicitor's office at Dublin. His first volume of verse, *Insurrections* (1909), attracted widespread favorable notice because of its original qualities, and enabled the author to give more attention to literary work. A second volume of poetry, *The Hill of Vision*, appeared in 1912. In the latter year he published also two novels, *The Charwoman's Daughter* (American edition under the title *Mary, Mary*) and *The Crock of Gold*. His subsequent writings include: *Here Are Ladies* (1913); *The Demi-Gods* (1914); *The Rocky Road to Dublin* (1915), verse; *Songs from the Clay* (1915).

STEPHENS, John Lloyd (1805–52). An American traveler and author, born at Shrewsbury, N. J. He graduated at Columbia in 1822, from 1825 until 1833 practiced law in New York City, and then traveled for two years in southern and eastern Europe and in Palestine and Egypt, writing letters for the *American Monthly Magazine*. Later he published *Incidents of Travel in Egypt, Arabia Petræa, and the Holy Land* (2 vols., 1837; 10th ed., 1848) and *Incidents of Travel in Greece, Turkey, Russia, and Poland* (2 vols., 1838; 7th ed., 1847–53). In 1839 he was sent by President Van Buren on an unsuccessful mission to Central America. On his return he published *Incidents of Travel in Central America, Chiapas, and Yucatan* (2 vols., 1841; 12th ed., 1852). He again went to Central America in 1841 and made further explorations, the results of which appeared in *Incidents of Travel in Yucatan* (2 vols., 1843). Both works were widely read at the time in America and England and attracted attention to the archæological remains in Yucatan. In 1849 Stephens became interested in the plan for building a railroad across the Isthmus of Panama, and was made vice president and afterward president of the company that was formed for that purpose.

STEPHENS, William (1671–1753). An English colonial governor, born at Bowcombe, Isle of Wight. He graduated at King's College, Cambridge, and was admitted to the Middle Temple. About 1736 he went to South Carolina to survey a barony and met General Oglethorpe. He removed to Georgia in 1737 and became secretary of the trustees. In 1741 he became president of Savannah, one of the two counties into which the colony was divided, and in 1743 was made president of the colony. He was requested to resign on account of his age in 1750, and gave up his office in April, 1751. He published *Journal of the Proceedings in Georgia, Beginning Oct. 20, 1737* (3 vols., 1742; reprint, 1906). One volume was printed separately as *State of the Province* (1742). His life was written by his son Thomas, under the title *The Castle Builder* (2d ed., 1759).

STEPHENSON, stē'ven-son. A town, including the villages of Daggett and Stephenson, in Menominee Co., Mich., 22 miles north of Menominee, on the Chicago and Northwestern Railroad (Map: Michigan, B 3). There are flour and lumber mills here, and extensive sugar-beet fields. Some dairy products are shipped. Pop., 1900, 3006; 1910, 2913.

STEPHENSON, George (1781–1848). An English engineer and inventor and the "founder of railways." He was born June 9, 1781, at Wylam, near Newcastle, where his father was fireman at a colliery. After a boyhood spent in farm work he became assistant to his father and was steadily advanced. He got some education by attending night school while working as fireman and brakeman, and in addition to his regular duties undertook the cleaning and repairing of clocks. He became acquainted with William Fairbairn (q.v.) at this time and the two were in frequent conference. After serving as engineer at various collieries and other establishments he was made engine-wright of the Killingworth High Pit, having by this time gained a thorough practical knowledge of the operation and construction of engines and pumping machinery. Devoting his leisure to scientific pursuits, he invented a miner's safety lamp (q.v.) known as the "Geordie" (1815), and there resulted a controversy over the priority of the invention, as a similar idea had been successfully worked out by Sir Humphry Davy (q.v.). His attention was meanwhile turned to the experiments of Blackett and Hedley with locomotives, then in progress at Wylam, and he induced the owners of the Killingworth Colliery to undertake the construction of a locomotive. (See Locomotive.) In 1821 he became chief engineer of the Stockton and Darlington Railway (see Railways), and in 1824 he was appointed engineer of the Liverpool and Manchester Railway. In 1825 the Stockton and Darlington road was opened, and was the first regularly operated in the world where locomotives were employed to haul freight and passengers. In 1829 his *Rocket* won in the celebrated competitive trial of locomotives on the Liverpool and Manchester Railway, and in 1830 the line was formally opened. Subsequent improvements were made in the locomotive and Stephenson became chief or consulting engineer to nearly all of the railway projects that were soon set on foot. His success in this field made it possible for him to become interested also in the development of coal mines. Stephenson visited the Continent in 1846, where he was received with unusual honors. He was the first president of the Institution of Mechanical Engineers, which he founded in 1847, but was never a candidate for political honors. In the latter part of his life he devoted himself to farming at his country place at Tapton House, Chesterfield, where he died, Aug. 12, 1848. By his successful development of the locomotive and of the railway Stephenson ranks as one of the foremost mechanical engineers of the nineteenth century. Not only was his influence felt in the purely mechanical and engineering difficulties to be overcome, but also in the conservative organization and prosecution of the railway enterprises of his time.—His nephew, George Robert Stephenson (1819–1905), built railways in England, New Zealand, and Denmark, and in 1876–77 was president of the Institution of Civil Engineers. For George Stephenson's son, see Stephenson, Robert. Consult Samuel Smiles, *Life of George Stephenson and of his Son Robert* (London, 1857); id., *Lives of the Engineers* (new ed., ib., 1904). See Locomotive; Railways.

STEPHENSON, John (1797–1842). A Canadian physician. He was born in Montreal, was educated by the Sulpicians in that city, went to Edinburgh, and received his medical degree there in 1820. Returning to Montreal in 1821, he was the first to organize medical education in Canada by establishing lectures in 1822 at the Montreal General Hospital. The McGill University medical faculty originated from these lectures, and Stephenson was its first registrar. He was the first professor to be appointed in anatomy, surgery, and physiology, and he held all three professorships at the same time.

STEPHENSON, Robert (1803–59). A British civil engineer. He was the only son of George Stephenson (q.v.) and was born at Willington Quay, near Newcastle. He was educated at Newcastle and received practical engineering experience at the Killingworth Colliery and with his father in railway surveying and the construction of locomotives, being, in the meanwhile, a student for six months at Edinburgh University. After managing his father's locomotive factory in Newcastle for a few months he went to South America on account of ill health (1824) and engaged in mining. Coming back to England in 1827, he returned to the locomotive works and supervised the construction of the *Rocket* (see Locomotive), incorporating in its mechanism many original and serviceable ideas, and assisted his father in other work. In 1833 he became the engineer of the London and Birmingham Railway, one of the first in which great engineering difficulties were encountered in the construction, but which was completed in 1838. The firm of Robert Stephenson & Co. by this time had become the leading engine builders of the world, and a standard type of locomotive was evolved which was subsequently enlarged and improved. Robert Stephenson was interested in every department of railway construction, and particularly in the design of bridges, where he achieved the highest reputation. Among the bridges he designed were the high-level bridge over the Tyne at Newcastle, the Victoria Bridge at Berwick, the famous Britannia Tubular Bridge across Menai Strait, the Conway Bridge, and the Victoria Bridge over the St. Lawrence. (See Bridge.) In 1847 Stephenson was elected to Parliament from Whitby as a Conservative, and in 1856 became president of the Institution of Civil Engineers. For bibliography, see Stephenson, George; also consult Jeafferson and Pole, *The Life of Robert Stephenson* (London, 1864). See Bridge; Locomotive; Railways; Steam Engine.

STEPHENSON, Thomas Bowman (1839–1912). An English Wesleyan clergyman, born at Newcastle, and educated at the University of London. He entered the ministry of the Wesleyan Methodist church in 1860 and was elected to the Legal Hundred in 1888. In 1891 he was president of the Conference. Of the National Childrens' Home and Orphanage, London, which he had founded in 1873, he was principal until his death. He was a member of the London School Board from 1873 to 1876 and was warden of the Wesley Deaconess Order and founder of the Wesley Deaconess Institute. Stephenson published: *Words of a Year* (1892); *The People's Order of Divine Service* (1901); *William Arthur, a Brief Biography* (1907).

STEP'NEY, George (1663–1707). An English minor poet and diplomatist, who, after his education at Westminster school and at Cambridge, entered the diplomatic service. Some of his correspondence is in J. M. Kemble, *State Papers* (London, 1857). For his poetry, see Chalmers's *English Poets*, vol. viii. Consult R. Harrison, *Notices of the Stepney Family* (London, 1870).

STEPNIAK, styĕp-nyäk' (pseudonym of Kravtchinsky), Sergei Mikhailovitch (1852–95). A Russian revolutionary exile and writer, born in southern Russia. He graduated at the St. Petersburg School of Artillery and entered the Forestry Institute at St. Petersburg. In 1872 he joined a Nihilist circle and engaged in spreading revolutionary ideas among the factory workmen in the capital. He was arrested in 1874 but escaped and thenceforth led the life of an outlaw. He engaged in conspiracies in Italy, took an active part at Geneva in the publication of *The Commune*, and in 1878 smuggled into Russia a press and type for illegal publications. When the revolutionists resolved upon the death of General Mezentsev, chief of the gendarmes, Stepniak, chosen by lot for the purpose, stabbed him on Aug. 16, 1878, and somewhat later, in justification of the act, published *Life for Life*. During the years 1879–83 he lived in Switzerland and Italy, where appeared his famous *Underground Russia* (1882). In 1884 Stepniak settled in London. In 1885 appeared his *Russia Under the Tsars*, followed by *The Russian Storm Cloud* (1886), *Russian Peasantry, Andrei Kozhukhov* (1889, translated as *The Career of a Nihilist*), *The Little Cottage on the Volga* and *King Stork and King Log* (1895). He edited *Free Russia* (founded in 1890), the monthly organ of the English Society of Friends of Russian Freedom. He died in London in an accident at a railway station. His works were collected and published at St. Petersburg in 1907.

STEPPE, stĕp (Russ. *stepi*, waste, heath, steppe). The name given to the undulating plains of southeastern Europe and northern Asia which correspond in general to the prairies and pampas of America, but are marked by some peculiarities due to their elevation and dry climate. The steppes are covered with grass in the rainy season or early summer and afford pasturage to great herds of cattle, sheep, and horses, and are largely occupied, where not brought under cultivation, by nomadic tribes of Tatars. See Grasslands; Prairie.

STEPPE MURRAIN. See Cattle Plague.

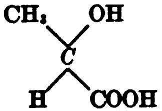
STEP RATE INSURANCE. See Life Insurance.

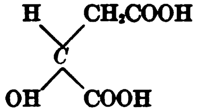
STERE, stĕr (Fr. *stère*, from Gk. *στερεός*, *stereos*, solid). Another name for a cubic meter established by the Law of 18 Germinal an III (April 7, 1795). The name was continued after the formal adoption of the metric system, being used for wood, especially firewood. See Metric System.

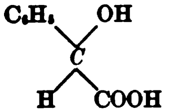
STER′EOCHEM′ISTRY. A branch of chemistry dealing with those cases of isomerism that cannot be explained by the doctrine of the linking of atoms, and explaining those cases on the assumption that the combining forces of an atom act in certain definite directions in space. Isomerism (i.e., the existence of compounds having the same qualitative and quantitative composition and the same molecular weight, yet differing more or less in their properties) and the doctrine of the linking of atoms (the structural theory) have been discussed in the article CARBON COMPOUNDS, which should be read in connection with the present sketch.

Optical Isomerism. Most of the cases not explained by the doctrine of the linking of atoms are presented by compounds identical in all their physical properties except the power of rotating the plane of polarized light. It is well known that this power is possessed by a number of crystalline substances in the solid state, and that every such substance (e.g., quartz) can be obtained in two enantiomorphous crystalline forms, rotating the plane of polarized light through equal angles but in opposite directions. But when melted or dissolved, such substances usually lose that power completely, which shows that their optical property is peculiar, not to their nature, but to the particular crystalline form which they assume in the solid state. These are not the substances that stereochemistry has to deal with; such substances, inasmuch as they lose their difference of optical rotatory power with their crystalline form and are therefore identical in the liquid, gaseous, or dissolved state, cannot be considered as different chemical individuals, and hence cannot form the subject of a theory of chemical compounds. Cases of optical isomerism proper are presented by substances retaining or acquiring their difference of optical rotatory power in the liquid, gaseous, or dissolved state.

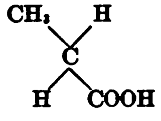
In 1874 Le Bel and Van't Hoff discovered, independently and almost simultaneously, that all optically active compounds, and only optically active compounds, contain one or more asymmetric carbon atoms, i.e., carbon atoms directly linked to four atoms or groups of atoms different from one another. The following formulas, containing asymmetric carbon atoms (denoted by an italic *C*), represent optically active compounds:


Lactic acids


Malic acids

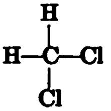

Mandelic acids

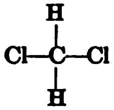
On the contrary, formulas like that of propionic acid,



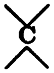
which contains no asymmetric carbon atom (i.e., no atom combined with four different atoms or groups), have in no case been found to represent optically active compounds. The relation between the optic rotatory power and the asymmetric carbon atom must therefore form the cornerstone of any explanation of optical isomerism that might be advanced.

Altogether three different explanations suggest themselves as possible: (1) the assumption that the four valencies of the carbon atom are unequal and that cases of isomerism may result from different distributions of the four atoms or groups combined with the carbon atom, among its different valencies; (2) the assumption that the atoms or groups combined with the carbon atom are in constant motion around it and that the molecules of optically different compounds may be made up of the same atoms or groups in different motions around the carbon atom; and (3) the assumption that the molecules of different compounds may be made up of the same atoms or groups, similarly linked to the carbon atom, but differently arranged in space around it. The first of these assumptions compels us to recognize the possible existence of isomers that are positively known to be impossible. For instance, if the assumption were correct, two different nitromethanes would be possible; yet a systematic experimental investigation carried out by Henry showed that nitromethane can exist in one form only. The second of the above assumptions is apparently incapable of either purely theoretical development or systematic correlation with facts, and must therefore be abandoned. The third assumption, viz., that the difference between optical isomers is due to differences in the configuration of the atoms in their molecules, presents itself, therefore, as the only possible explanation. Furthermore, even this explanation must first of all discard the hypothesis of the arrangement of atoms in a plane. Indeed, were the plane graphical formulas, as we ordinarily write them, true to reality, then, e.g., two methylene chlorides would be possible, the configurations of whose atoms would be represented by the following formulas:


$$\begin{matrix} & H & \\ H- & C & -Cl \\ & Cl & \end{matrix}$$


$$\begin{matrix} & H & \\ Cl- & C & -Cl \\ & H & \end{matrix}$$

Yet only one methylene chloride is possible. If the valencies of the carbon atom were assumed to be distributed, in the plane, not exactly at equal angles, but, let us say, as in the following symbol



then the number of theoretically possible yet really nonexisting isomers would be even greater.

Considerations of this nature led Van't Hoff to the conclusion that if optical isomerism is to be explained, it is necessary to assume that the four valencies of the carbon atom are evenly distributed around it in space. This is the fundamental hypothesis of stereochemistry. In agreement with this hypothesis one may imagine that the asymmetric carbon atom is situated at the centre of a regular tetrahedron, and the four different atoms or groups held by it are situated at the four corners of the tetrahedron.

The application of the stereochemical hypothesis to the study of isomerism is very difficult to explain or to grasp without the use of models. A crude but sufficient form of model may be readily made in a few minutes from pasteboard, by cutting out four equal equilateral triangles and fastening them together to form a regular tetrahedron, by means of strips of gummed paper. Small slips of paper of different colors may be used to represent the four different atoms or groups and may be fastened to the corners by means of pins. With the aid of two such models it is easy to demonstrate the following cases: (1) with three slips of paper of one color and one of another color, only one arrangement is possible, which corresponds, e.g., to the fact that only one nitromethane, $CH_3(NO_2)$, can be obtained. (2) With two slips of paper of one color and two of another color, again only one arrangement is possible, which corresponds, e.g., to the fact that only one methylene chloride, CH_2Cl_2, can be obtained. (3) With two slips of paper of one color, one slip of another color, and one of a third color, again only one arrangement is possible, which corresponds, e.g., to the fact that only one propionic acid, $CH_2(CH_3)(COOH)$, can be obtained. (4) With four slips of different colors two different arrangements are possible, which corresponds to the fact that only molecules containing an asymmetric carbon atom, i.e., one linked to four different atoms or groups, can be different in spite of being made up of the same atoms linked together in the same manner. The two models will, in this case, be like an object and its image in a mirror: the object being right-handed, its reflected image will be left-handed, and vice versa. Thus the models will illustrate the difference between the two optically active lactic acids, malic acids, or mandelic acids (see above); or, in general, any pair of optical isomers whose molecules contain one asymmetric carbon atom. As an instructive example it may be demonstrated, by means of the models, why only one acetic acid, $CH_3(COOH)$, is possible; why only one monochloracetic acid, $CH_2(Cl)(COOH)$, is possible; why only one dichloracetic acid, $CHCl_2(COOH)$, is possible; why only one trichloracetic acid, $CCl_3(COOH)$, is possible; why two optically isomeric chlorobromoacetic acids, $C(H)(Cl)(Br)(COOH)$, are possible; and why two optically isomeric chlorobromofluoracetic acids, $C(Cl)(Br)(F)(COOH)$, are possible.

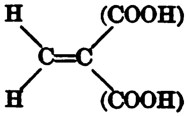
The work of later years showed that while the presence of an asymmetric carbon atom is always sufficient to cause asymmetry of the molecule as a whole and therefore isomerism, molecular asymmetry (and hence also optical isomerism) may occur in some cases in which asymmetric carbon atoms are absent. This principle is well illustrated by the inosites (q.v.). However, a beginner may be advised to adhere to the doctrine of the asymmetric carbon atom in the form in which its youthful creator, Van't Hoff, originally formulated it.

As already pointed out above, optical isomers possess precisely the same physical properties and differ only with regard to the direction in which they rotate the plane of polarized light. Their behavior towards chemical reagents is likewise identically the same, except if the reagents themselves are optically active—i.e., made up of unsymmetrical molecules. In general, a pair of optical isomers will appear identically similar unless exposed to an agency, whether physical (like polarized light) or chemical (an optically active reagent), that is itself unsymmetrical. From this point of view it is clear that since, in general, the separation of mixed substances can only be effected (chemically) by reagents towards which the given substances behave differently—the separation of mixed optical isomers can only be effected by either some purely mechanical means or by reagents that are themselves unsymmetrical. It may be remarked that all reactions by which compounds with asymmetric carbon atoms may be produced from compounds containing no such atoms cause the simultaneous production of both optical isomers in precisely equal quantities; so that a separation is required whenever optically active compounds are to be prepared artificially (in nature either one or the other of a pair of optical isomers is usually found isolated). Three methods have thus far been found for effecting the separation. First, it is possible in many cases and under certain conditions of temperature, to separate the isomers mechanically. In all such cases the two isomers are found to form enantiomorphous crystals. Below, or sometimes above, the point of temperature at which this takes place, the two isomers usually crystallize together, forming a double compound, the so-called "racemic" modification of the given compound. The racemic modification is optically inactive because its two components tend to rotate the plane of polarized light to the same extent in opposite directions. The second method of separating optical isomers is applicable only to acids and bases. If a mixture of two optically isomeric acids is treated with an optically active base, two salts result differing more or less considerably in solubility, and therefore capable of being separated by fractional crystallization. The result is similar when a mixture of two optically active isomeric bases is treated with an optically active acid. Finally, the third method is based on the fact that certain processes of fermentation often destroy one of the optical isomers much more rapidly than the other. Thus, levo-glucose may be prepared by subjecting to fermentation its mixture with dextro-glucose, the latter alone being affected by the fermentation. It has been assumed by some that the living organisms (e.g., *Penicillium glaucum*) causing fermentation are capable of discriminating, by a sort of instinct, between the isomers, and, while feeding on one, reject the other. But the lifeless enzymes (q.v.) obtained from ferments have been shown to exercise the same action as the ferments themselves; and hence the peculiar action of the latter may be confidently ascribed to the stereochemical properties of their enzymes.

Passing now to the consideration of compounds whose molecules contain more than one asymmetric carbon atom, the most important case to be mentioned is that of tartaric acid $(COOH)C(H)(OH)\cdot C(H)(OH)(COOH)$, with two asymmetric carbons in its molecule. By the use of models like those mentioned above, it is easy to convince one's self that three different arrangements are possible: (1) a right-handed arrangement of the groups around either of the asymmetric carbons; (2) a left-handed arrangement of the groups around either of the asymmetric carbons; (3) a right-handed arrangement around one, and a left-handed arrangement around the other asymmetric carbon. Corresponding to these are the well-known dextrorotatory, levo-rotatory, and inactive (mesotartaric) modifications of the acid, the last named being inactive because one-half of its molecule rotates the plane of polarized light to the same extent in one direction as the other half does in the opposite direction. Besides these there is the racemic modification (racemic acid), which is a double compound of the dextro-rotatory and levo-rotatory tartaric acids (q.v.). The compounds containing more than two asymmetric carbon atoms include the sugars (q.v.)—an important class of compounds whose theory could not have been developed, and many of which would certainly not have been discovered without the concepts of stereochemistry.

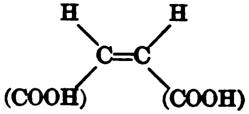
Geometrical Isomerism. It may be seen from the preceding paragraphs that the fundamental hypothesis of stereochemistry, viz., that the valencies of a carbon atom act symmetrically around it in space, while indispensable for correlating optical isomers, also throws additional light on the phenomena of chemical isomerism proper. Take, e.g., again the case of methylene chloride, CH_2Cl_2. Were optical isomerism unknown and the stereochemical hypothesis nonexistent, the question as to why only one modification of this compound is possible would be answered by pointing out that the four carbon valencies are identical and that, hydrogen and chlorine atoms being univalent, only one mode of linking the atoms is possible. If it were further asked, "But how do we know that two methylene chlorides might not exist, in whose molecules the atoms are linked similarly, but arranged differently?"—chemists would answer: "Of course, such a state of things is not inconceivable; only in all the innumerable cases thus far discovered, the doctrine of the linking of atoms is sufficient, the number of known isomeric compounds never exceeding the number of possible modes of linking; and so we deem it unnecessary to enter into speculations as to the arrangement of atoms in space." From the standpoint of stereochemistry the answer is thorough: only one methylene chloride is possible, (1) because the four valencies of carbon are identical; (2) because only one mode of linking the atoms is possible; (3) because only one arrangement of the atoms in space is possible, as may be readily demonstrated by the use of tetrahedron models.

It is, therefore, clear that stereochemistry not only explains, and hence permits of foreseeing all possible cases of optical isomerism, but also explains thoroughly why more cases of chemical isomerism than are explained and foretold by the doctrine of the linking of atoms are not possible. But stereochemistry has still another important application. Its fundamental hypothesis applied to the so-called "unsaturated" compounds (see Carbon Compounds) leads to a clear explanation of cases of isomerism which, again, cannot be explained by the doctrine of atomic linking alone. In the simplest class of unsaturated compounds one carbon atom is united by two valencies to another carbon atom. Using the stereochemical concept of the carbon tetrahedron, this means that two carbon tetrahedra have an edge in common, the four atomic groups held by the two carbons being situated at the four free corners of the tetrahedra. Take, e.g., the case of two carbon atoms united by a double bond and holding two hydrogen atoms and two carboxyl (COOH) groups. In this case the doctrine of the linking of atoms recognizes the possibility of two isomeric modifications, as shown by:



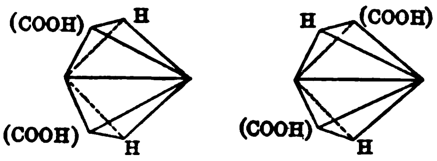
Methylene malonic acid

and



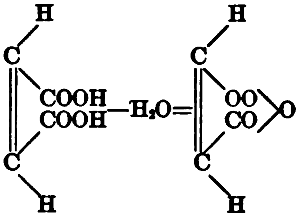
Maleic and fumaric acids

Stereochemical doctrine recognizes further that with the second of these modes of linking two different arrangements in space are possible, as may be seen from the accompanying diagram,



Maleic acid Fumaric acid

and better still by the use of models. As a matter of fact, three unsaturated acids $C_2(H_2)(COOH)_2$ are known, viz., methylene malonic acid characterized by the first of the above modes of linking, and two acids—maleic and fumaric—both characterized by the second mode of atomic linking, and differentiated from each other by the different configuration of their atoms. Optical activity is of course out of question, because none of the molecules under consideration is unsymmetrical. But corresponding to the difference in configuration are certain differences in the chemical behavior of maleic and fumaric acids, although the close relationship between the two is indicated by the great readiness with which they are transformed into each other. The most important difference between the two consists in the fact that maleic acid forms an anhydride, its two carboxyl groups losing the elements of water and becoming joined together, thus:



Maleic acid Maleic anhydride

Fumaric acid, on the contrary, has no anhydride of its own. This indicates that in maleic acid the two carboxyl groups must be nearer together than in fumaric acid, and therefore the first of the above two stereochemical formulas is assigned to maleic, the second to fumaric acid. (See Fumaric and Maleic Acids.) The oxidation of fumeric and maleic acids with aqueous potassium permanganate has furnished striking proof of the correctness of this assignment of formulæ. But this matter cannot be taken up here.

As to compounds with triple bonds in their molecules (see CARBON COMPOUNDS), the verdict of stereochemistry is that no more isomers are possible than can be foreseen by the doctrine of atomic linking. This, too, may be best demonstrated by means of models.

History. The optical rotary power of a substance in the noncrystalline state (sugar in solution) was first observed by Biot in 1815. The optically isomeric tartaric acids were thoroughly investigated by Pasteur, who in 1860 discovered the three classic methods of separating such isomers (see above). Ten years later Wislicenus studied the isomeric lactic acids, and in a memoir published in 1871 expressed the view that the doctrine of atomic linking was no longer sufficient for the purposes of organic chemistry. Wislicenus's remark attracted the attention of Van't Hoff, who advanced the stereo-chemical theory of optical isomerism in 1874. Meanwhile Le Bel, in Paris, had undertaken to continue the work of Pasteur, and soon independently arrived at the same conclusions as Van't Hoff. Remarkably enough, Le Bel's and Van't Hoff's memoirs appeared within one month. The theory of geometrical isomerism was worked out by Van't Hoff about 1878. At present stereochemistry forms quite an extensive science, and its theories, to which no exception has yet been found in the case of carbon compounds, are being gradually extended also to the compounds of nitrogen, selenium, tin, and other elements, and especially, by Werner, to complex inorganic compounds.

Consult: Hantzsch, *Grundriss der Stereochemie* (Breslau, 1893; French trans., Paris, 1896); Van't Hoff, *Die Lagerung der Atome im Raume* (Brunswick, 1894); Bischoff, *Handbuch der Stereochemie* and *Materialien* (Frankfort am Main, 1893 and 1902); Werner, *Lehrbuch der Stereochemie* (Basel, 1904). Consult also the works on theoretical and organic chemistry recommended in the article CHEMISTRY. See CHEMISTRY; CARBON COMPOUNDS; LACTIC ACID; TARTARIC ACID; FUMARIC AND MALEIC ACIDS; SUGARS; INOSITE; VALENCY.

STEREOCHROMY, stĕr′ē-ŏk′rō-mĭ (from Gk. *στερεός*, *stereos*, solid + *χρῶμα*, *chrōma*, color). A process of wall-painting, invented in 1896 by Prof. J. N. von Fuchs, of Munich, and first practiced by the painter Joseph Schlotthauer. Upon a thin coating of mortar forming a part of the wall, mineral water colors were applied, thus admitting of any part of the picture being retouched, as in the case of oil paintings. A coating of liquid glass was then added to protect it from the effects of the atmosphere. Experience has shown, however, that the surface of the painting cracks, and the process is no longer employed.

STEREOPTICON. See PROJECTION APPARATUS.

STEREORNITHES, stĕr′ē-ôr′nĭ-thēz (Neo-Lat. nom. pl., from Gk. *στερεός*, *stereos*, solid + *ὄρνις*, *ornis*, bird). A group of extinct ratite birds of gigantic size whose remains are found in the Miocene strata of Patagonia. The propriety of this name as indicative of a distinct group has been criticized, and it is believed that, on the contrary, many of the species are not ratite at all, but carinate, one, at least, having been determined to be a vulture. The most conspicuous genus is *Phororhacos*. Consult Alfred Newton, *Dictionary of Birds* (New York, 1893–96). See BIRD, FOSSIL.

STER′EOSCOPE′ (from Gk. *στερεός*, *stereos*, solid + *σκοπεῖν*, *skopein*, to view). An optical instrument that enables one to see the pictures of objects not merely as plane representations, but with an appearance of solidity, and in relief. When a person looks at a solid body with both eyes the pictures formed on the retinas are not alike, as the right eye is able to see more of the right side of the object and the left eye more of the left side. When these two impressions are blended the object is seen with an appearance of depth or relief. The first stereoscope was devised in 1838 by Wheatstone (q.v.) and consisted of two plane mirrors at an angle of 90° and two similar clamps or supports for holding the picture. The face of the observer was placed close to the meeting point of the two mirrors and the light from each picture was reflected into the eye by the adjacent mirror. The pictures for use in this instrument were drawn as they would appear to each eye separately, and consequently were reflected to the eyes as they would actually be seen. The apparatus was successful so long as the pictures were confined to representations of geometrical objects of three dimensions, which could be constructed readily, but the reproduction of more complex objects, such as natural scenery, was beyond the skill of the artists, and it did not occur to the inventor to use photography, then being developed. Sir David Brewster in 1849 constructed a lenticular stereoscope in which lenses were substituted for Wheatstone's reflectors, and he was able to obtain also a magnified image. He divided a double convex lens transversely into halves, which were placed in front of the two pictures with their thin edges adjacent, so that the rays would be deviated by such an amount that they would apparently originate in a common point between the two pictures, the lens acting as a prism which always bends the rays around its base. Thus the two pictures, which are placed directly in front of the two lenses at a distance equivalent to the principal focus, are united into one image. The growth of photography and the ease of reproduction for the stereoscope soon made the instrument popular; the open form used in the United States was devised by Dr. Oliver Wendell Holmes, the poet. Brewster also invented a form of photographic camera with two lenses to take stereoscopic pictures. Instead of two lenses, which in modern stereoscopic cameras are generally of the rapid rectilinear type, the position of the camera can be shifted, but the results are not as good as those obtained with two similar lenses mounted on a camera with a vertical partition which enables two pictures to be taken on the same plate. The lenses, generally speaking, should be about 2½ inches apart, though a slight increase does not make any great difference, the relief becoming more prominent. Too great a difference exaggerates the picture. In printing, the negative reverses conditions, and prints must be interchanged, as pictures taken on the right-hand side must always be seen with the right eye.

The opera glass furnishes a familiar instance of the application of the binocular principle, and in the more modern double-tube telescopes and field glasses, particularly those with reflecting prisms and of high power designed for military operations, great success has been attained in securing the stereoscopic effect with considerable magnifying power. Furthermore the stereoscopic principle is applied with success in many modern range finders. In the binocular microscope (see Microscope) the same idea is applied, while in the stereomicrometer it is possible to measure small distances. Consult: Brewster, *The Stereoscope* (Leipzig, 1856); Helmholtz, *Physiologische Optik* (ib., 1856–66); Le Conte, *Sight* (New York, 1881); Müller-Pouillet, *Lehrbuch der Physik* (11th ed., Brunswick, 1914); C. Pulfrich, *Stereoskopisches Sehen und Messer* (*mit Literaturverzeichnis*) (Jena, 1911); M. v. Rohr, "Abhandlungen zur Geschichte des Stereoskops," in Ostwald, *Klassiker der exakten Wissenschaften*, vol. clxviii (Leipzig, 1908); A. Keller, "Das Stereoscop und seine wichtigsten Anwendungen in der modernen Wissenschaft," in *Himmel und Erde*, vol. xxvi (Leipzig, 1914). See Range Finder.

STEREOTOMY (from Gk. *στερεός*, *stereos*, solid + *τομή*, *tomē*, a cutting). A special branch of descriptive geometry (q.v.) which treats of its applications to the making of exact patterns for the various forms of wood and stone required for stairs, stair rails, vaults, arches, etc. See Stone Work.

STER'EOT'ROPISM. See Tropism.

STEREOTYPING. See Printing.

STERIL'ITY (from Lat. *sterilis*, barren). Barrenness, infecundity. In a woman, sterility consists of an incapacity for conception; in a man, of the inability to procreate the species. The causes of sterility in a woman are as follows: (1) Causes preventing the entrance of semen into the uterus, including absence of the uterus or vagina, imperforate hymen, vaginismus, atresia vaginæ, occlusion of cervical canal, conical shape of cervix, cervical endometritis, polypi or fibroids, displacements, very small os internum or externum. (2) Causes preventing the production of a healthy ovule, including chronic ovaritis, cystic disease of both ovaries, cellulitis or peritonitis, absence of ovaries. (3) Causes preventing passage of ovule into uterus, including stricture or obliteration of Fallopian tubes, absence of Fallopian tubes, detachments and displacements of Fallopian tubes. (4) Causes destroying the vitality of semen or preventing fixation of impregnated ovum, including corporeal or cervical endometritis, membranous dysmenorrhœa, menorrhagia or metrorrhagia, abnormal growths, areolar hyperplasia.

Sterility in man is *organic* when there is anatomical derangement of the apparatus; *atonic* when erections are wanting or feeble; *anæsthetic* when there is a diminution of sensitiveness in the nerves supplying the male organ; or *psychic* when mental conditions (as of fright, repulsion, etc.) inhibit the genital centre in the spinal cord. The determination of which partner in marriage is sterile is of great importance. In many countries obloquy and derision attach to the wife who fails to bear children, and her legal status is impaired. The woman is much less often to blame than has been supposed. See Hybridity.

STER'ILIZA'TION. See Bacteria.

STERILIZATION (from Lat. *sterilis*, barren). Sterilization, with reference to the human race, is a term applied to an operation performed for the purpose of depriving a member of either sex of the power to reproduce. The most common operations now employed are: (*a*) in the male, *vasectomy*, sometimes known as "Rentoul's operation"—the removal of a small portion of each sperm duct; and (*b*) in the female, *salpingotomy*—the removal of a small portion of each Fallopian tube. These methods avoid certain harmful effects, physical or mental, which often follow other forms of sterilization—forms which are more correctly termed asexualization.

Three motives appear to have prompted sterilization of individuals in the United States, first eugenic, second punitive, third therapeutic. Discussion at the present time centres chiefly upon: (*a*) the advisability of compulsory sterilization as a method of practical eugenics, and (*b*) the legal limitations which should be placed upon compulsory sterilization wherever adopted. As a method of practical eugenics sterilization is advocated to prevent the procreation of habitual criminals, idiots, feeble-minded, insane, diseased, and degenerate persons. In a large number of instances, it is argued, criminality, insanity, feeble-mindedness, and degeneracy are the result of hereditary characteristics. When such is the case the advocates of sterilization hold it to be the duty of the State to prevent persons possessing these characteristics from handing them down to later generations. The more conservative advocates of sterilization desire its application, at first, only in the most patently degenerate cases where the operation is often of direct therapeutic as well as eugenic value. They urge segregation as an alternative. The custodial care of defectives at present, however, is wholly inadequate and it is a tenable hypothesis that sterilization would prove a more practicable means of attaining the desired end.

Various States of the Union have passed experimental sterilization laws and under these somewhat less than 1000 operations had been performed prior to 1914. The first sterilization law was passed by Indiana, March 9, 1907. Washington, California, Connecticut, Nevada, Iowa, New Jersey, New York, North Dakota, Michigan, Kansas, and Wisconsin have also enacted important sterilization measures. Bills on this subject have been introduced from time to time into the legislatures of Illinois, Minnesota, New Hampshire, Ohio, Oregon, Pennsylvania, and Virginia. In Oregon the bill was passed by the Legislature and approved by the Governor, but was repealed by referendum. In Indiana and California a number of operations have been performed, but in several other States no action under the law has been taken. Commenting on laws actually on the statute books, H. H. Laughlin, Secretary of the Eugenics Record Office, remarks: "All of the existing statutes, with the possible exception of the Kansas statute, have totally inadequate provisions for safeguarding the rights of the individuals designated for sterilization; no hearing is provided; no easy method of appeal may be had by persons whose sterilization has been decided upon." Nevertheless he thinks that most of the existing statutes have some elements of virtue, and are at least an attempt to bring legislation into line with scientific advance. Consult: Havelock Ellis, "The Sterilization of the Unfit," in the *Eugenics Review*, vol. i (London, 1909); H. H. Laughlin, "The Legal, Legislative, and Administrative Aspects of Sterilization," in *Eugenics Record Office Bulletin No. 10 B.* (Cold Spring Harbor, N. Y., 1914). See Eugenics; Heredity; Mental Defectives, *Segregation*.

STER'ILIZED FOOD. Food subjected to an agent (usually heat) capable of destroying germs of fermentation or disease which may be present. The articles of diet which are not usually prepared by heat before ingestion, and which are capable of conveying disease, are fresh fruits, some vegetables, water, and milk. Water and milk are very likely to act as carriers of pathogenic microörganisms. Water may be rendered sterile by boiling or by distillation. It is then best kept for use in sterile bottles, sealed, and maintained at a low temperature. Ice may be the means of carrying disease, since many bacteria, although retarded in their growth, are not killed by freezing.

Milk is the food around which the question of sterilization centres, because it is the sole nourishment of infants and is filled with bacteria, particularly in summer. Although sterile when from the breast of the suckling mother or udder of the healthy cow, milk is almost a perfect culture medium for many varieties of bacteria, pathogenic and nonpathogenic, which increase with great rapidity. It may become contaminated during the interval between milking and ingestion in various ways. Unclean material may be introduced into the milk from the udders or the milker's hands. Impure water used as an adulterant or for cleansing containers may be a means of contamination. Exposure to the air is sufficient to introduce, through dust, many different forms of bacteria.

Diseases most likely to be propagated through milk are typhoid fever, tuberculosis, especially the glandular and intestinal types, scarlet fever, cholera, suppuration, diphtheria, septic sore throat, and especially the summer diarrhœa of children. Besides producing their specific diseases, bacteria produce elements in milk capable of giving rise to ptomaine poisoning (q.v.). The addition of nonpoisonous antiseptic substances has been proposed. But it has been found that with such drugs as salicylic acid and boric acid quantities too large to be wholesome must be employed. Formalin has been extensively used of late years to keep milk sweet and aseptic; but the addition of preservative agents is no longer looked upon with favor. Cold is a very imperfect means of sterilization.

Milk is usually sterilized by boiling or by exposure to superheated steam. Germs existing in this fluid can be absolutely destroyed only by heating to 212° F., or higher on two or three successive occasions. The ordinary method of sterilizing milk is to place it in sealed jars or bottles containing sufficient for one feeding, which are then subjected to the action of steam. It is then cooled rapidly, kept sealed, and placed on ice. Exposure to such high temperatures alters the character of milk materially, both as to digestibility and nutritive qualities; it is therefore rendered unfit for use except as a makeshift in very hot weather and in cases of infantile summer diarrhœa. Prolonged use of sterilized milk for children dependent solely upon it for nutriment has resulted in symptoms of scurvy. To obviate this difficulty milk is often subjected to a process known as pasteurization. (See PASTEURIZER.) Pasteurization has been shown to be sufficient to kill the microörganisms most commonly found in milk, and in particular those giving rise to diarrhœal diseases, which are very vulnerable to heat. Spores, however, are not destroyed. The tubercle bacillus is more resistant. Pasteurized milk will keep two or three days at ordinary temperatures or several days on ice, and its taste, digestibility, and nutritive value are believed to be unchanged. See ADULTERATION; FOOD; MILK, and bibliography thereto appended.

STERLING. An epithet generally applied to the coinage of Great Britain. Charlemagne had a *livre esterlin* or true pound which superseded earlier systems of coinage and weights. In this a pound of 12 ounces became the money weight. The older *silfer* or scruple of 24 wheatcorns being superseded by the penny of 32 wheatcorns, the term "sterling" seems to have been applied to the latter, in consequence of its being in use among the Ripuarian or Austrasian Franks, sometimes called the *Esterlings*. In England the word "sterling" retaining the ancient French meaning of "true" came in the course of time to be associated with the fineness of the gold coin of the realm, as pounds sterling, and especially to indicate the fineness of the silver. The superiority of the English silver, maintained by laws requiring its assay at government mints, was generally acknowledged over Europe; and hence the adjective "sterling" has become a synonym for "pure" or "genuine."

STERLING, stẽr'lĭng. A city and the county seat of Logan Co., Colo., 128 miles northeast of Denver, on the Union Pacific and the Chicago, Burlington, and Quincy railroads (Map: Colorado, F 1). It carries on an important trade in beets, alfalfa seed, cattle, and sheep, and has a sugar factory. Pop., 1900, 998; 1910, 3044.

STERLING. A city in Whiteside Co., Ill., 110 miles west of Chicago, on Rock River, the Hennepin Canal, and on the Chicago and Northwestern and the Chicago, Burlington, and Quincy railroads (Map: Illinois, E 2). The principal manufactures are hardware, agricultural implements, funeral cars, ambulances, gasoline engines, wire fence, canned goods, paper, and foundry and machine-shop products. There are a public library and a hospital. Sterling adopted the commission form of government in 1915. Pop., 1900, 6309; 1910, 7467.

STERLING, JOHN (1806–44). An author of Irish parentage, born on the island of Bute. He was educated at Glasgow and at Cambridge. He went to London and began writing for the *Athenæum*. Owing to ill health, he passed two years in the West Indies (1830–32). Returning to England, he took orders and served eight months as a curate. In 1838 the Sterling Club was instituted and named after him. It included Lord Houghton, Carlyle, and Tennyson. Among his writings are: *Arthur Coningsby* (1833); *Poems* (1839); *The Election* (1841), a poem; *Strafford* (1843), a drama. Sterling, a man of many friends, cut down with consumption in the prime of life, has been immortalized by Carlyle in a *Life* (London, 1851; new ed., Oxford, 1909). Consult *Essays and Tales*, with a memoir by J. C. Hare (London, 1848).

STERN, stĕrn, ADOLF (1835–1907). A German literary historian and poet, born in Leipzig. He studied at the universities of Leipzig and Jena, and in 1868 was appointed professor of the history of literature in the Polytechnikum of Dresden. His publications include the compilation *Fünfzig Jahre deutscher Dichtung* (1871); two collections of essays, *Aus dem achtzehnten Jahrhundert* (1874), *Geschichte der neuern Litteratur* (7 vols., 1882–85); *Grundriss der allgemeinen Literaturgeschichte* (4th ed., 1906); and editions of Hauff, Herder, and Körner, Sr. Among his literary works may be mentioned: *Gedichte* (1860; 4th ed., 1900); *Die*

Wiedertäufer (1866), stories; the novels *Die letzten Humanisten* (1880), *Camoëns* (1887), and *Die Ausgestossenen* (1911), a fragment. His selected works appeared in eight volumes (Leipzig, 1908). Stern's real name was Adolf Ernst. Consult Adolf Bartels, *A. Stern, der Dichter und Litterarhistoriker* (Dresden, 1905).

STERN, Daniel. See Agoult, Comtesse d'.

STERN, L. William (1871–). A German psychologist. He was born in Berlin and studied in the university there under Ebbinghaus and Stumpf. In 1897 he became a lecturer at Breslau, where he was associate professor and director of the psychological seminary after 1907. His publications include: *Die Analogie im volkstümlichen Denken* (1893); *Psychologie der Veränderungsauffassung* (1898); *Ueber Psychologie der individuellen Differenzen* (1900); *Die psychologische Arbeit des 19. Jahrhundert* (1900); *Zur Psychologie der Aussage* (1902); *Die Aussage als geistige Leistung und als Verhörsprodukt* (1903); *Helen Keller* (1905); *Person und Sache* (1906); *Monograph über die seelische Entwicklung des Kindes* (2 vols., 1907–08), with his wife, Clara Stern; *Die differentielle Psychologie in ihrem methodischen Grundlagen* (1911); *Die psychologischen Methoden der Intelligenzprüfung* (1912; Eng. trans. by G. M. Whipple as *The Psychological Method of Testing Intelligence,* 1914); *Physiologie der frühen Kindheit bis zum sechsten Lebensjahre* (1914).

STERNBERG, stĕrn′bĕrk. A town in Moravia, Austria, 12 miles north-northeast of Olmütz (Map: Austria, E 2). It is the chief seat of the Moravian cotton and linen industry, and there is a large tobacco factory. Pop., 1910, 14,585.

STERNBERG, Constantin (1852–). A Russian-American pianist and composer, born at St. Petersburg. In 1871 he became conductor of the Court Opera at Strelitz, in 1875 director of the music school, and court pianist at Schwerin. He settled in the United States in 1885, becoming director of the College of Music at Atlanta, Ga. In 1890 he became the head of the Sternberg School of Music in Philadelphia. His compositions include some admirable pianoforte music.

STERNBERG, stĕrn′bĕrg, George Miller (1838–1915). An American army surgeon. Born at Hartwick Seminary, Otsego Co., N. Y., he graduated from the College of Physicians and Surgeons, New York, in 1860, and entered the medical corps of the United States army the following year as assistant surgeon. He rose until he was appointed, in 1893, brigadier general and surgeon general of the army, retiring in 1902. He saw active service in the Civil War with the Army of the Potomac and in the Spanish-American War as commander of the medical service. He also helped suppress cholera and yellow-fever epidemics, being secretary of the Havana Yellow Fever Commission in 1879. In 1898 he was president of the American Medical Association. Sternberg was much interested in bacteriology, to which he made important contributions, such as his discovery (1881), independently of Pasteur (q.v.), of the diplococcus of pneumonia, and the results of his researches in disinfection. He contributed many valuable papers to medical literature. Among his works are: *Photomicrographs* (1879); *Photomicrographs and How to Make Them* (1883); *Malaria and Malarial Diseases* (1884); *Disinfection and Individual Prophylaxis against Infectious Diseases* (1886; Ger. and Sp. trans.); *Immunity* (1895); *A Text Book of Bacteriology* (1896; 2d ed., 1901); *Infection and Immunity* (1903); *Sanitary Lessons of the War and Other Papers* (1912).

STERNE, Carus. See Krause, E. L.

STERNE, Laurence (1713–68). A humorist, born at Clonmel in Ireland. Carried about in the regiment in which his father was an officer, he saw many phases of life in Ireland and England. From 10 to 18 he was at school at Halifax in Yorkshire. Later he went to Jesus College, Cambridge, receiving his degree in 1736. He was ordained two years later, probably with a view to the family living of Sutton, near York, which was immediately given him, followed in 1741 by the prebend in York Minster. In 1743 the living of Stillington, carrying another prebendal stall in the cathedral, was given him. He passed 20 years in his Yorkshire home, preaching curious sermons and reading Cervantes, Rabelais, and old romances. He found himself suddenly famous when the first two volumes of his *Tristram Shandy* appeared at York at the end of 1759, and were announced as published Jan. 1, 1760. He went up to London, became the lion of the moment, and published a collection of sermons. In 1760 he was presented to the living of Coxwold. There he went on with *Tristram,* publishing the ninth and last volume in 1767. During these years he spent much time in London and traveled on the Continent. The outcome of his tour in the autumn of 1765 was *A Sentimental Journey through France and Italy* (1768). Less than a month after its publication Sterne died in a London lodging. In 1775 appeared *Letters to his Intimate Friends,* with the fragment of an autobiography, edited by his daughter; *Letters from Yorick to Eliza* (i.e., Mrs. Elizabeth Draper); and *Twelve Letters to his Friends,* letters iv–ix being of doubtful authenticity.

Sterne's work reached a wide popularity at once, and had a following in England, France, and Germany for years. His sentimentality, the deliberate self-conscious indulgence in feelings of pathos, became the fashion of the day. His work is curiously subjective, dependent upon the moods and whims of the moment; and he has a formless, easy-going style, admirably representing his thought. His characters are remarkable for their genuine human quality, remote as they live from the interests of the ordinary people of the time, and belong to the small class of positive creations in literature.

Bibliography. W. M. Thackeray, in *English Humourists of the Eighteenth Century* (London, 1853; new ed., New York, 1911); Percy Fitzgerald, *Life of Laurence Sterne* (London, 1864; 2d ed., ib., 1896); Paul Stapfer, *Laurence Sterne, sa personne et ses ouvrages* (2d ed., Paris, 1882); H. D. Traill, *Laurence Sterne,* "English Men of Letters" (London, 1882); Texte, *Rousseau et le cosmopolitisme littéraire au XVIIIème siècle* (Paris, 1895); H. W. Thayer, *Laurence Sterne in Germany* (New York, 1905); P. E. More, *Shelburne Essays* (3d series, ib., 1905); W. L. Cross, *Life and Times of Sterne* (ib., 1909); W. S. Sichel, *Sterne: A Study* (ib., 1910); L. S. Benjamin, *Life and Letters* (2 vols., ib., 1912). His works, first collected in 1779, were edited, with newly discovered letters, by J. P. Browne (London, 1873). A less complete edition was edited by G. Saintsbury (ib., 1894).

STERNE, Simon (1839–1901). An American economist and lawyer, born in Philadelphia. He studied at Heidelberg and at the University of Pennsylvania (LL.B., 1859), and was admitted to the New York bar in 1860. Beside serving as counsel for corporate interests, he was active in social and political reform movements, edited the *Commercial Advertiser* in 1867, and in 1870 was secretary of the Committee of 70 that overthrew the Tweed Ring. He served on various commissions, State and national, relating to problems of government and public utilities. His publications include: *On Representative Government and Personal Representation* (1871); *Constitutional History and Political Development of the United States* (1882; 4th rev. ed., 1888); *Railways in the United States* (1912), posthumously collected papers.

STERNEGG, Karl Theodor von Inama-. See Inama-Sternegg, K. T. von.

STERN'ER, Albert Edward (1863–). An American painter, lithographer, and illustrator. He was born in London and studied at Birmingham, and in Paris under Boulanger, Lefebvre, and Gérôme. In 1881 he came to America, settling in New York in 1885. Possessed of great versatility, he used all mediums with equal success, his red chalk and other drawings displaying dashing technique and facility of execution. Good examples are: "Amour Mort," a lithograph; "La Surprise," a series of red-chalk portraits including Mrs. Catherine Gardner Boyer (1912); "Portrait of my Son" and "In the Studio," both oil paintings. He became an Associate of the National Academy of Design, and instructor at the Art Students' League and in the New York School of Applied Design.

STER'NUM (Neo-Lat., from Gk. *στέρνον*, breastbone), or Breastbone. A narrow flat bone in the median line of the chest in front, giving attachment to the first seven ribs through the costal cartilages and thus closing anteriorly the thoracic cavity. In the adult it consists of three parts, the upper or manubrium, the middle or gladiolus, and the inferior or ensiform. A sternum is not present in fishes, batrachians, or serpents, but it does occur in all warm-blooded vertebrates and reaches its highest development in the flying birds, where a heavy ridge or keel furnishes attachment for the powerful muscles of the wings. In the tortoise it is represented by the lower shell or plastron. See Skeleton.

STERNU'TATORIES. See Errhines.

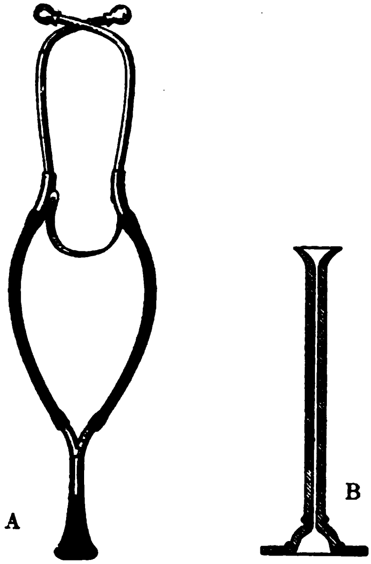
STER'RETT, John Robert Sitlington (1851–1914). An American classical scholar, born at Rockbridge Baths, Va. He was educated at the University of Virginia and in Europe. Later he engaged in important archæological expeditions in Asia Minor, the results of which were published in the papers of the American School at Athens under the titles *Wolf Expedition to Asia Minor* (1885), *Epigraphical Journey in Asia Minor* (1888), and also in *Leaflets from the Notebook of a Traveling Archæologist* (Texas, 1889). After holding professorships of Greek at Miami University and the University of Texas, he was called in 1892 to a similar position at Amherst College; in 1901 he became head of the department of Greek in Cornell University. In 1896–97 he was professor in the American School of Classical Studies at Athens. His writings, besides those mentioned, include: *Qua in re Hymni Homerici quinque maiores inter se differunt* (1881); *Inscriptions of Assos; Inscriptions of Tralles* (1885); *The Torch-Race* (1902); school edition of part of the *Iliad* (1907); *A Call of Contemporary Society for Research in Asia Minor and Syria* (1911). Sterrett had begun also a translation of Strabo (q.v.) for the Loeb Classical Library.

STER'RY, Joseph Ashby-. See Ashby-Sterry, Joseph.

STESICHORUS, stē-sĭk'ō-rŭs (Lat., from Gk. *Στησίχορος*) (c.640–555 b.c.). A famous Greek lyric poet, born in the Locrian Mataurus in Italy, but considered a Himeræan, since he spent the greater part of his life in Himera, Sicily. It is reported that he was at first the friend of Phalaris, the tyrant of Agrigentum, but that later, recognizing the cruel character of that tyrant, he warned his fellow citizens against his schemes by telling them the fable of the horse that, as the result of his efforts to avenge himself on the stag that had intruded upon its pasture, became subject to man. The Himeræans did not listen, and he was compelled to flee to Catania, where he died. The Himeræans, however, in later times honored him with a statue, which was seen by Cicero; his figure was also stamped on their coins. A famous story relates that Stesichorus was struck with blindness because of his attack on Helen, but recovered his sight after he had published a recantation in which he declared it was only the shade of Helen, not Helen herself, that went to Troy.

In his hands the religious hymn was somewhat secularized. The content also was epic, although the form continued to be that which had been established for melic verse. He treated in his *Destruction of Troy* the story of Æneas' wanderings, which thereafter was established in literary tradition. He also employed folk tales and was the forerunner of the Greek romance in that he established in Greek literature the impersonal love poem, and he was the first to give literary treatment to the Sicilian story of Daphnis, later handled by Theocritus and other bucolic poets. His dialect was a combination of epic with Doric. He also contributed to the development of the strophic and epodic structure of lyric poetry. His poems were written in strophe, antistrophe, and epode, and this arrangement became the norm for lyric poetry, which was thereafter changed only in minor details. The fragments are published by Bergk, *Poetæ Lyrici Græci* (Leipzig, 4th ed., 1882; reprinted, 1914). Consult: Welcker, *Stesichorus' Kleine Schriften* (Bonn, 1884); G. S. Farnell, *Greek Lyric Poetry* (London, 1891); Rizzo, *Questioni Stesichoree* (Messina, 1895); H. W. Smyth, *Greek Melic Poets* (London, 1900); W. C. Wright, *A Short History of Greek Literature* (New York, 1907); Christ-Schmid, *Geschichte der griechischen Litteratur*, vol. i, part i (6th ed., Munich, 1912).

STETH'OSCOPE (from Gk. *στῆθος*, *stēthos*, breast + *σκοπεῖν*, *skopein*, to view). An instrument for examining the heart and lungs through their sounds. In its simplest form, invented by Laennec (q.v.), the stethoscope consists of a tube of wood, from 10 to 12 inches long, with a flanging end to be placed on the chest to receive the sound, an open canal to conduct it, and a broad flat earpiece at the other end for apposition to the ear and excluding extraneous sounds. (See Fig. B.) An improvement upon this is the binaural stethoscope, introduced by Dr. Camman, of New York, in the form of a binaural or double instrument having an earpiece for each of the ears and flexible rubber tubes connecting them with the chest piece. (See Fig. A.) A still finer instrument is the phonendoscope (q.v.), which conveys sounds with greater minuteness and intensity. See AUSCULTATION; RESPIRATORY SOUNDS.



STETHOSCOPE.

A, stethoscope with ear tubes; B, older form.

STET′SON, AUGUSTA E(MMA), (*née* SIMMONS) (?–). An American Christian Science leader, born at Waldoboro, Me. She studied at the Blish School of Oratory in Boston, and in 1884 received the degree of Doctor of Christian Science (C.S.D.) from the Metaphysical College. She then began Christian Science healing in Boston, and in 1885 led the service on alternate Sundays at Chickering Hall. The next year she was sent by Mrs. Eddy to New York City, where she organized the First Church of Christ, Scientist, in 1887. She was appointed pastor of that church (1888) and in 1895 was made first reader when the title of pastor was changed in all Christian Science churches. For a time she was also principal of the New York City Christian Science Institute (chartered 1891). Mrs. Stetson raised more than $1,250,000 to rebuild a structure for the use of the First Church, and in 1903 it was dedicated free of debt. In 1909 she was excommunicated by the Mother Church at Boston, on charges of insubordination and of false teaching. She published: *Poems* (1901; 2d ed., 1910); *Reminiscences, Sermons, and Correspondence* (1913); *Vital Issues in Christian Science* (1914).

STETSON, FRANCIS LYNDE (1846–). An American lawyer. He was born at Keeseville, N. Y., and graduated at Williams College in 1867, afterward taking a law course in Columbia University. He was admitted to the bar in 1869 and practiced in New York City. He devoted attention chiefly to corporation and railway law, becoming eminent in those lines. He became general counsel of the United States Steel Corporation, the International Mercantile Marine Company, the Northern Pacific Railway, the Southern Railway, and the United States Rubber Company; also director in several railway companies and other corporations.

STETSON UNIVERSITY. See JOHN B. STETSON UNIVERSITY.

STETTIN, shtĕt-tēn′. The capital of the Province of Pomerania, Prussia. The city is situated on both banks of the Oder, 17 miles south of the Stettiner Haff, an inlet of the Baltic, and 83 miles by rail northeast of Berlin (Map: Germany, F 2). The district on the right bank of the river comprises the former suburbs of Lastadie and Silberwiese. The main part of the city is on the left bank of the river; the site is hilly, and consequently the streets are uneven, but the houses are well built. The extensive fortifications were demolished in 1874. The castle, dating from 1577, formerly occupied by the dukes of Pomerania, is now a government building. The Königs-Thor and the Berlinger Thor, remains of the old fortifications, are interesting sandstone gates built by Frederick William I. St. James is an imposing thirteenth-century church, restored in 1897; St. Peter and St. Paul is the oldest church in Pomerania, restored in 1816–17; and the fine Roman Catholic church (1890) is noteworthy.

Stettin is the most important manufacturing city in Pomerania. Its principal industrial establishment is the Vulcan shipbuilding yard, employing over 8000 men and covering 70 acres. The clothing industry ranks second in importance only to shipbuilding, and employs over 10,000 men, women, and children. There are numerous large factories of chemicals and cement, locomotives, anchors, bicycles and sewing machines, soap and candles, sugar, paper, glass, etc. A new harbor on the east bank of the Oder was opened in 1900; its area is 150 acres, and its quays have a length of over 14,000 feet. This, together with the deepening of the Oder to the Stettiner Haff (1903), enabling large vessels, which formerly stopped at Swinemünde, to reach the city, has made Stettin the fourth port of Germany. It has direct steamship communication with New York, London, and other foreign cities. The chief exports are grain, spirits, lumber, sugar, chemicals, and cement; the imports, iron, petroleum, wine, groceries, and coal. Pop., 1890, 116,228; 1900, including annexed suburbs, 210,680; 1910, 236,113.

Stettin is of Slavic origin. It first came into notice in the twelfth century. As a member of the Hanseatic League it became a flourishing commercial town. It belonged to Sweden from 1648 until 1720, when it passed to Prussia. It was held by France from 1806 to 1813. Consult W. H. Meyer, *Stettin in alter und neuer Zeit* (Stettin, 1887).

STEUBEN, stū′bĕn; *Ger. pron.* shtoi′ben, FRIEDRICH WILHELM VON, BARON (1730–94). A German-American soldier, born at Magdeburg, Prussia. He was educated at the Jesuit colleges of Neisse and Breslau, and at the age of 14 served as a volunteer under his father at the siege of Prague (q.v.). In 1747 he was appointed cadet of infantry, and in 1758, after promotions, became an adjutant general with the rank of captain. He fought with distinction in the Seven Years' War, at its end becoming grand marshal of the Prince of Hohenzollern-Hechingen, in which position he remained until about 1774. In 1777 Saint-Germain, the French Minister of War, induced him to go to America, and he arrived at Portsmouth, N. H., in the beginning of 1778. He immediately offered his services as a volunteer to Congress and was directed to join the army at Valley Forge. This he did Feb. 23, 1778, and in May, 1778, he was appointed instructor general of the Continental army with the rank of major general. He devoted himself to the task of reorganizing the army on the European model, drilling untrained soldiers and introducing system. He increased the general efficiency of the army, contributing greatly to the success of ensuing campaigns. At Monmouth he rendered valuable service, and in 1780 he was sent with a separate command to coöperate with General Greene in Virginia, where he opposed the marauding expedition of Benedict Arnold, and finally took an active part in the siege of Yorktown. In 1780 he prepared a manual for the army which came into general use. After the war he received grants of land from several States, and finally Congress voted him a tardy pension of $2400. For several years he lived in New York City and then removed to the tract of land (Steuben Township) granted to him by New York, where he lived in a log cabin (near the site of the present Utica) until his death, Nov. 28, 1794. A monument to Baron Steuben was unveiled at Utica, N. Y., Aug. 3, 1914. Friedrich Kapp has written the most trustworthy biography (New York, 1859).

STEUBENVILLE, stū'ben-vĭl. A city and the county seat of Jefferson Co., Ohio, 43 miles west by south of Pittsburgh, Pa., on the Ohio River and on the Pennsylvania, the Wheeling and Lake Erie, and the Pittsburgh, Cincinnati, Chicago, and St. Louis railroads (Map: Ohio, J 5). It is favorably situated for commerce and industry. Noteworthy features are the Carnegie Library, city hall, courthouse, Gill and Ohio Valley hospitals, Stanton Park, and the Y. M. C. A. building. The surrounding region has coal deposits, natural gas, and petroleum wells. There are manufactures of iron and steel, glassware, chimneys and electric-light bulbs, paper, foundry and machine-shop products. The water works are owned and operated by the municipality. Pop., 1900, 14,349; 1910, 22,391; 1915 (U. S. est.), 26,631. A fort named in honor of Baron Steuben was erected here in 1787. Consult Howe, *Historical Collections of Ohio* (Columbus, 1890–91).

STEUNENBURG, stoi'nen-bûrg, Frank (1861–1905). An American governor, born at Keokuk, Iowa. Moving to Caldwell, Idaho, in 1887, he engaged in newspaper work, was chosen to the State Legislature in 1890, and, having been elected on the Populist ticket, served as Governor of Idaho from Jan. 1, 1897, to Dec. 31, 1900. His handling of the miners' strike which occurred in his administration aroused great hostility among the miners, and led to his assassination by Harry Orchard (q.v.) in 1905. See also Haywood, William D., and Idaho, *History*.

STEVAERTS, stā'värts. See Palamedesz.

STE'VENS, Abel (1815–97). A Methodist Episcopal clerical writer. He was born at Philadelphia and entered the New England conference (1834). He was editor of *Zion's Herald* (Boston, 1840–60), of the *National Magazine* (New York, 1852), of the *Christian Advocate* (ib., 1856–60), corresponding editor of the *Methodist* (ib., 1860–74). He was the author of *Memorials of the Introduction of Methodism into the Eastern States* (1852), *Memorials of the Early Progress of Methodism in the Eastern States* (2d series, 1854), *The History of the Religious Movement of the Eighteenth Century Called Methodism* (3 vols., 1858–61), *History of the Methodist Episcopal Church in the United States of America* (4 vols., 1864–67), *Supplementary History* (1899), *Madame De Stäel: A Study of her Life and Times* (2 vols., 1880), *Christian Work and Consolation* (1882).

STEVENS, Alfred (1828–1906). An eminent Belgian genre painter. His father had been an officer in the service of William I of the Netherlands. He was born at Brussels, studied there under Navez, and in Paris with Roqueplan and at the Ecole des Beaux-Arts under Ingres. He first exhibited in Brussels, but in 1849 settled at Paris, where he spent the remainder of his life, a notable figure. Among his works are the "Discouragement of the Artist" and "Love of Gold" (1853); "Masquerade on Ash Wednesday" (1853, Marseilles Museum); "Consolation" (1857, Ravené Gallery, Berlin); "The Lady in Pink," "The Japanese Robe," "Preparing for the Ball," "The Morning Call," and "Ready for the Fancy Ball" (all in the Metropolitan Museum, New York). His most characteristic subjects depict interiors of modern houses as background for the figures of women and children of fashionable life. He revels in painting Oriental furniture and rich stuffs, securing remarkable effects of texture and rich, scintillating color. He is master of an impeccable technique and an amazing perfection of finish, but errs sometimes in overcrowded detail and lack of unity in composition. His management of tone and light is scientific, yet admirable. He was the painter par excellence of women, endowing them with the quality of charm, to which is added a reserve of expression and a refinement and grace not shown by the ultramoderns in his genre. Stevens received many prizes, medals, and various foreign orders and was an Officer of the Legion of Honor. In 1911 an interesting exhibition of his work was held in New York. He published *Impressions on Painting* (Eng. trans., New York, 1886). Consult Camille Lemonnier, *Alfred Stevens* (Brussels, 1906).

STEVENS, Alfred George (1818–75). An English sculptor. He was born at Blandford in Dorset, the son of a house painter, and received his artistic training, chiefly under Thorvaldsen, during a nine years' stay in Italy. Returning to England in 1842 he was employed as a teacher and as a designer of metal articles. He is celebrated for his designs for articles of daily use, executed in exquisite classical taste, as well as for more ambitious efforts like the vases decorating the railing in front of the British Museum, and the lions on the posts, since placed in the Museum; the mantelpiece in the dining room of Dorchester House, Park Lane; and the mosaics designed to fill the spandrels under the dome of St. Paul's. His greatest achievement, however, is the Duke of Wellington monument in St. Paul's Cathedral, probably the finest work of its kind in England. From 1856 his life was devoted to its accomplishment, although he did not live to see it placed in its final position. The monument is marked by vigorous and original execution, and by great dignity and unity of design. The two powerful groups of "Truth Tearing Out the Tongue of Falsehood" and "Valor Triumphing Over Cowardice," which decorate the canopy above the edifice are comparable to the best work done in sculpture. He was almost unrecognized and little appreciated by the British public. Although his training was classical, his work is strikingly free from the mannered classicism of his day, and he was unquestionably the greatest sculptor of the period in England. Consult H. Stannus, *Alfred Stevens and his Work* (London, 1891).

STEVENS, Benjamin Franklin (1833–1902). An American bibliographer, born at Barnet, Vt. He joined his brother Henry in London in 1860, for many years had charge of the Chiswick Press, acted as agent for American libraries, and United States dispatch agent. For over 30 years he and his agents searched the archives of England, France, Holland, and Spain for papers relating to America. His publications include: *American Manuscripts in European Archives* (1887); *Campaign in Virginia in 1781* (1888); *Facsimiles of Manuscripts in European Archives Relating to America, 1773–83* (25 vols., 1889–98); *Gen. Sir William Howe's Orderly Book at Charlestown, Boston, and Halifax* (1890); *Columbus, his Own Book of Privileges, 1502* (1893); *Introduction to Calendar of American Papers in the Earl of Dartmouth's Collection* (1895).

STEVENS, Ebenezer (1751–1823). An American soldier, born in Boston, Mass. He enlisted as a lieutenant in a Rhode Island artillery regiment in May, 1775, and by successive promotions rose to the rank of lieutenant-colonel in April, 1778, serving in the expedition against Quebec (1775), and commanding the artillery at Ticonderoga, at Freeman's Farm, and, for a time, at Yorktown. He was one of the founders of the Society of the Cincinnati, became prominent as a merchant in New York, and was made a major general of militia.

STEVENS, Edward (1745–1820). An American soldier. He was born in Culpeper Co., Va., became colonel of Virginia militia early in 1775, was in command at the skirmish at Great Bridge (Dec. 9, 1775), saved part of Washington's army from capture at Brandywine (Sept. 11, 1777), served with gallantry and marked ability at Germantown, Camden, and Guilford Court House, and became a brigadier general of militia in 1779.

STEVENS, Edwin Augustus (1795–1868). An American capitalist, railroad organizer, and shipbuilder, born at Hoboken, N. J. With his brothers J. C. Stevens and Robert L. Stevens (q.v.) he succeeded to the large shipping and railroad interests of their father, John Stevens (q.v.), and became one of the most prominent railroad organizers in the United States. J. C. and E. A. Stevens assisted their brother in the design and construction of a high-speed, iron-hulled, seagoing ironclad of 6000 tons and 15¾ knots (estimated) speed. This vessel was authorized by Congress and her keel was laid in 1854, but she was never completed, She is commonly, but erroneously, called the *Stevens Floating Battery*. After the death of Robert, the work was directed by E. A. Stevens. About 1863 the United States government relinquished its claim on the vessel. Mr. Stevens continued its construction until his death in 1868, and in his will he left $1,000,000 for its completion, directing that it should be given, when finished, to the State of New Jersey. The bequest was expended without achieving its object; and, pursuant to subsequent litigation instituted by the heirs of the Stevens estate, the uncompleted ship was sold for old iron in 1880. Another vessel built by E. A. Stevens, the *Naugatuck*, was accepted by the Federal government and was used during the Civil War. He founded the Stevens Institute of Technology (q.v.).

STEVENS, Frank Lincoln (1871–). An American plant pathologist, born near Syracuse, N. Y. He was educated at Hobart and Rutgers colleges, at Ohio State University, at the University of Chicago (Ph.D., 1900), and at Bonn and Halle. He was professor of botany and vegetable pathology in 1902–12 at the North Carolina College of Agriculture and Mechanical Arts, and for some years was biologist of the North Carolina Agriculture Experiment Station. In 1912–14 he was dean of the College of Agriculture and Mechanical Arts in the University of Porto Rico, and thenceforth held the chair of plant pathology at the University of Illinois. In 1910 he served as president of the American Phytopathological Society. He is coauthor of *The Hill Readers* (1906); *Practical Arithmetic* (1909); *Diseases of Economic Plants* (1910); *The Fungi which Cause Plant Disease* (1913).

STEVENS, George Barker (1854–1906). An American theologian, born at Spencer, Tioga Co., N. Y. He graduated at the University of Rochester in 1877 and at Yale Divinity School in 1880. He was pastor of the First Congregational Church in Buffalo (1880–82) and of the First Presbyterian Church in Watertown, N. Y. (1882–85), and then, after a year's study at Jena, became professor of New Testament criticism and interpretation at Yale; in 1895 he was transferred to the chair of systematic theology. He wrote *The Pauline Theology* (1892); *The Johannine Theology* (1894); *A Short Commentary on Galatians* (1894); *The Messages of Paul* (1900; new ed., 1912); *The Messages of the Apostles* (1900; 2d ed., 1911); *The Teaching of Jesus* (1901; 2d ed., 1909); *The Christian Doctrine of Salvation* (1905).

STEVENS, Henry (1819–86). An American bibliographer, born at Barnet, Vt. He graduated at Yale in 1843 and studied law at Harvard. He visited England in search of Americana in 1845, and remained there, acting as purchasing agent for the British Museum and for many libraries, public and private, among which was the Lenox Library of New York, whose collection of Americana he formed. He published bibliographical catalogues and pamphlets, prized for their minute accuracy, and made a collection of Franklin documents which was purchased by the United States government. Of his numerous publications the more noteworthy are: *Catalogue Raisonné of English Bibles* (1854); *Catalogue of American Books in the Library of the British Museum* (1857); *Bibliotheca Americana* (1861); *Bibliotheca Historica* (1870); *Historical Collections* (1881–86); *Who Spoils our New English Books* (1885); *Recollections of James Lenox* (1886).

STEVENS, Isaac Ingalls (1818–62). An American soldier and administrator, born at North Andover, Mass., and graduated at West Point in 1839. He joined General Scott's army in Mexico as adjutant of engineers in 1847, and was in its important engagements. In 1849 he became assistant in charge of the United States Coast Survey office at Washington, but resigned from the army in 1852 to accept the governorship of Washington Territory. In 1855 the Washington Indians revolted. Stevens at once suppressed the insurrection, and arrested Chief Justice Lander, who had issued writs of habeas corpus for Indian prisoners. On the outbreak of the Civil War he was commissioned colonel of the Seventy-ninth New York Volunteers, and later was promoted to the rank of brigadier general. He took part at Stone River and Secessionville. On July 4, 1862, he was promoted to the rank of major general, and during August took part in the campaign in northern Virginia, fighting at the second battle of Bull Run and at Chantilly. At the latter, while leading a charge, he was killed, Sept. 1, 1862. He published *Campaigns of the Rio Grande and Mexico* (1851).

STEVENS, John (1749–1838). An American inventor, engineer, and steamboat builder. He was born in New York City, and in 1768 graduated at King's (now Columbia) College. He then studied law, and in 1771 was admitted to the bar. In 1790 he petitioned Congress for legislation for the protection of American inventors, and through his efforts a bill was passed which laid the foundations for the present patent system of the country. In 1788 he began experiments as to the motive power of steam, and in 1792 took out two patents for marine engines under the new law. Subsequently, with Nicholas Roosevelt and Robert R. Livingston, he built a steamboat, and sought from the New York State Legislature the exclusive right of navigation of the Hudson River, but his boat, completed in 1801, failed to fulfill the speed conditions imposed, and Livingston later became associated with Fulton in his successful attempt. In 1804 he built a twin-screw steamship, and in 1807, with his son R. L., built the paddle-wheeled steamboat *Phœnix*, which was in successful operation only a few days after Fulton's *Clermont*. The *Phœnix* was shut out by the monopoly of Fulton and Livingston, but was operated for six years on the Delaware River, to reach which the *Phœnix* sailed around from New York City, being thus the first steamship to navigate the ocean successfully. In October, 1811, he established the first steam ferry in the world (Hoboken to New York City). He invented many improvements in boat and engine construction, and designed in 1812 a circular ironclad floating battery for harbor defense. In 1826 he constructed a locomotive model of his own, which he exhibited in operation in Hoboken—said to have been the first locomotive ever to run on a track in America. See Armor Plate.

STEVENS, John Austin (1795–1874). An American banker and financier, born in New York City. He graduated at Yale in 1813 and in 1818 became a partner in the extensive mercantile business of his father, Ebenezer Stevens, in New York City. During the Civil War he was one of the principal financial advisers of the government, and his greatest public service was rendered as chairman of the famous "treasury notes committee" of New York, Boston, and Philadelphia bankers, which played a prominent part in placing the first 7-30 and later war loans.

STEVENS, John Austin (1827–1910). An American author, born in New York City. He graduated at Harvard in 1846; was secretary to the New York Chamber of Commerce from 1862 to 1868; and later was for some years librarian of the New York Historical Society. He founded the Society of the Sons of the Revolution and the Loyal League. In 1877 he established the *Magazine of American History*, of which he was the editor until 1883. His publications include: *The Valley of the Rio Grande* (1864); *Colonial Records of the New York Chamber of Commerce* (1867); *The Expedition of Lafayette against Arnold* (1878); *Life of Albert Gallatin* (1884), in the "American Statesmen Series"; *New York City in the Nineteenth Century* (1901).

STEVENS, John F. (1853–). An American civil and railroad engineer and executive. He was born at West Gardiner, Me., and after a course of technical training was assistant engineer of the city of Minneapolis (1874–76). Thereafter till 1889 he was connected, as an engineer, with various railways. He then saw service with the Great Northern, being its general manager in 1902–03, and with the Chicago, Rock Island, and Pacific Railway, of which he was second vice president in 1904–05. From his activity as a railway engineer Stevens was called in 1905 to be chief engineer of the Panama Canal (q.v.), and he was largely responsible for the plans which were followed in the construction of that waterway. He resigned April 1, 1907. In February–March of that year he was also chairman of the Isthmian Canal Commission. Subsequently he was vice president of the New York, New Haven, and Hartford Railroad in charge of operation until 1909, and president of several railways in the Northwest in 1909–11.

STEVENS, John Leavitt (1820–95). An American journalist and diplomat, born at Mount Vernon, Me. In 1855 he became associate editor of the Kennebec (Me.) *Journal*, and in 1857 chief editor of the paper. He was an advocate of the Republican party, which he helped to organize in Maine. He was Minister Resident to Uruguay and Paraguay in 1870–73, to Sweden and Norway in 1877–83, and to the Hawaiian Islands, his title being changed to Minister Plenipotentiary in 1890, after a year at this last post. Upon the outbreak of a revolution against the royal government in 1893 and the establishment of a provisional government (see Hawaiian Islands; *History*) Stevens established a protectorate over the islands. This action was disavowed by the Secretary of State of the United States, and subsequently Stevens was recalled; but he was exonerated by the Senate. His publications include a scholarly *History of Gustavus Adolphus* (1884) and *Picturesque Hawaii* (1894).

STEVENS, Lillian M. N. (1844–1914). An American temperance worker, born at Dover, Me. She was educated at Foxcroft Academy, taught school for a time, and was married to Michael Stevens of Portland, Me., in 1867. In 1874 she assisted in organizing the Maine Woman's Christian Temperance Union, of which she was treasurer in 1874–77 and thenceforth president until her death. She was vice president of the National W. C. T. U. in 1894–98, and after the death of Miss Frances Willard (q.v.) in the latter year was its president until her own death. Mrs. Stevens was a lady manager of the Chicago Exposition in 1892–93, and served as Maine representative on the National Conference of Charities and Correction for many years. In 1911 she received the honorary degree of A.M. from Bates College. Selections from her addresses were published in 1914.

STEVENS, Phineas (1707–56). A colonial soldier in America, born at Sudbury, Mass. About 1711 he removed with his father to Rutland, N. H. (now in Vermont), and in 1723 was a captive for a time among the Abnaki Indians on the St. Francis River. He was one of the pioneer settlers of "Township No. 4" (now Charlestown, N. H.), and in April, 1747, during King George's War, as commandant of the fort there, repelled the attack of 400 French and Indians under Niverville. He was twice (1749 and 1752) sent to Canada to negotiate an exchange of prisoners. The journal kept by him during his first trip to Canada is printed in the *New Hampshire Historical Collections*, vol. v, and that kept during his second trip is printed in *Travels in the American Colonies*, edited by N. D. Mereness (New York, 1916).

STEVENS, Robert Livingston (1787–1856). An American inventor and marine engineer, son of John Stevens (q.v.), born in Hoboken, N. J. He applied the wave line to shipbuilding, invented a percussion shell (the rights to which were bought by the government), was one of the first to use anthracite coal in steam navigation, and introduced many improvements in the construction of steamships and marine engines. In 1842 he was commissioned by the government to build the first ironclad warship ever constructed, generally known as the *Stevens Floating Battery*, but he died without completing it. See Stevens, Edwin Augustus.

STEVENS, Thaddeus (1792–1868). An American statesman and congressional leader, born at Danville, Vt., April 4, 1792. He graduated at Dartmouth College in 1814; taught school in York, Pa., and studied law; began to practice in Gettysburg, and removed to Lancaster, Pa., in 1842. In 1833 he served in the State Legislature, and was an early advocate of negro suffrage. Stevens affiliated with the Anti-Masonic party (see Anti-Masons), and was active at its Baltimore convention in 1831; but from the time of his election to the Legislature he acted with the Whigs. His career in the Legislature was varied, but indicative of his energy and ability; he conquered the "machine" in his own party, and in December, 1849, took his seat in Congress. During two terms there he opposed not only the Fugitive Slave Law, but also every form of concession to the South. He took a leading part in the formation of the Republican party in Pennsylvania. After an interval of six years devoted to the practice of law he returned to Congress in 1859, and from then until his death was the recognized leader of the House of Representatives, being chairman of the Committee on Ways and Means throughout the war, and later chairman of what was then the equally important Committee on Reconstruction. He was regarded as the most radical antislavery advocate in Congress, and was the most powerful opponent of the presidential plan of reconstruction. Stevens was one of the authors of the so-called Wade-Davis Reconstruction Bill of 1865 and reported the Reconstruction Act of 1867 from the committee of which he was chairman. (See Reconstruction.) He was chairman of the House committee in charge of the impeachment of President Johnson (q.v.). He died at Washington, Aug. 11, 1868. Consult E. B. Callender, *Thaddeus Stevens* (Boston, 1882), and S. W. McCall, *Thaddeus Stevens*, in "American Statesmen Series" (ib., 1909). See also Woodburn, *Thaddeus Stevens* (Indianapolis, 1913).

STEVENS, Walter Le Conte (1847–). An American physicist. He was born in Gordon Co., Ga., graduated from the University of South Carolina in 1868, and later studied at Strassburg, Berlin, and Zurich. After teaching for several years in the South he was an instructor at Cooper Institute, New York, and professor successively at Packer Institute, Rensselaer Polytechnic Institute, and Washington and Lee University (from 1898). Stevens made special researches in physiological optics and acoustics. He revised Steele's *Physics* (1886), and contributed to works of reference and to scientific journals.

STEVENS, William Arnold (1839–1910). An American philologist and Baptist theologian, born at Granville, Ohio. He graduated from Denison University in 1862 and then studied at the Rochester Theological Seminary, and later at Harvard, Leipzig, and Berlin. From 1877 until his death he was professor of New Testament interpretation at the Rochester Theological Seminary. His publications include: *Select Orations by Lysias* (1876); *Commentary on the Epistles to the Thessalonians* (1887); *Outline Handbook of the Life of Christ* (1892), with E. D. W. Burton; *A Harmony of the Gospels for Historical Study* (1894; 3d ed., 1905), also with Burton; *Life of the Apostle Paul* (1894).

STEVENS INSTITUTE OF TECHNOLOGY. An engineering school founded in 1870, in Hoboken, N. J., by Edwin A. Stevens, who bequeathed to it a block of land and $650,000. The school was opened for instruction in 1871, with Henry Morton as first president. The courses include training in applied mathematics, theory of machine construction, mechanical drawing and designing, shop practice in experimental mechanics, physics, chemistry, and applied electricity. English branches and modern languages are also taught. Admission to the institute is by examination only. The only degree conferred is that of Mechanical Engineer. In 1915 the endowment was $1,425,000; the annual income about $190,000. The ground and buildings were valued at $500,000 with a total estimated value of $2,600,000 for the property under the control of the institute. There were in 1915–16 453 students with 37 instructors. In the academic department there were 238 students with 13 instructors. The library contained about 11,000 volumes. Alexander C. Humphreys became president in 1901.

STE'VENSON, Adlai Ewing (1835–1914). An American politician, Vice President of the United States in 1893–97. He was born in Christian Co., Ky., educated at Centre College, Danville, Ky., but removed with his parents to Bloomington, Ill., before graduating. At Bloomington he studied law and in 1857 was admitted to the bar. He was a master in chancery (1860–64), became prominent in Democratic local politics, and was a member of the 44th Congress (1875–77), and of the 46th Congress (1879–81). As First Assistant Postmaster-General during Cleveland's first administration he antagonized civil-service reformers by his sweeping removals. In 1892 he was in the Illinois delegation to the Democratic Convention by which he was nominated for Vice President on the Cleveland ticket, which was elected. In 1897 he was appointed by President McKinley a member of the bimetallic commission sent to Europe. In 1900 he was again the candidate of the Democratic party for Vice President and in 1908 the Democratic candidate for Governor of Illinois.

STEVENSON, Edward Luther (1860–). An American cartographer and historian, born at Rozetta, Ill. He graduated from Franklin (Indiana) College and then studied at Johns Hopkins, Jena, Halle, and Heidelberg (Ph.D., 1891). He was professor of history at Rutgers College from 1891 to 1910, when he was appointed secretary of the Hispanic Society of America. In 1913 he was decorated Knight of the Royal Order of Isabella the Catholic of Spain, in recognition of his achievements in cartography, a subject on which he became the leading American authority. His publications include: *Maps Illustrating the Early Exploration and Discovery of America, 1502–1530* (1903–06); *The Marine World Chart of Nicolo de Canerio Januensis* (1908); *Early Spanish Cartography of the New World* (1909); *Atlas of Portolan Charts* (1911); *Willem Janszoon Blaeu, 1571–1638* (1914); *Portolan Atlas Joan Martines en Messina ano 1582* (1915).

STEVENSON, John James (1841–). An American geologist, born in New York City. He graduated in 1863 at New York University, where, after two years (1869–71) as professor of chemistry at West Virginia University, he served as professor of geology until 1909. In 1873–74 and 1878–80 he was geologist on the United States Geological Survey. He also served on the Pennsylvania Geological Survey in 1875–78 and in 1881–82. He was president of the Geological Society of America in 1898. His publications include: *The Geology of a Portion of Colorado Explored and Surveyed in 1873* (1875); *Report of Progress in the Greene and Washington District of the Bituminous Coal Fields of Western Pennsylvania* (1876); *Report upon Geological Examinations in Southern Colorado and Northern New Mexico during 1878 and 1879* (1881); *Origin of the Pennsylvania Anthracite* (1893); *Carboniferous of the Appalachian Basin* (1903–07); *Formation of Coal Beds* (1911–13); and many other contributions of permanent importance.

STEVENSON, Joseph (1806–95). A Scottish historian and antiquary, born at Berwick-upon-Tweed. In 1834 he became a subcommissioner of the public records, London. He was ordained a priest in the Church of England (1839), but his studies in the Reformation period of English history led him to the Roman Catholic church (1863). In 1877 he entered the Society of Jesus. At the suggestion of Stevenson, the English government began in 1857 the valuable *Chronicles and Memorials of Great Britain and Ireland,* otherwise known as the *Rolls Series.* The government also sent him to Rome in 1872 to make an exhaustive examination of the Vatican archives. The 13 volumes of his manuscript still remain unpublished in the Public Record Office. Stevenson edited nearly 50 works for the leading learned societies, among the most important of which are eight volumes of *The Church Historians of England* (1853–56), and the *History of Mary Stewart* by her secretary Claude Nau (1883).

STEVENSON, J(oseph) Ross (1866–). An American Presbyterian minister and educator, born at Ligonier, Pa. He graduated from Washington and Jefferson College in 1886 and from McCormick Theological Seminary in 1889, and studied at the University of Berlin in 1889–90. After a Western pastorate he was adjunct professor (1894–97) and professor (1897–1902) of ecclesiastical history at McCormick. He was minister of the Fifth Avenue Presbyterian Church, New York, in 1902–09, and of the Brown Memorial Church, Baltimore, in 1909–14. In the latter year he succeeded F. L. Patton as president of Princeton Theological Seminary. In 1915 he was elected moderator of the General Assembly of his church.

STEVENSON, Matilda Coxe (*née* Evans) (1855–1915). An American ethnologist, born at San Augustine, Tex. In 1872 she was married to James Stevenson, an ethnologist (died 1888), with whom she spent 13 years in explorations of the Rocky Mountain region. After 1889 she was on the staff of the Bureau of American Ethnology of the Smithsonian Institution. Mrs. Stevenson explored the cave, cliff, and mesa ruins of New Mexico, studied all the Pueblo tribes of that State, and in 1904–10 made a special study of the Taos and Tewa Indians. She was the author of *Zuñi and the Zuñians* (1881); *Religious Life of the Zuñi Child* (1887); *The Sia, Zuñi Scalp Ceremonials* (1890); *Zuñi Ancestral Gods and Masks* (1898); *The Zuñi Indians: Their Mythology, Esoteric Fraternities, and Ceremonies* (1904).

STEVENSON, Robert (1772–1850). A Scottish engineer, born at Glasgow. He was educated at Anderson's College, Glasgow, and at Edinburgh University, and his progress in the study of engineering was so rapid that in 1791 he was intrusted with the erection of a lighthouse on Little Cumbrae. During 47 years' service as engineer and inspector of lighthouses, he planned and constructed 23 lighthouses round the Scottish coasts, with the catoptric illumination, and his invention of intermittent and flashing lights. The most remarkable of these structures was that on the Bell Rock (q.v.). The enterprise was unprecedented in lighthouse engineering, for Bell Rock was washed except by lowest ebb tides. Stevenson was the author of four volumes of professional printed reports, a large work on *The Bell Rock Lighthouse* (Edinburgh, 1824), and articles in important reference works.

His sons Alan (1807–65), David (1815–86), and Thomas (1818–87) were also noted lighthouse engineers, and writers in the field of their specialty. Thomas was the father of Robert Louis Stevenson. Consult David Stevenson, *Life of Robert Stevenson* (Edinburgh, 1878). See Lighthouse.

STEVENSON, Robert Alan Mowbray (1847–1900). An English art critic, a cousin of Robert Louis Stevenson. He was born in Edinburgh, graduated with the master's degree from Sidney Sussex College, Cambridge, and studied art in the Edinburgh School of Art and in Paris and Antwerp, but never practiced painting extensively. From 1889 to 1893 he was professor of fine arts at University College, Liverpool, and from 1893 art critic on the *Pall Mall Gazette.* He was one of the most gifted and just of English critics. His sympathies were with the Impressionist school, but his judgment was impartial, and he possessed a keen analytical mind and an effective style. His works include: *Engraving* (1886), from the French of Delaborde; *Peter Paul Rubens* (1898); *The Art of Velazquez* (1895); *Velazquez* (1899); and an *Essay on Raeburn* (1900).

STEVENSON, Robert Louis (properly Robert Lewis Balfour) (1850–94). A Scottish romancer, essayist, and poet, born in Edinburgh, Nov. 13, 1850, the only son of Thomas

Stevenson, a distinguished lighthouse engineer. After education at various schools and under private tutors, he entered Edinburgh University in 1867, intending to become an engineer. On this profession he turned his back in 1871, and, after partially recovering from an illness in which nervous exhaustion and pulmonary symptoms were combined, prepared for the bar, to which he was called in 1875. He had already written several essays and tales and some verse, chiefly with a view of, in his own forcible phrase, "playing the sedulous ape" to the great masters. His bent to a literary career was encouraged by the friendship of Edmund Gosse, Andrew Lang, and Sidney Colvin, whom he met in London. A canoeing trip in Belgium and France and a walking tour in the Cévennes furnished material for *An Inland Voyage* (1878) and *Travels with a Donkey* (1879), sketches in which he gave full proof of his exquisite literary art. Without attracting much attention, he was contributing to the *Cornhill Magazine* and *Temple Bar* short stories, and some of his best essays afterward collected under the titles of *Virginibus Puerisque* (1881) and *Familiar Studies of Men and Books* (1882). To this period also belong the fantastic *New Arabian Nights* (1882), first published between 1876 and 1878. In 1876 he had met, in an artistic colony near Paris, Mrs. Osbourne, an American lady, afterward to be his wife. In 1879, hearing from California that she was seriously ill, he made up his mind to go there. His resources were so limited that he made the long journey in an emigrant ship and train, noting his experiences and publishing them in *The Amateur Emigrant* (first printed entire in Edinburgh edition, see below), and *Across the Plains* (1892). He spent somewhat more than a year in California, often in very delicate health, and in 1880 married Mrs. Osbourne. The next few years were spent in various health resorts—Davos, the Riviera, Bournemouth, and in America in the Adirondacks, where he was a member of Dr. Trudeau's (q.v.) colony at Saranac Lake. Often under the most discouraging conditions, but with that brave cheerfulness which marked his character, he worked incessantly, and for years his life seemed to hang by a thread. Success first came to him with the publication in 1882 of *Treasure Island*, a tale of pure adventure. *Dr. Jekyll and Mr. Hyde* (1886), a striking ethical parable under the guise of fiction, attracted thoughtful people. In the same year appeared *Kidnapped*, which, with the *Master of Ballantrae* (1889), offered vivid pictures of past Scottish life. In 1888 he was in San Francisco, still in quest of health, from which city he sailed with his family on a voyage to the South Seas. Pleased with the scenery and the people of Samoa, he made a home for himself there in 1890 and acquired a position of influence among the natives. After a long struggle against tuberculosis, he died, by rupture of a blood vessel in the brain, Dec. 3, 1894, and was buried on the peak of Mount Vaea, above Vailima, his Samoan home. He left several manuscripts, among which were two romances, *Weir of Hermiston* (1896) and *St. Ives* (completed by Quiller-Couch, 1897). The former, which no writer was bold enough to touch, is generally considered, even in its unfinished state, Stevenson's masterpiece. Other works deserving special mention are: *The Silverado Squatters* (1883); *Prince Otto* (1885), a dainty romantic tale; three books in collaboration with his stepson, Lloyd Osbourne, *The Wrong Box* (1888), *The Wrecker* (1892), and *The Ebb Tide* (1894); a volume of exquisite verse, *Underwoods* (1887); *A Child's Garden of Verses* (1885); *The Merry Men and Other Tales* (1886), a volume of short stories in which his mastery over the grim and terrible best shows itself; "Memoir of Fleeming Jenkin" (prefixed to *Papers of Fleeming Jenkin*, 1887); *Island Nights' Entertainments* (1893); *Catriona* (1893), the sequel to *Kidnapped*. Stevenson's delightful *Letters* (4 vols., New York) were edited by Sidney Colvin in 1911.

In both fiction and essays Stevenson displays an exquisite and finished style; his work is that of a true artist in words, and his example stimulated many younger artists of the day to more or less conscious imitation. His influence was also great in regard to the subject matter of fiction. At a time when the novel had forgotten to tell a story and was running into minute philosophical analysis, Stevenson came forward with adventure as purely romantic as Scott's, though in structure, in method of description and narrative, and in brilliancy of style he marks the great technical advance since the days of the *Waverley Novels*. But it was not only the many delightful qualities of his written work which made Stevenson the best-loved writer of his time; even more, perhaps, he was endeared to countless readers by the frank revelation of a most engaging personality, which shines through all his works—of a serene undaunted cheerfulness, gained not by shutting his eyes to the pathos and the difficulty of human conditions, but by a brave rising to the height of their demands.

The most nearly completed collection of his works is the sumptuous Edinburgh edition (27 vols.) edited by Sidney Colvin (1894–98); two volumes of charming letters arranged by the same editor, with much biographical matter, appeared in 1899, and the *Vailima Letters*, written from Samoa in 1895. Consult also the biographies by his cousin Graham Balfour, his authorized biographer (2 vols., New York, 1901; abridged ed., 1 vol., with additions, ib., 1915); M. M. Black (Edinburgh, 1898), and L. C. Cornford (ib., 1899); also E. B. Simpson (1906); id., *Stevenson's Edinburgh Days* (London, 1898); Fraser, *In Stevenson's Samoa* (ib., 1895); Osbourne and Strong, *Memories of Vailima* (ib., 1903); and critical studies by Walter Raleigh (ib., 1895); Henry James, in *Partial Portraits* (ib., 1888); J. J. Chapman, in *Emerson and Other Essays* (New York, 1896). Among later books, criticism or biography, or both, should be mentioned: H. B. Baildon, *R. L. Stevenson: A Life Study* (New York, 1901); G. K. Chesterton, *Varied Types* (ib., 1903); A. H. Japp, *R. L. Stevenson: A Record, an Estimate, and a Memorial* (ib., 1905); *Stevensoniana* (ed. J. A. Hammerton, Edinburgh, 1910), consisting of anecdotes and appreciations by friends and critics of R. L. S.; E. B. Simpson, *Stevenson Originals* (New York, 1912); F. Watt, *R. L. S.* (ib., 1913); R. L. B. Stevenson, *R. L. Stevenson* (London, 1913), treating of the man and his work; F. Swinnerton, *R. L. Stevenson: A Critical Study* (New York, 1914); Mrs. R. L. Stevenson, *The Cruise of the Janet Nichol among the South Sea Islands* (ib., 1914); Sir A. W. Pinero, *Robert Louis Stevenson as a Dramatist* (ib., 1914);

Henry James, in *Notes on Novelists* (ib., 1914); W. A. Raleigh, *Stevenson* (ib., 1915); Clayton Hamilton, *On the Trail of Stevenson* (Garden City, N. Y., 1915); also W. F. Pridaux, *Bibliography of R. L. Stevenson* (London, 1903).

STEVENSON, Sara Yorke (Mrs. Cornelius Stevenson) (1847–). An American archæologist, born in Paris, France. She was educated in Paris at the Cours Rémy and the Institut Descauriet, and resided in Mexico in 1862–67. Of the department of archæology in the University of Pennsylvania, with which she had been prominently connected for many years, she became president in 1904. She was also secretary of the American Exploration Society in 1897 and of the Pennsylvania branch of the Archæological Institute of America in 1899–1903; and in 1893 was vice president of the jury on ethnology at Chicago. For the purpose of archæological investigations she visited Rome and Egypt. After 1908 Mrs. Stevenson served as assistant curator of the Pennsylvania Museum. In 1909 she was president of the Pennsylvania Equal Suffrage Society. Besides papers and articles on archæology, she wrote *Maximilian in Mexico* (1899) and she became literary editor of the Philadelphia *Public Ledger*.

STE′VENS POINT. A city and the county seat of Portage Co., Wis., 155 miles by rail northwest of Milwaukee, on the Wisconsin and Plover rivers, and on the Minneapolis, St. Paul, and Sault Ste. Marie, and the Grand Bay and Western railroads (Map: Wisconsin, D 4). It is the seat of a State normal school, and has a Polish convent and a public library. The city has some mineral wealth and there is excellent water power. There are saw mills, paper mills, foundries, and manufactories of sashes and doors, furniture (including tables and desks), engines, boxes, etc. The manufacture of artificial flies for fishing and self-rocking cradles are important industries. Pop., 1900, 9524; 1910, 8692.

STEVIN, stā′vĭn, Simon. See Stevinus.

STEVINUS, stȧ-vē′nụs, Simon (1548–1620). A Dutch mathematician, born at Bruges. He became a favorite of Prince Maurice of Orange, who made him a quartermaster general. Skilled in mechanics and geometry, he proved the law of equilibrium on an inclined plane, distinguished stable from unstable equilibrium, demonstrated the resolution of forces, and showed that the downward pressure of liquids was independent of the shape of the containing vessel. He is chiefly remembered, however, for his introduction of decimal fractions into common use by publishing in 1586 a small pamphlet, which was soon translated into French as *La Disme enseignant facilement expédier par Nombres Entiers sans rompuz tous Comptes se rencontrans aux Affaires des Hommes*. Consult M. Cantor, *Vorlesungen über Geschichte der Mathematik* (2d ed., Leipzig, 1900).

STEWARD (AS. *stigweard, stiweard,* from *stig*, pen for cattle, sty + *weard*, guard), Lord High. The first of the great offices of state in England. Although of ancient origin, it owes its eminence to John of Gaunt (1340–99). It was hereditary in various lines until the accession of Henry IV (1399), when it was merged with the crown, and has since been in abeyance except when temporarily revived from time to time under the great seal pro hac vice. It is now revived only on the occasion of a coronation, or the trial of a peer by the House of Lords for treason or felony, when the Steward presides. When the proceedings are at an end, the Lord Steward terminates his commission by breaking his wand of office. See Lord High Steward.

STEWARD OF THE CHILTERN HUNDREDS. See Chiltern Hundreds, Steward of the.

STEWART, stū′ẽrt. A Scotch and English royal family. See Stuart.

STEWART, Alexander Turney (1803–76). An Irish-American merchant, born at Lisburn, near Belfast, Ireland, of Scotch parentage. He entered Trinity College, Dublin, with the intention of studying for the ministry, but left before graduating and in 1823 emigrated to America. Settling in New York City, he taught school for two years, and in 1825, having fallen heir to a small legacy from some Irish relatives, he established himself in the dry-goods business. In 1848 he built a store at Broadway and Chambers Street, which at the time was the largest dry-goods store in the world. In 1862 he removed his retail business to a new store, erected at a cost of $2,750,000, at Broadway and Ninth and Tenth streets, retaining his old store for wholesale trade. At the time of his death the business of A. T. Stewart and Company comprised branches and agencies in the principal cities of Europe, and several mills and factories in the United States.

STEWART, Alvan (1790–1849). An American abolitionist, born at South Granville, Washington Co., N. Y. After teaching in the Royal School of the seigniory of St. Armand, Canada, in 1811–12, and practicing law at Utica, N. Y., he devoted himself chiefly to advocating temperance and the abolition of slavery. In 1835 he called together in Utica an antislavery convention that was dispersed by mob violence. According to William Godell, Stewart was the first to insist "on the necessity of forming a distinct political party to promote the abolition of slavery." When such a party was formed, he was its candidate for Governor, but was, of course, defeated. Years before Lincoln made his famous "house divided against itself" speech or Seward his "irrepressible conflict" speech, Stewart declared that "these States must necessarily be in eternal conflict until liberty conquers slavery or slavery overturns the liberty of all." A collection of his speeches, with a slight memoir, was published by his son-in-law, Luther R. Marsh (New York, 1860).

STEWART, Balfour (1828–87). A British physicist and meteorologist. He was born at Edinburgh, and was educated at St. Andrews University and Edinburgh University. After a brief career in business in 1856 he became connected with Kew Observatory, later (1859) being appointed its director. He was appointed professor of natural philosophy in Owens College, Manchester, in 1870, where he served until his death. Stewart's researches in radiant heat procured for him in 1868 the Rumford medal of the Royal Society. He also devoted himself to the study of terrestrial magnetism and meteorological problems, particularly those connected with solar radiation. He was also a devout churchman and was a member of a committee appointed to promote the interchange of views of scientific men of orthodox religious opinions. In *The Unseen Universe* (1876), a popular work written by Stewart in conjunction with Prof. P. G. Tait, an attempt was made to combine theological doctrines with the scientific ideas then current to demonstrate the existence of the soul and of a transcendental universe. Stewart was prominently identified with the Society for Psychical Research. He published an *Elementary Treatise on Heat* (1866; 6th ed., rev., 1895); *Lessons in Elementary Physics* (1871); *Physics* (1872); *The Conservation of Energy* (1875; 9th ed., 1900); and *Lessons in Practical Physics*, with W. H. Gee (vol. i, 1885; vol. ii, 1887).

STEWART, CHARLES (1778-1869). An American naval officer, born in Philadelphia, Pa. At 13 he shipped on a merchant vessel as cabin boy, and later rose to be captain of an Indiaman. In 1798 he entered the United States navy as fourth lieutenant of the frigate *United States*, serving until 1800, after which he had command of different schooners. He captured the French vessel *Deux Amis*, and a few days later the schooner *Diane*. While on this cruise he took the British privateer *Louisa Bridger* by a night action, but on discovering her nationality made reparation. In 1804, in command of the *Siren*, he joined the Mediterranean squadron. He then returned to the United States in command of the *Constellation*, and 1806 was promoted to be captain. Afterward he was for a time in the merchant service, but reëntered the navy, and in the War of 1812 aided Commodore Bainbridge in persuading the administration to send the United States warships to sea instead of keeping them in New York Harbor. In 1813 he was transferred to the *Constitution*, which on Feb. 20, 1815, captured two British war vessels, the *Cyane*, 34 guns, and the *Levant*, 18 guns. Later he was surprised by a British squadron and the *Levant* was recaptured. He commanded the Mediterranean squadron from 1817 to 1820, after which he was sent to the Pacific station. He commanded the home squadron in 1842-43, and became commandant of the Philadelphia Navy Yard. In 1862 he was promoted to the rank of rear admiral. During the last 17 years of his service he was senior officer of the navy.

STEWART, DAVID, DUKE OF ROTHESAY and EARL OF CARRICK. See ROTHESAY.

STEWART, SIR DONALD MARTIN (1824-1900). A British field marshal. He was born near Forres, Elginshire; completed his education at Aberdeen University, and in 1840 joined the Bengal army. He fought on the frontier; served with distinction during the Indian Mutiny at Delhi and Lucknow; commanded the Bengal troops in the Abyssinian War in 1867-68; and was chief commissioner at Andaman and Nicobar (1869-74). During the Afghan War in 1878 he commanded the Kandahar field force, and in 1880 on his march from Kandahar to Kabul won the battles of Ahmed Khel and Urzu. As commander in chief in northern Afghanistan he sent Sir Frederick Roberts on his march from Kabul to Kandahar, while he withdrew with the remainder of the army through the Khyber Pass. Consult C. R. Elsmie, *Field-Marshal Sir Donald Stewart* (London, 1903).

STEWART, DUGALD (1753-1828). A Scottish philosopher, born in Edinburgh. He studied at the University of Edinburgh from 1765 to 1769. In 1771 he went to Glasgow, where he stayed only one session, partly to attend the lectures of Thomas Reid. In 1772 he was called to teach the mathematical classes in the University of Edinburgh; in 1775 he was elected joint professor, and acted in that capacity till 1785, when he was appointed professor of moral philosophy, and continued in the active duties of the chair for 25 years. In 1792 appeared his first volume of the *Elements of the Philosophy of the Human Mind*. In 1793 he published his *Outlines of Moral Philosophy*. In 1806, on the accession of the Whig party to power, he received a sinecure office worth £300 a year. In 1810 Stewart gave up his active teaching work and retired to Kinneil House, Linlithgowshire, which the Duke of Hamilton placed at his service. In the same year he published his *Philosophical Essays;* in 1814 the second, and in 1827 the third volume of the *Elements;* and in 1828 *Philosophy of the Active and Moral Powers*. He died in Edinburgh, June 11, 1828.

The philosophy of Stewart was the following up of the reaction against the skeptical results that Berkeley and Hume drew from the principles of Locke. Both Reid and Stewart professed the Baconian empirical method, but considered that these processes of investigation could establish certain ultimate truths of a higher certainty than themselves. His collected works were edited by Sir W. Hamilton, in 11 vols. (Edinburgh, 1854-59), to which Professor Veitch contributed a biography.

STEWART, GEORGE (1848-1906). A Canadian journalist and author. He was born in New York City, but was taken to Ontario in 1851 by his parents, who lived in that province, mostly in London, until 1859 and then removed to St. John, N. B. He was for a few years a druggist, but relinquished that occupation for journalism. At a comparatively early age he founded *Stewart's Literary Quarterly Magazine*, an excellent periodical, but after five years it was discontinued. He was afterward connected editorially with St. John newspapers, then was editor in chief of Rose-Belford's *Canadian Monthly*, Toronto; but in 1879 he removed to the city of Quebec where until 1896 he edited the *Daily Chronicle*. Stewart contributed to various British, American, and Canadian reviews and works of reference and was made a member of several Canadian and foreign literary societies. His publications include: *The Story of the Great Fire in St. John, N. B.* (1877); *Evenings in a Library* (1878); *Canada under the Administration of the Earl of Dufferin* (1878); *Emerson, the Thinker* (1879); *Alcott, The Concord Mystic* (1880); "Frontenac and His Times," in Justin Winsor's *Narrative and Critical History of America*, vol. iv (1885); *Essays from Reviews* (1892-93).

STEWART, GEORGE BLACK (1854-). An American Presbyterian theologian, born at Columbus, Ohio. He graduated from Princeton in 1876, attended McCormick Theological Seminary, and graduated from Auburn Seminary in 1879. Ordained to the Presbyterian ministry, he was pastor at Auburn, N. Y., in 1878-84, and at Harrisburg, Pa., in 1884-99. Thenceforth he was president of Auburn Seminary and professor of practical theology there. He founded and for five years was president of the Pennsylvania Chautauqua. Besides editing the *Auburn Seminary Record* and writing for the religious press, he published *Life of Jesus for Juniors* (1896) and *A Study of the Life of Jesus* (1907).

STEWART, HENRY. See DARNLEY, LORD.

STEWART, Sir Herbert (1843–85). A British soldier, born at Sparsholt, Hampshire. Entering the army in 1863, he served in India until 1873. In 1878 he went to South Africa, where he participated in the Zulu War in 1879, and was captured by the Boers at Majuba in 1881. In the following year he was made assistant adjutant general of the cavalry in Egypt. He participated in the victory of Tel el Kebir (1882), and took possession of Cairo in the same year, and for his services in the Suakin campaign was made K.C.B. in 1884. In 1884–85 he took part in the expedition for the relief of Gordon at Khartum, repulsed the Arabs in the battle of Abu Klea, but three days later was mortally wounded. He was promoted to major general before he died.

STEWART, James (1846–1906). A Canadian physician. He was born at Osgoode, Russell County, Ontario, and graduated in medicine at McGill University in 1869. He was professor of materia medica and therapeutics in McGill University in 1883–91; was appointed registrar of the faculty in 1884; was professor of clinical medicine in 1891–93; and in 1893 took the combined chair of medicine and clinical medicine, being professor of the former subject at the time of his death. He was elected president of the Association of American Physicians in 1903, and was coeditor of the *Montreal Medical Journal*. He made noteworthy contributions to medical literature on neurology.

STEWART, John Alexander (1846–). A British moralist. He was born in Wigtownshire, Scotland, and was educated at Edinburgh University and Lincoln College, Oxford, where he won the Newdigate prize for English verse in 1868. He was appointed White's professor of moral philosophy in the University of Oxford in 1886. He published: *The English MSS. of the Nicomachæan Ethics* (1882); *Notes on the Nicomachæan Ethics* (1892); *The Myths of Plato* (1905); *Plato's Doctrine of Ideas* (1909). He contributed to important reference works.

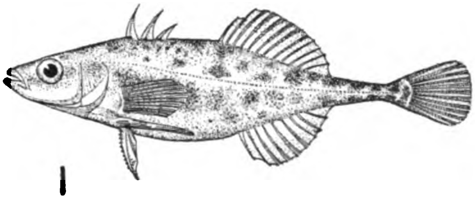
STEWART, Julius (1855–). An American figure and genre painter. He was born in Philadelphia, and studied under Gérôme and Madrazo in Paris, where he made his home. He painted many charming studies of nudes in the open air. His pictures of the life of the American colony in Paris, such as "The Hunt Ball" (Essex Club, Newark, N. J.) and "Five O'clock Tea," are French in method and elegance, but thoroughly American in spirit. He was made an Officer of the Legion of Honor in 1901, and received gold medals at Berlin in 1891 and 1895, and in Munich in 1897 and 1901.

STEWART, Matthew, Earl of Lennox (1516–71). A Regent of Scotland, born in Dumbarton Castle, the son of John, third Earl of Lennox. After negotiations with Henry VIII of England which resulted in treason to his own country, he married Henry's niece, Lady Margaret Douglas, and engaged in fruitless expeditions in attempting to bring Scotland under the control of England. When Mary Stuart came to the Scottish throne, Lennox returned to his native country, was reinstated in his forfeited estates, and arranged the marriage between Mary and his eldest son, Henry, Lord Darnley (q.v.). After his son's murder he took part in the seizure and imprisonment of Mary in Lochleven Castle, and was provisionally appointed Regent on behalf of his infant grandson, afterward James VI. He was appointed lieutenant general of the kingdom and confirmed in the regency after the assassination of Murray, in 1570; he gallantly defeated the Queen's supporters, capturing the castles of Doune and Dumbarton; and convened a parliament at Leith which was adjourned to be held later at Stirling. On his journey to the latter town he was mortally wounded in a skirmish with some of the Queen's partisans.

STEWART, Robert, second Marquis of Londonderry, best known as Viscount Castlereagh (1769–1822). An eminent English statesman. He was the eldest surviving son of Robert, first Marquis of Londonderry, and was educated at St. John's College, Cambridge. He entered the Irish Parliament in 1790, became Viscount Castlereagh (1796), and Chief Secretary for Ireland (1798). In suppressing the rebellion of that year he was energetic. In helping to bring about Parliamentary union with England he made use of money in corrupting opponents. Castlereagh entered the Imperial Parliament, and in 1805–06 was Secretary of State for the War and Colonial departments. Resigning on Pitt's death in 1806, he resumed the office of War Minister next year, and organized the disastrous Walcheren expedition (1809). Canning (q.v.), then Foreign Secretary, bitterly attacked Castlereagh for this. The result was that both resigned, and a duel took place, Sept. 21, 1809, in which Canning was wounded. After the assassination of Perceval in 1812, Castlereagh became Foreign Secretary, a post which he held during the achievements of the Duke of Wellington. His personal influence and his untiring exertions kept together the coalition against Napoleon. He represented England at the Congress of Vienna in 1814–15, at the Treaty of Paris in 1815, and at the Congress of Aix-la-Chapelle in 1818. His foreign policy was favorable to the principles of the "Holy Alliance" abroad and he recommended despotic measures at home. As the leader of the Liverpool government in the Lower House, he carried the suspension of the Habeas Corpus Act in 1817. The "Six Acts" of 1819 made him extremely unpopular. The retirement of Canning from the ministry (1820) threw the whole weight of business on Castlereagh. By the death of his father in 1821 he became Marquis of Londonderry. The great toil and responsibility of his office deranged his mind, and he died by suicide at North Cray Place, Kent, Aug. 12, 1822. Consult his *Memoirs and Correspondence* (12 vols., London, 1848–53) and Arthur Hassall, *Viscount Castlereagh* (ib., 1908).

STEWART, Sir Thomas Grainger (1837–1900). A British physician. He was born and educated in Edinburgh (M.D., 1858) and settled there after postgraduate work in Berlin, Prague, and Vienna. In 1876 he was elected professor of the practice of physic at Edinburgh University. Six years later he was appointed physician in ordinary to the Queen in Scotland, and he was knighted in 1894. In 1898 he was president of the British Medical Association. Stewart excelled in practice as well as in lecturing, and contributed to general as well as to medical literature. Among his works are: *A Practical Treatise on Bright's Disease of the Kidneys* (1868; 2d ed., 1871); *An Introduction to the Study of the Diseases of the Nervous System* (1884); *Clinical Lectures on Important Symptoms* (1884, 1888, and 1894); and *The Good Regent: a Chronicle Play* (1898).

STICKLEBACKS



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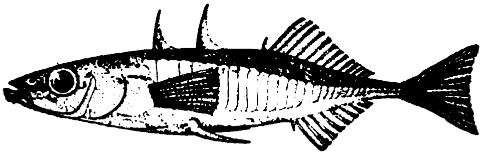

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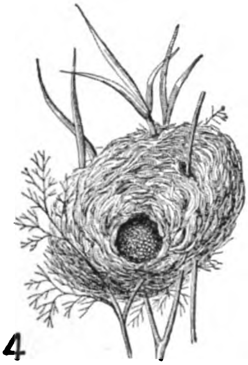

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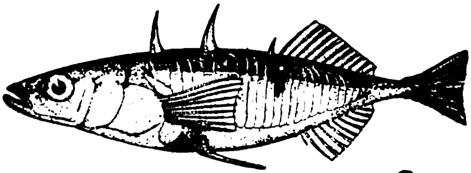

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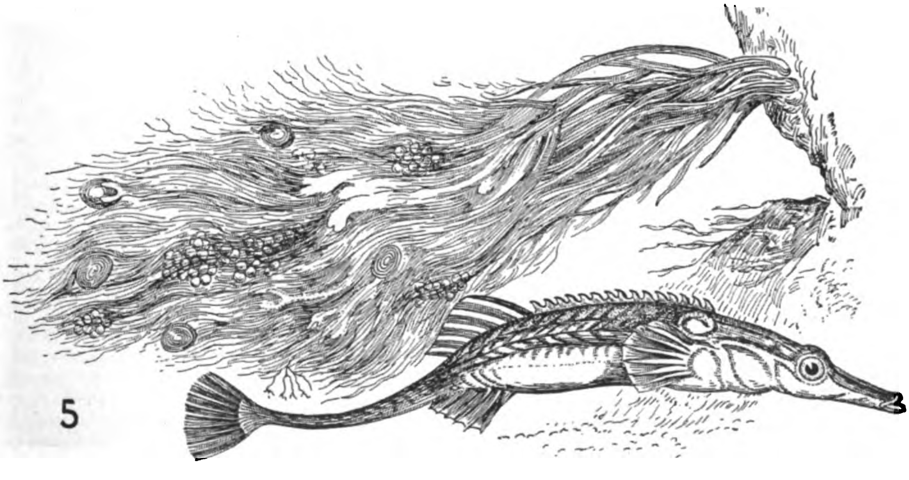

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1. COAST STICKLEBACK (Apeltes quadracus).
2. EUROPEAN STICKLEBACK (Gasterosteus aculeatus).
3. SALMON-KILLER (Gasterosteus cataphractus).
4. NEST OF EUROPEAN STICKLEBACK (Gasterosteus aculeatus).
5. SEA-ADDER (Spinachia spinachia) and its eggs hidden among the seaweed.

STEWART, William Rhinelander (1852–). An American humanitarian, born in New York City. He graduated from the Columbia Law School in 1873 and practiced law for a time, but gained other interests and in 1908 became president of the Rhinelander Real Estate Company. In 1882 he was appointed a commissioner on the New York State Board of Charities, of which he was also president from 1894 to 1900 and after 1904. In 1898 he was president of the 25th National Conference of Charities and Correction. Two years later he organized a similar State Conference, of which he was president in 1903, and in 1910 a New York City Conference. He was the originator in 1889 and treasurer of the committee that erected the Washington Arch in Washington Square, New York, and in 1894 was a member of the Committee of Seventy that fought Tammany Hall. He published *The Philanthropic Work of Josephine Shaw Lowell* (1911).

STEWART ISLAND. See New Zealand.

STEYN, stīn, Martinus Theunis (1857–). A South African statesman, the last President of the Orange Free State. He was born at Winbury, Orange Free State, was educated at Grey College, Bloemfontein, and in Holland, after which he studied law at the Inner Temple, London, and was called to the bar in 1882. Returning to South Africa, he became state attorney in 1889; was elevated to the bench, the same year, as second puisne judge; and in 1893 was appointed first puisne judge. In 1896 he was chosen by universal suffrage President of the Republic. His policy was to draw the two Boer states closer together, and the defensive alliance agreed upon by the Orange Free State and the Transvaal in 1897 had his hearty support. In 1899 he represented his state in the conference at Bloemfontein with Sir Alfred Milner (q.v.) and President Kruger (q.v.) in an attempt to adjust the difficulties existing between the British and the Boers. Upon the failure of negotiations and the breaking out of hostilities he called out the Free State troops to act in coöperation with those of the Transvaal. In May, 1900, after the British had annexed the Orange Free State by proclamation, he issued a counter proclamation reasserting the state's independence. After Kruger's departure he became the virtual head of the Boer forces. He took part in the peace conference that led to a cessation of hostilities in 1902 and later was a prominent advocate of Boer interests in the Orange River Colony under British rule.

STEYNE, stīn, Lord. A clever and wicked old nobleman in Thackeray's *Vanity Fair*, who is involved in a scandal with Becky Sharp.

STEYR, shtīr, or **STEIER.** A town of Upper Austria, at the confluence of the Steyr and the Enns, 90 miles west by south of Vienna (Map: Austria, D 2). Its principal structures are the Gothic church (1443) and the palace of Count Lamberg (tenth century). It is an important centre of the Austrian iron and steel industry. There is here a large government rifle factory; other manufactures are cutlery, leather, paper, woolens, hosiery, etc. Pop., 1900, 17,592; 1910, 17,451.

STHENEBŒA, sthĕn'ḗ-bē'ȧ, or **STHENOBŒA,** sthĕn'ṓ-bē'ȧ. See Bellerophon.

STHENELUS. See Hercules.

STIB'NITE (from Neo-Lat. *stibium*, from Gk. *στίβι*, *stibi*, *στίμμι*, *stimmi*, sulphuret of antimony, probably from Egypt. *stm*, stibium). A mineral trisulphide of antimony crystallized in the orthorhombic system. It has a metallic lustre, and is steel-gray to lead-gray in color. It occurs with quartz, in beds or veins, in granite or gneiss, often with other antimony minerals and metallic sulphides. Stibnite is an important ore of antimony, and was used by the ancients for coloring the hair, eyebrows, etc.

STICHARION, stĭ-kā'rĭ-ŏn. See Costume, Ecclesiastical.

STICK'LEBACK' (so called from the sharp spines on its back). A general name for the small active fresh-water hemibranch spiny-rayed fishes of the family Gastrosteidæ, interesting because of their nest-building. They are natives of northern America, Europe, and Asia. There are a dozen or so species, none exceeding 6 inches long. The body is slender and more or less compressed, without scales, but usually mailed with plates. The anterior dorsal fin is replaced by several strong, widely separated spines. The ventral fin consists of a strong spine and one or two rudimentary rays. The typical form is the common European stickleback or burnstickle (*Gasterosteus aculeatus*), represented in eastern North America by the very similar or identical *Gasterosteus bispinosus*. It is four inches long, is olivaceous and dotted on the back, and has three dorsal spines. In the spring the male of this species builds upon the bottom of the stream a nest composed of bits of straw, sticks, leaves of plants, and sand, glued together by a secretion produced by a special gland. This secretion is drawn out into a silklike thread by which the materials are woven together as the fish trails it after him. The completed shape is like that of a hand muff, smooth inside, with openings in the direction of the current. When the house is completed the male induces a female to enter and deposit her eggs, a process lasting a few minutes. The female then leaves by one of the openings and the male enters by the other to deposit milt over the eggs. Other females enter, until the nest contains layers of eggs and milt. These the male guards until the young are hatched and able to shift for themselves. Sticklebacks are remarkably voracious and extremely destructive to the young fry of fishes. Consult authorities cited under Aquarium and Fish. See the accompanying Plate of Sticklebacks.

STICK-TIGHT. See Hound's-Tongue.

STIEGLITZ, stēg'lĭts, Julius Oscar (1867–). An American chemist, born in Hoboken, N. J. He graduated from the Realgymnasium in Karlsruhe, Germany, in 1886 and from the University of Berlin (Ph.D.) in 1889. After coming to the United States, he studied at Clark University, from which he received the honorary degree of Sc.D. in 1909. Called to the University of Chicago, he rose from docent (1892–93) to be professor (1905), director of analytical chemistry (1909), and in 1912 became director of the university laboratories. In 1909 he was Hitchcock lecturer at the University of California, and in 1911 was elected to membership in the National Academy of Sciences. He published numerous papers on molecular rearrangements, imido ethers, carbamid bases, and similar subjects, and is author of *The Elements of Qualitative Chemical Analysis* (2 vols., 1911–12).

STIELER, shtē'lēr, Adolf (1775–1836). A German cartographer, born at Gotha, and educated in law at Jena and Göttingen. He was employed in the government service at Gotha. His principal cartographic work, establishing a remarkable standard of accuracy and completeness, is *Der Handatlas* (1817–23; 9th ed., 1914). He published other similar works.

STIELER, KARL (1842–85). A Bavarian dialect poet and author, born in Munich, son of the preceding. After studying law in his native city he undertook extensive travels, which he described in letters to the *Allgemeine Zeitung*. Afterward he became state archivist in Munich. His poems, written in the dialect of Upper Bavaria and overflowing with fresh, delicious humor, appeared in the following collections: *Bergbleameln* (1865), *Weil's mi freut* (1876), *Habt's a Schneid'?* (1877), and others, all of which met with great favor, as did also his High German poems *Hochlandslieder* (1879), *Neue Hochlandslieder* (1883), and *Wanderzeit* (1882). Posthumously were published *Ein Winteridyll* (39th ed., 1908), *Kulturbilder aus Bayern* (2d ed., 1895), *Natur- und Lebensbilder aus den Alpen* (1890), *Aus Fremde und Heimat* (1886), and *Durch Krieg zum Frieden* (1895). For his biography, consult Heigel (Bamberg, 1891); A. Dreyer, *K. Stieler* (Stuttgart, 1905).

STIER, shtēr, RUDOLF EWALD (1800–62). A German Lutheran divine, born at Fraustadt, Posen. After studying law and theology at Halle, Berlin, and Wittenberg, he was appointed professor in the Missionary Institute at Basel in 1824. He then became pastor at Frankleben in 1829 and at Wichlinghausen in 1838, and was superintendent at Schkeuditz after 1850 and at Eisleben after 1859. Besides publishing an edition of Luther's Catechism and a translation of the Bible, he published *Die Reden der Apostel* (2 vols., 1824–30; Eng. trans., 1869); the important mystical commentary *Reden des Herrn* (3 vols., 1843; 3d ed., 7 vols., 1870–74; Eng. trans., 3 vols., 1869); *Die Reden der Engel in der heiligen Schrift* (1862). Consult J. P. Lacroix, *Life of Rudolf Stier* (New York, 1874).

STIFFNECK. See WRYNECK.

STIFTER, shtĭf′tẽr, ADALBERT (1805–68). An Austrian poet, novelist, and painter, born at Oberplan, Bohemia. He studied law at the University of Vienna, but gave the preference to history, philosophy, and natural science, took up teaching, and in 1850 was appointed superintendent of public schools in Upper Austria. His idyls and novelettes, collected under the title *Studien* (1844–51; 17th ed., 1901), rank with the best prose writings of his time, and from their first appearance evoked unstinted admiration. Their purely idyllic character, utterly alien to all worldly problems and tendencies, the masterly details in the author's original conceptions and descriptions of nature, constituted so grateful a contrast to the current belletristic productions as to atone for the merely accessory rôle assigned to the human element. The *Studien* were followed by *Bunte Steine* (1852; 10th ed., 1897); and the novels *Der Nachsommer* (1857; 3d ed., 1877) and *Witiko* (1865–67). His letters, with biography, were published by Aprent (1869). An edition of his complete works appeared in Prague (1901 et seq.). A critical edition by A. Sauer, F. Hüller, J. Radler, et al., began appearing in 1904. Consult: Kuh, *Zwei Dichter Oesterreichs* (Pressburg, 1872); the biographies by Markus (Vienna, 1877), Pröll (Prague, 1891), and Stoessl (Berlin, 1902); A. Sauer, *Stifter als Stilkünstler* (Prague, 1902); W. Kosch, *A. Stifter und die Romantik* (ib., 1905).

STIG′MA (from Gk. *στίγμα*, *stigma*, mark, brand, puncture). In anatomy, a spot or mark on the skin or a small cicatrix; in botany, a special tissue for the reception of pollen; in entomology, the spiracle of an insect. To the psychiatrist a stigma is an anatomical or functional deviation from the normal in a degenerate person. Certain stigmata are so constant and so frequent that they have been accepted as indices of degeneration by teachers, physicians, and officers in prisons and asylums. Besides idiots, insane persons, and certain criminals, the feeble-minded and the markedly eccentric are classed as degenerates. (See DEGENERACY.) The stigmata of degeneration are anatomical, physiological, or psychical; i.e., they are deviations in form and shape, in function and faculty, from the normal.

Anatomical Stigmata comprise irregularity in formation of the skull cap or of the face; deformity of the palate; irregularity of the teeth; anomaly of tongue, lips, or nose; spots on the iris, crossed eyes, and other ocular changes; absence of pigment in iris, hair, and skin (see ALBINO); anomaly of the ears; shortening or lengthening of part of a limb, reduction or increase in the normal number of fingers; deformity of the thorax, dwarfing, giantism, the occurrence of feminine configuration in a male or of masculinity in a female; anomalies of the skin, including abnormal growth of hair or absence of proper hair, etc.

The most frequently and easily observed anatomical stigmata are the irregular ears and teeth. The principal ear types are the Darwin ear, marked by a tubercle; the Morel ear, a large smooth organ with thin edges; the Stahl ears, with various anomalies of the helix and crura (see EAR); and the Blainville type, in which the ears are not mates. Dental and palatal anomalies are very frequent, the degenerate's hard palate being dome-shaped, hip-roofed, or flat-roofed, provided with a Gothic arch, or a horseshoe arch, or asymmetrical. Frederick Peterson (q.v.) considers the deformed palate one of the chief anatomical stigmata of degeneration. Talbot found 43 per cent of abnormal palates among 1605 feeble-minded persons. Charon found 82 per cent of abnormal palates in idiots and feeble-minded folk, 76 per cent in epileptics, 80 per cent in cases of general insanity, 70 per cent in hysterical insane, 35 per cent in cases of general paralysis, and 10 per cent in apparently normal people.

Physiological Stigmata, to follow Peterson's classification, include (1) anomalies of the motor function, such as delay in learning to walk, tremors, epilepsy; (2) anomalies of sensory function, such as deaf-mutism, migraine, blindness, defects in sight; (3) anomalies in speech, such as stammering, mutism; (4) anomalies of genito-urinary function; (5) anomalies of instinct or appetite, such as desire for liquor or drugs; (6) diminished resistance to external influences and to diseases; (7) delayed development of puberty.

Psychical Stigmata include feeble-mindedness, imbecility, idiocy, insanity, eccentricity, certain moral delinquency and sexual perversion. Consult: Morel, *Traité des dégénérescences* (Paris, 1857); Max Nordau, *Degeneration* (Eng. trans., New York, 1895); Peterson, "The Stigmata of Degeneration," in *State Hospitals Bul-*

letin (Utica, N. Y., July, 1896). See Eugenics; Heredity, and bibliographies there given.

STIGMA′RIA (Neo-Lat., from Gk. *στίγμα*, mark). The generic name given to fossilized plant remains with pitted surfaces, found in the coal measures. They were first thought to represent a distinct species of plant, but they are now known to be the roots of Sigillaria and other trees that lived in carboniferous times.

STIG′MATIZA′TION (from Gk. *στιγματίζειν*, *stigmatizein*, to mark). The name applied to the impression on certain individuals of the stigmata or marks similar to the wounds made in the body of Christ during his torture. These stigmata comprise not only the wounds of the hands and feet and of the side received in the crucifixion, but also those impressed by the crown of thorns and by the scourging. In some cases the stigmata have been only subjectively felt and could not be seen by others. The first and most remarkable example of stigmatization is that of St. Francis of Assisi (q.v.). In his case these mysterious markings are said to have persisted for three years, until his death, and to have been seen by St. Bonaventure and by several popes, and closely observed by multitudes after his death.

Since St. Francis's time there have been many such cases. Dr. Imbert-Gourbeyre in 1894 was able to collect 321 examples, in every century since the thirteenth, in every European country and in every station in life. While the great majority were religious, mostly Dominicans or Franciscans, many were not and some 20 were in the married state. Twenty-nine cases were listed during the nineteenth century. The most noteworthy of these are Anna Katherine Emmerich (died 1824) and Louise Lateau (1850–83) of Bois d'Haine, Belgium. This last case attracted great attention and provoked public discussion, in which the Salpétrière school of neurology took the position that stigmatization is only a neurotic phenomenon in hysterical individuals. Dr. Lefebvre, an eminent physician, professor of medicine at the University of Louvain, after a prolonged investigation of Louise Lateau's case, pronounced it miraculous. On the other hand, Theodor Schwann, the distinguished biologist, also a professor at Louvain and himself a Catholic, refused after careful examination to admit the preternatural character of the phenomena. In the *Comptes Rendus* of the Society of Biology of Paris for July 11, 1885, there is a report of a case in which bleeding through the unbroken skin was produced by hypnotic suggestion.

Bibliography. Lefebvre, *Louise Lateau* (Louvain, 1870); A. Imbert-Gourbeyre, *Les stigmatisés* (Paris, 1873); Bourneville, *Louise Lateau* (ib., 1875); id., *Le science et le miracle* (ib., 1878); Richer, *Etudes cliniques sur l'hystéro-épilepsie ou grande hystérie* (ib., 1881); J. J. von Görres, *The Stigmata* (London, 1883); A. Imbert-Gourbeyre, *Le stigmatization, l'extase divine, et les miracles de Lourdes* (Paris, 1894); P. Janet, *The Mental State of Hystericals: A Study of Mental Stigmata* (New York, 1901). See Emmerich, Anna Katherina; Lateau, Louise.

STIG′MONOSE. See Carnation.

STIKINE (stĭ-kēn′) **INDIANS.** See Tlinkit.

STIKINE RIVER. The largest and most important stream of southeastern Alaska, where it debouches at Wrangell. Its principal course lies in British Columbia, and it has for years been the principal route between the interior of that country and the Pacific Ocean (Map: Alaska, O 7). There is a summer steamer service as far as Telegraph Creek, 170 miles from the mouth.

STIL′BITE. A mineral, one of the commonest of the zeolites (q.v.). It occurs in sheaf-like aggregates in basaltic rocks, granites, and gneisses.

STILES, stilz, Charles Wardell (1867–). An American zoölogist and pathologist. He was born at Spring Valley, N. Y., and was educated at Wesleyan University and abroad, especially in Germany and France. From 1892 to 1906 he was professor of medical zoölogy at Georgetown University, and he became zoölogist and later consulting zoölogist to the Bureau of Animal Industry, and in 1902 professor of zoology in the Public Health Service. As secretary of the International Commission on Zoological Nomenclature he prepared, with Albert Hassall, the *Index Catalogue of Medical Zoölogy* (1902–14). Stiles paid especial attention to the hookworm disease and discovered that the parasite of the American infection was a new species, which he called *Uncinaria americana* and later *Necator americanus*. He was a prolific writer. Many honorary degrees were conferred on him.

STILES, Ezra (1725–95). An American clergyman and college president, born at North Haven, Conn. He graduated at Yale in 1746, was tutor there from 1749 to 1755, was ordained by the Congregational church in 1749, and preached for a time to the Stockbridge Indians. Transient religious doubts induced him to abandon the ministry and study law (1752); and he was admitted to the bar in 1752, and practiced in New Haven in 1753–55. Returning to the ministry in 1756, he was pastor of the Second Church in Newport, R. I., in 1756–77, and during this period spent a large part of his time in literary and scientific studies, learning several European and Oriental languages and carrying on an extensive correspondence with learned men in many parts of the world. In 1777–78 he was pastor of the North Church, Portsmouth, N. H., and in 1778 became the president of Yale, which position he held until his death. He also occupied the chair of ecclesiastical history from 1780 to 1795. Both during and preceding the Revolution he was an ardent patriot. He published *An Account of the Settlement of Bristol, R. I.* (1785) and a rambling, diffuse *History of Three of the Judges of King Charles I* (1794). His *Literary Diary* (45 vols.), edited by F. B. Dexter, was published in 1901. For his grandson and great-grandson see Gannett, Ezra Stiles, and Gannett, William Channing. Consult Abiel Holmes, *Life* (Boston, 1798), and J. L. Kingsley in Jared Sparks, editor, *American Biography* (new ed., New York, 1902).

STILET′TO FLY′. A small, slender predatory fly of the family Therevidæ, frequently of varied color and closely resembling one of the robber flies (Asiliidæ). It does not catch its prey on the wing as do the robber flies, but lies in wait upon leaves and bushes and even upon the ground, springing on weaker insects as they approach. The larvæ are very long and slender, and live in rotten wood and in rich earth, and seem to feed upon both decaying animal and vegetable matter.

STILICHO, stil'ĭ-kō, Flavius (?–408 A.D.). A Roman general and statesman. He was the son of a Vandal who served as an officer in the Roman army under Valens, Emperor of the East (364–378). He himself followed a military career, earning the special recognition of the Emperor Theodosius (379–395), who, in 383, sent him at the head of an embassy to the court of the Persian King Sapor III. Here by skillful diplomacy he at once arranged a very advantageous peace. On his return to Constantinople at the end of 384 he married Serena, the Emperor's niece, and received the titles of *comes stabuli sacri* and *comes domesticorum*. During the next decade he attained the grade of commander in chief (*magister militum*) of the army in Thrace (385) and directed the campaign in Britain against the Picts, Scots, and Saxons (386). The same year he was battling with his Emperor against the barbarians on the banks of the Hebrus. In 392 he was successful in campaigns against the Bastarnæ, Goths, Alani, and Huns, but was prevented from gaining greater glory by the jealousy of the Consul Rufinus, who exercised a great influence over the Emperor. In 394, however, he received a greater honor; for Theodosius made his son Honorius *Augustus*, giving him the sovereignty of Italy, Spain, Gaul, and Africa, and appointed Stilicho and Serena guardians of Honorius. Thus Stilicho found himself on a footing with his hated rival Rufinus, for he became the real ruler of the West, with headquarters at Rome, as the young Honorius was wholly indifferent to the cares of state. While Theodosius lived, Stilicho and Rufinus were forced to maintain a semblance of peace, but when he died, in 395, their rivalry broke out openly. Stilicho had a stronger personality and a close connection with the Imperial family, for his daughter Maria was betrothed to his ward, the Emperor Honorius. After successful campaigns on the Rhine he marched to the East, nominally to drive back the Goths and the Huns, whom Rufinus had persuaded to invade the Empire, but really to overthrow Rufinus, and by connivance with these same Goths Stilicho procured his assassination at the close of 395. He was now the virtual master of the Empire, for Honorius and Arcadius, the joint emperors, were puppets in his hands; but Stilicho never aspired to the throne, remaining as yet loyal to the worthless son of his old patron. His attention, indeed, was now wholly occupied with the formidable invasion of the Goth Alaric (q.v.), who had forced his way into the Peloponnesus with a great army, and was abetted by Arcadius from jealousy of Stilicho. Alaric was almost caught in a trap, but escaped northward, where he held his own for six years. At the end of 402 the contest was fought out. Alaric had invaded northern Italy, and the cowardly Honorius fled from Mediolanum (Milan) to Ravenna. Stilicho gathered all available troops from the western provinces and made a stand. He was blockaded in Milan, but early in 403 he broke the blockade and won a victory over Alaric at Pollentia, near Turin, and another at Verona. Alaric withdrew from Italy, but retained his power at the court of Arcadius. In 406 a new invasion threatened. A countless horde of Germans and Celts was led down from the north by their chief, Radagaisus, who occupied the heights of Fæsulæ, above Florence, where Stilicho, by a brilliant movement, hemmed him in and forced him to surrender. Radagaisus was treacherously put to death and his followers were sold into slavery. This was the last great achievement of Stilicho. His downfall was due to his ambition to see his own son Eucherius on the throne of Rome; and in this he might have succeeded but for the wily Olympius, who warned Honorius of Stilicho's designs. Honorius now for the first time showed signs of energy. He aroused the soldiers by a clever speech and won over many partisans of Stilicho, who, deserted by his friends, met death by assassination at Ravenna in 408. Consult Thomas Hodgkin, *Italy and her Invaders*, vols. i–ii (Oxford, 1880), and Pasquale Villari, *The Barbarian Invasions of Italy*, vol. i, English translation by Linda Villari (New York, 1902).

STILL, Andrew Taylor (1828–). An American osteopath. He was born at Jonesboro, Lee Co., Va., and served as a surgeon and major of the Twenty-first Kansas Volunteers during the Civil War. Still was the founder of osteopathy (q.v.), the practice of which he began in 1874, and after 1892 was president of the American School of Osteopathy at Kirksville, Mo. His writings include: *Autobiography of A. T. Still* (1897; rev. ed., 1908); *Philosophy and Mechanical Principles of Osteopathy* (1902); *Osteopathy, Practice and Research* (1910).

STILL, John. See Gammer Gurton's Needle.

STILLBIRTH. See Abortion.

STILLÉ, stil'lâ, Alfred (1813–1900). An American physician. Born in Philadelphia, he was educated at Yale and at the University of Pennsylvania (M.D., 1836). He settled in practice in his native city, but spent parts of 1841 and 1851 in Paris and Vienna. From 1854 to 1859 he was professor of medicine at the Pennsylvania Medical College and from 1864 to 1884 at the University of Pennsylvania. Stillé was one of the first in America to distinguish between typhus and typhoid fever. His observations in this connection he made during a typhus epidemic in Philadelphia in 1836 and reported in 1838. He acquired a great reputation as a practitioner, teacher, and writer, and was the first secretary, and in 1867 the president, of the American Medical Association. Among his numerous works are: *Medical Education in the United States* (1846); *Elements of General Pathology* (1848); *Therapeutics and Materia Medica* (1860; 4th ed., 1874); *Epidemic Meningitis* (1867); *Cholera* (1885). He edited with A. Maish the *National Dispensatory* (1879).

STILL-HUNTING. This method of hunting is similar to stalking (essentially an English term) in that each involves approaching an animal by stealth; but the two differ in that the still-hunter, either tracking or lying in wait for his quarry, usually in thick cover, often does not see it until near enough to shoot, whereas the stalker, generally hunting in the open, detects his game sometimes at a great distance, and then endeavors to keep out of sight until within range. American big-game animals most frequently taken by still-hunting include the smaller deer, moose, caribou, elk, and bears. Those that are usually stalked are sheep and goats, in their mountain fastnesses, elk and bears when found in thinly timbered country, and the caribou when they are feeding on the great barrens. Both forms of hunting, to be reasonably successful, demand patience, much knowledge of the animal's habits, good eyesight and hearing, physical endurance, especially in the pursuit of the mountain animals, and ability to shoot accurately and quickly with a rifle.

In this necessarily brief treatment of the subject it is impossible more than to suggest a few general rules which should guide the still-hunter; and the discussion may well apply chiefly to the common white-tailed deer, since that species is the most widely distributed of American animals pursued in this way. The two legitimate methods of still-hunting this wary, alert, and intelligent creature are by lying in wait in frequented localities, or by deliberately tracking it to within shooting distance. Though the first-named method demands much patience and often skillful manœuvring, and is entirely sportsmanlike, the literal pursuit of the animal by tracking it through the forest involves much more of expert woodcraft, and is fascinating sport for the hunter.

Some hunters become remarkably expert in following a deer's trail under even most unfavorable conditions, as, e.g., when the animal moves through a dense forest over a thick carpet of fallen foliage, in which they pick out the trail by noting freshly overturned leaves or the small hoofprints on the leaves themselves. Tracking on the snow is a simple matter as to following the trail; but the keen hunter should be able quickly and accurately to read many things from a trail so plainly marked, such as the sex and sometimes the approximate age of the deer; whether the animal suspects that it is being pursued or is feeding quietly; its speed, and whether it is moving steadily or stopping frequently, etc. It is absolutely essential to follow a deer, or any other big-game animal, upwind, as the slightest air current from the hunter will carry for a long distance to the animal's extraordinarily sensitive nose the scent of a human being, a warning almost certain to result in the deer's instant and precipitate flight. It is best also, when possible, to follow a trail with the sun at one's back.

The hunter must also bear in mind constantly the fact that a deer's hearing and eyesight are exceedingly keen, and that it is always on the alert for unusual sounds or movements in the forest. He must therefore move with the utmost caution, and avoid striking branches or breaking twigs by stepping upon them or otherwise, as the snapping of a twig is likely to put a deer to instant flight. A movement of any kind if detected is also very likely to produce the same result, though under such conditions a deer, if he has not seen the hunter plainly, may stop after taking a few jumps and look back to satisfy its curiosity. Another singular habit of a deer, of which the hunter should always be ready to take advantage, is that of stopping to look back upon reaching the brow of a hill. It may also be noted that a deer in full flight which will take him past the hunter is likely entirely to overlook him if he stands still as the animal approaches.

Once within range, if it is possible to do so with safety, the hunter should wait until the deer shows its full broadside, and then should shoot carefully at the point of the foreshoulder. That shot, if correctly placed, is not only fatal, but is likely to break both forelegs, with the result that the animal cannot run far; whereas it is well established that a sturdy buck shot cleanly through the heart may, unless the great arteries or veins are cut, run several hundred yards or more before he falls. Some hunters suppose it to be a sure sign that a deer has not been hit if it runs away with its great white tail held aloft in the usual manner; this is by no means invariably true, though it is probably always a sign the animal has been hit if it runs with tail down. In either event the hunter should at once search carefully for blood spots, following the trail for a hundred yards at least; but on finding such signs he should abandon the pursuit (unless the trail is likely to be obliterated by rain or snow) for at least half an hour, for a badly wounded deer, if not pursued, will soon lie down and die, or become so weak from loss of blood that he will not be able to escape when the hunter approaches.

Still-hunting the moose involves much the same tactics, but demands even more care, especially about the wind; for this remarkable animal has not only the largest, but apparently the most efficient, nose in the woods. Moreover, where it has been hunted, if only to a very limited extent, it becomes even more watchful and suspicious of everything than its smaller relatives, which it equals, if it does not exceed, in intelligence. (For hunting the moose by calling, see HUNTING BIG GAME.) Caribou are stalked with comparatively little difficulty, if the hunter has any cover at all, and takes advantage of the wind; and their habit of pursuing an almost perfectly straight line when they are feeding often makes it possible for the hunter to get ahead of them by a détour and await their approach. Bull elk, during the rutting season, are very likely to betray their whereabouts by their persistent and defiant challenging (bugling), and bears, especially the grizzly and big brown species, are often seen at great distances on thinly timbered mountainsides.

Consult: T. S. Van Dyke, *The Still Hunter* (New York, 1904), the standard work on still-hunting deer; J. Brunner, *Tracks and Tracking* (ib., 1909); Theodore Roosevelt, *The Wilderness Hunter* (ib., 1909); also bibliography under HUNTING.

STILLING, shtĭl′ĭng, BENEDIKT (1810–79). A German anatomist and surgeon. He was born at Kirchhain (Hesse), studied medicine at the University of Marburg (M.D., 1832), and was district surgeon in Cassel until 1840. He afterward practiced privately. Stilling traveled much. He is well known through his studies on the brain and the nervous system, having been the founder of the theory of the vasomotor nervous system—*Physiologische, pathologische, und medizinische praktische, Untersuchungen über die Spinal Irritation* (1840); and after his first visit to Paris he introduced ovariotomy into Germany (1837), using his own method, the extraperitoneal one, etc. Four of his writings received the prize of the Academy of Medicine at Paris. His best-known works are *Untersuchungen über die Funktionen des Rückenmarks und der Nerven* (1843, 1859); *Untersuchungen über den Bau des kleinen Gehirns des Menschen* (1864–67, 1878); *Ueber die Medulla oblongata* (1843).

STILLING, JOHANN HEINRICH JUNG-. See JUNG-STILLING, J. H.

STIL′LINGFLEET, EDWARD (1635–99). An Anglican prelate, born at Cranborne, Dorsetshire. He received his education at Cambridge. In 1659 he published the *Origines Sacræ, or Rational Account of the Christian Faith, as to the Truth and Divine Authority of the Scriptures*, a work which made his reputation, and is still esteemed as a masterly treatise, though much of it is superseded by modern scholarship. In 1664 appeared his *Rational Account of the Grounds of the Protestant Religion*, a defense of the Church of England from the charge of schism in its separation from Rome, which was received with great favor, and led to his appointment as preacher at the Rolls Chapel. In 1670 he became canon of St. Paul's Cathedral, and in 1678 was made dean. After the Revolution of 1688 he received the appointment to the Bishopric of Worcester. Stillingfleet's chief works, besides those mentioned, were the *Origines Britannicæ, or Antiquities of the British Churches* and *The Doctrines and Practices of the Church of Rome Truly Represented* (1686; 3d ed., 1851), a standard work. His complete works were published in six volumes (London, 1710, with life by Richard Bentley, supplementary vol., 1735).

STILLINGIA, stĭl-lĭn′jĭ-ȧ (Neo-Lat., named in honor of Stillingfleet, English botanist). A genus of plants belonging to the family Euphorbiaceæ. The species are mostly trees or shrubs of tropical Asia and America, and of the islands of Bourbon and Mauritius. One species, *Stillingia sylvatica*, queen's delight or yaw shrub, a perennial herb 2 to 3 feet high, is found from Virginia to Kansas and south to the Gulf. The root of this plant has been variously used in medicine. *Stillingia sebifera* or *Sapium sebiferum*, the tallow tree of China, from the fruit of which the Chinese obtain tallow, and which was introduced into the East and the West Indies, has a trunk and branches like the cherry and foliage like the black poplar.

STILL LIFE (still, i.e., dead). A branch of painting devoted to the representation of lifeless objects, such as dead game, fish, household utensils, vases, plate glasses, and the like; taken to include also fruits and flowers. Still-life painting is concerned purely with pictorial effects like the charm of color and treatment of light and shadow. It was practiced by the Greeks of the best period, and further developed during the Alexandrian period, as may be seen in the surviving Pompeian frescoes and Roman mosaics. During the Renaissance it was in abeyance, except as an accessory to figure painting. The early Netherlanders from Jan van Eyck down, and Germans, like Dürer and Holbein, excelled especially in this variety. But still-life painting did not develop independently in the Netherlands until the seventeenth century, its golden age—Holland was its special home. Until about 1650 the local schools are plainly discernible: Haarlem, with its breakfast scenes, rich or frugal, and goldsmith's plate; Leyden, the university city, with books, writing materials, and musical instruments; The Hague, with the products of the fish markets; Utrecht, with fruits and flowers. The most eminent masters were Jan de Heem of Utrecht, Willem Kalf of Amsterdam, and Abraham van Beyeren of The Hague. Others were Snyders, Seghers, and Johannes Fyt in Flanders; Claesz, Heda, Van Aelst, Dou, Rembrandt (occasionally), Weenix, Van Huysum, and Rachel Ruysch in Holland. The greatest still-life painter of the eighteenth century was Chardin in France. During the nineteenth century this genre was practiced occasionally by many of the great artists (Delacroix, Courbet, Manet, Cézanne), and as a specialty by Desgoffe, Philippe Rousseau, Antoine Vollon, the greatest of the century, and many others like Ribot, Roybet, and Bonvin. In the United States, W. M. Chase, celebrated for his fish, came to be known as the most brilliant painter of still life. Well known also are Emil Carlsen and Wilton Lockwood, the latter for his flowers.

STILL′MAN, Samuel (1738–1807). An American clergyman. He was born in Philadelphia, Pa., removed to Charleston, S. C., in 1748, was ordained as a Baptist minister in 1759, and preached first at James Island (S. C.), then at Bordentown (N. J.), and finally at Boston. He was one of the incorporators of Brown University (1764). Among his published sermons are *A Sermon on the Repeal of the Stamp Act* (1766), *Election Sermon* (1779), *Masonic Discourse* (1785), and a *Sermon Occasioned by the Death of George Washington* (1799).

STILLMAN, Thomas Bliss (1852–1915). An American chemist, born in Plainfield, N. J. He graduated from Rutgers College in 1873, receiving the degree of M.S. in 1876. During 1876–79 he studied analytical chemistry in the laboratory of Fresenius in Wiesbaden, and in 1879 began practice as an analytical chemist in New York. At Stevens Institute, where in 1883 he received the degree of Ph.D., he was appointed professor of analytical chemistry (1886) and in 1902 he was given the chair of engineering chemistry and was made head of the chemical department. In 1909 he retired, but continued active as a consulting chemist, and from 1911 until his death was city chemist of Jersey City and Bayonne, N. J. He published *Engineering Chemistry: A Manual of Quantitative Chemical Analysis for Students, Chemists, and Engineers* (1897) and *Examination of Lubricating Oils* (1914).

STILLMAN, William James (1828–1901). An American journalist, landscape painter, and author. He was born in Schenectady, N. Y., and after graduating at Union College in 1848 took up landscape painting under Frederick Church. In 1849 he studied in England, where he was influenced by the Pre-Raphaelites, becoming acquainted with Turner, whose work he admired, and with Ruskin. From 1851 to 1859 he exhibited at the National Academy, of which he was elected an associate in 1854. In 1852 he was commissioned by Louis Kossuth to go to Hungary to carry away the crown jewels which Kossuth had hidden during the Revolution. He continued to practice painting until 1855, when he took up journalism, devoting himself to political and artistic subjects. Stillman was United States Consul at Rome (1861–65), and in Crete (1865–69). From 1883 to 1885 he was art critic of the *Evening Post*, and from 1875 to 1885 correspondent on political affairs for the London *Times*. He lived in Italy from 1878 to 1898, after which he retired to Surrey, England, where he died. His writings include: *The Cretan Insurrection of 1866–68* (1874); *On the Track of Ulysses* (1888); *Union of Italy, 1815–1895* (1898; new ed., with epilogue by G. M. Trevelyan, 1909); *Francesco Crispi* (1899). Consult his *Autobiography of a Journalist* (2 vols., Boston, 1901), full of interesting reminiscences.

STILL′WA′TER. A city and the county seat of Washington Co., Minn., 18 miles northeast of St. Paul, on the St. Croix River and Lake, and on the Chicago, Milwaukee, and St. Paul, the Chicago and Northwestern, and the Northern Pacific railroads (Map: Minnesota, E 5). It has a situation of great natural beauty at the foot of the celebrated dalles of St. Croix, cliffs which extend for 30 miles above the city. Still-water has the Minnesota State prison, a public library, a United States government building, a fine city hall, Stillwater City Hospital, and St. Joseph's and St. Mary's convents. The city has extensive lumber interests, breweries, foundries and machine shops, grain elevators, a brickyard, and manufactories of wagons, boats, farm implements, boots and shoes, boxes, etc. The commission form of government was adopted in 1915. Pop., 1900, 12,318; 1910, 10,198.

STILLWATER, Battle of. See Saratoga, Battles of.

STILL′WELL, Lewis Buckley (1863-). An American electrical engineer. He was born at Scranton, Pa., and studied at Wesleyan and Lehigh universities in 1882-85. After 1886 he was engaged in practice as a consulting electrical engineer at New York City. He served as chief engineer of the Westinghouse Electric and Manufacturing Company in 1891-97, and as electrical director of the Niagara Falls Power Company in 1891-1900, and of the Rapid Transit Subway Construction Company in 1900-08. He was also consulting electrical engineer to the Manhattan Railway Company in 1900-04 and afterward to the Hudson Companies. In 1909-10 he was president of the American Institute of Electrical Engineers.

STI′LO, Lucius Ælius Præconinus (called also Philologus). A celebrated Roman grammarian. He was learned in both Greek and Latin and was an instructor of Cicero in rhetoric and of M. Terentius Varro in grammar. His sympathy with the aristocratic party led him to accompany Quintus Metellus Numidicus into exile at Rhodes in 100 B.C. His works include commentaries on the *Axamenta*, or Songs of the Salii, and the *Twelve Tables*, and a volume entitled *De Proloquiis*. Consult J. E. Sandys, *A History of Classical Scholarship*, vol. i (2d ed., Cambridge, 1906).

STILT (Swed. *stylta*, OHG. *stelza*, Ger. *Stelze*, stilt, crutch). A large, handsome, long-shanked shore bird of the genus *Himantopus*, related to the avocets. The common Old World species (*Himantopus himantopus*) is widely distributed. The American species (*Himantopus mexicanus*) is common to both continents; and others are known in other parts of the world along seacoasts. They frequent muddy flats in small flocks, and walk with long, measured steps, seeking for food among the reeds, and catching small fishes in the pools and shallows. See Plate of Beach Birds.

STILT BUG. A plant bug of the family Berytidæ, which includes very slender species with long, thin legs in which the thighs are thickened at the tip. Only six species are known to occur in the United States.

STIM′SON, Frederic Jesup (1855-). An American lawyer and author, born at Dedham, Mass. He graduated at Harvard in 1876 and at the Harvard Law School in 1878, and began practice in Boston. In 1884-85 he was Assistant Attorney-General of Massachusetts, and in 1898-1902 general counsel to the United States Industrial Commission. In 1903 he became professor of comparative legislation at Harvard, and in 1914 was appointed first ambassador of the United States to Argentina. He is best known as the author of law books, including *American Statute Law* (2 vols., 1886); *Stimson's Law Glossary* (1890); *Labor in its Relation to Law* (1894); *Handbook to the Labor Law of the United States* (1896); *Uniform State Legislation* (1896); *The American Constitution* (1908); *Popular Law-Making* (1911). Under the pen name of "J. S. of Dale" he wrote novels and short stories (*Guerndale*, 1882, was his first novel), and later under his own name.

STIMSON, Henry Lewis (1867-). An American lawyer and cabinet officer, born in New York City. He was educated at Yale (A.B., 1888), Harvard (A.M., 1889), and Harvard Law School. Admitted to the bar in 1891, he became a member of the law firm of Root and Clarke in 1893, of Root, Howard, Winthrop, and Stimson in 1897, and of Winthrop and Stimson in 1901. In 1906-09 he was United States Attorney for the Southern District of New York. Stimson was unsuccessful as Republican candidate for Governor of New York in 1910. In 1911-13 he served as Secretary of War in the cabinet of President Taft. In 1915 he was a delegate to the New York State Constitutional Convention.

STIM′ULANTS (from Lat. *stimulare*, to urge, prick, from *stimulus*, goad, incitement; connected with Gk. *στίζειν*, *stizein*, to pierce, Skt. *tij*, to be sharp, OHG. *stehhan*, Ger. *stechen*, Eng. *stick*). Agents which increase temporarily the functional activity of the organism as a whole or of the various organs of the body. These may be cardiac, respiratory, nervous, hepatic, renal, gastric, etc., depending on the organ or system affected. Stimulants embrace a wide range of therapeutic agents, but popularly the term is applied to those acting especially on the circulatory, respiratory, and nervous systems. Alcohol is the most generally employed, in the form of whisky, brandy, or wines. The various preparations of ammonia, inhaled or given as the aromatic spirit of ammonia, are very serviceable diffusible stimulants. Ether may be taken as an inhalation, a hypodermic injection, or in solution by the mouth, and acts rapidly. Among the many other general stimulants may be mentioned camphor, strychnine, lavender, ginger, peppermint oil, and the other essential oils. This class of remedies is useful in fainting, hysteria, shock, etc.

STIM′ULUS (from Lat. *stimulus*, goad, incitement). A mechanical, molecular, chemical, or ethereal change in the conditions external to a plant cell or to the plant body, which produces a change (reaction) in the cell, a particular organ, or the whole plant. Mechanical stimuli, due to the mass movement of the external agents, are contact, pressure, traction, friction, torsion, etc. (See Movement; Tendril; Thigmotropism.) In the absence of knowledge as to its nature, gravity may be included in this group, since it depends upon the mass of the body acting (the earth), although it is not in itself mechanical. (See Geotropism.) Molecular stimuli depend upon molecular movements. Osmotic pressure has been proved capable of acting as a stimulus. The reactions of organisms to solutions of varying concentration are interpreted as due not to the chemical nature but to the physical character, viz., the amount of osmotic pressure. (See Osmosis.) Chemical stimuli depend not upon the mass, but upon the chemical composition of the body acting. They are, therefore, almost as various as chemical compounds, although many substances are nearly or quite inert. The most common acting upon plants are water, organic acids, mineral salts and other solutes in the water. (See Chemotropism.) Ethereal stimuli are propagated in the ether, light, and heat. (See Heliotropism; Ther-

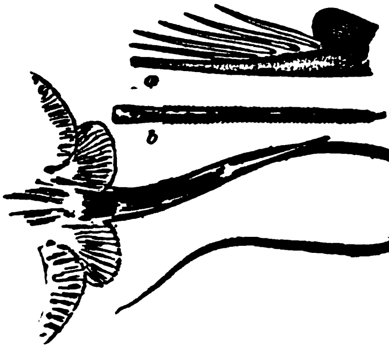
Motropism.) Here also may be included electricity, whose action in nature is little understood. See Irritability; Psychology; Psychological Apparatus.

STINDE, shtĭn′de, Julius (1841–1905). A German humorist. He studied and practiced manufacturing chemistry, became editor of a Hamburg trade journal, contributed to periodicals, and was gradually drawn wholly to literature, wherein he won popularity by *Buchholzens in Italien* (1883), *Die Familie Buchholz* (1884, translated), a second part of this (1886), *Frau Buchholz im Orient* (1888), *Frau Wilhelmine Buchholz' Memoiren* (1895), and *Hotel Buchholz, Ausstellungserlebnisse* (1896). His other writing, dramatic and otherwise, is of slight worth, but in the *Buchholz* series the lower middle class of Berlin is depicted with a fresh, genial, healthy humor. Consult R. M. Meyer, *Die Ahnen der Familie Buchholz in Gestalten und Problemen* (Berlin, 1905).

STING (from AS. *stingan*, to push out). An organ possessed by various kinds of animals, by which they not only inflict a mechanical wound in their prey, but also insert into it an irritant or poison. Stinging or nettling cells (see Nematocyst) occur in all the Cœlenterata except ctenophores, in some turbellarian worms, and on the cerata of the nudibranch *Eolis*. The sting of scorpions (q.v.) is in the tail. The poison, secreted by a gland, exudes through small openings into the wound, and is powerful enough to cause death in the small natural prey. Among insects, several forms are provided with a sting. This organ, of especial use as a means of defense to the so-called aculeate Hymenoptera, a group which includes the bees, wasps, and many ants, and to the Mutillidæ or cow ants or velvet ants, is simply a modified ovipositor connected with a poison gland. The sting of a bee consists of three distinct pieces: two barbed needles and one gougelike piece, the director; the needles move up and down on the director, controlled by muscles attached to their bases. In the anterior part of the director there is a slight projection on the needle which catches a bit of the poison in the chamber and carries it to the wound. The director itself is composed of a united pair of stylets, and without the director is a third pair of stylets which are thick and hairy. (See Insect, *Poisonous Insects*.) The poison is secreted by glands which pour this into the chamber. The poison of the bee is said to be secreted by two glands, one producing an acid and the other an alkaline fluid. Merely acid poison glands are said by some investigators to be present in those wasps which only stupefy the prey they store up for nourishment of their young.

STINGFISH. See Weever.

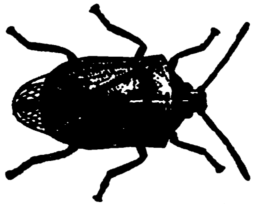
STING′RAY′, or **STINGAREE**, stĭŋ′gȧ-rē′. A ray (q.v.) of the family Dasyatidæ, characterized by the usual possession of a long whiplike tail, bearing near its base one or more long, strong, sharp spines retroversely serrated. When broken off the spine is replaced by the coming forward of one of a succession growing behind it. The family includes about fifty species, inhabitants of the warmer seas, some species occurring in the fresh waters of Northern South America, some of which are 10 or 12 feet in length. They are generally much dreaded because of the ugly wound they are capable of inflicting with the spine or sting. The sting is not poisonous, as is frequently supposed, although the mucous secretions of the skin may be responsible for the serious inflammations frequent in the wounds. See Devilfish; also Ray and accompanying Plate.



TAIL OF A STINGRAY.

a, enlarged view of the base of the tail of a stingray, having several spines; *b*, a single spine, barbed on both sides.

STINKBUG. Any one of the heteropterous insects of the family Pentatomidæ, many of which are protected from their natural enemies by a nauseous and persistent odor, which remains upon berries over which these bugs may have walked. The family is large; 5000 species have been described, of which 500 are found in the United States. They are broad, flat insects with five-jointed antennæ, are usually green, gray, or brown, though some have a brilliant combination of black and red or yellow and black. They vary in habit, some species being exclusively carnivorous and others exclusively plant feeders, while others seem to feed indifferently upon the juices of plants or upon other insects. See Soldier Bug.



A STINKBUG.

STINK DAMP. See Coal, *Mining*.

STINKHORN. See Plate of Types of Fungi, with article Fungi.

STINKING GOOSEFOOT. See Chenopodium.

STINKING SMUT. See Bunt.

STINKPOT. See Musk Tortoise.

STINKWEED. See Stramonium.

STINKWOOD. See Oreodaphne.

STINT (from AS. *styntan*, to make blunt, short, from *stunt*, dull, stupid). One of the small sandpipers (q.v.) of the genus *Tringa* or *Pisobia*. The American stint (*Tringa* or *Pisobia minutilla*) is the smallest of the sandpipers, less than 6 inches long, breeds only in the Arctic regions, and is common throughout North America during the migrations. The plumage in summer is variegated bright bay, blackish, ashy and whitish above, whitish beneath; in winter the color is simply ashy above, whitish beneath. The little and Temminchi stints (*Erolia minuta* and *E. temminchii*) are European and Asiatic species, nesting in the far north of Siberia. For their interesting habits consult M. D. Haviland, *A Summer on the Yenesei* (New York, 1915).

STI′PA. See Feather Grass.

STI′PENDS, CLERICAL (Lat. *stipendium*, tax, from *stips*, gift + *pendere*, to weigh out). A general designation of the means of support provided for the clergy. There have developed in Western civilization five general methods of providing clerical support: (1) voluntary offerings, (2) tithes, (3) endowments, (4) state aid, and (5) contracts. No country shows any one method prevailing to the exclusion of the others. Tithes (q.v.) were ordained in the Hebrew law, and the system continued in Christian times. State aid is of two kinds, direct and indirect; the latter is of the greater antiquity. When the political power under the Emperor Constantine came to the support of the Christian religion one of the first results of the coöperation of the state was the legal capacity given churches in a corporate character to receive gifts inter vivos and by bequest, and to hold the same in perpetuity. This was an indirect method of state aid. Direct state support has been developed since the Reformation. It is now in operation in those European states of Roman Catholic allegiance which entered into a treaty—the concordat—with the see of Rome for the support of the clergy. Such treaties came about as a return for the sequestration of the older ecclesiastical endowments in land. Spain, Portugal, and Austria give such direct support. The Protestant German and Scandinavian states furnish a like support to the Protestant ministry. Russia supports the hierarchy of the orthodox church. A similar system prevails in the Central and South American states for the Roman Catholic clergy. The fifth method, that of contracts, is essentially American. It consists of a contract between a church (in the Protestant denominations) and its minister for the payment of a definite sum for his support, and then a series of contracts between the church and its attendants for the rental of pews and sittings. As a reaction from this method has developed what is known as the free-church movement, which seeks to abolish rentals and to substitute voluntary contributions. Most churches combine pew rentals with voluntary contributions.

STIP'PLE (from Dutch *stippeln*, to speckle, from *stippen*, to dot, prick, from *stip*, point, dot), or Stippling. In engraving, a process of working by dots instead of lines. In dotted prints (*Schrotblätter*, *manière criblée*) the dots showed white on a black ground. In *opus mallei*, punches were driven into the plate with a hammer. Stippling was intermingled with line engraving (q.v.), but as an art in itself it resulted in prints produced altogether, or mainly, by dots. In the simplest form of stipple the plate is covered with an etching ground (see Etching) and the design is executed with a point, but complicated roulettes were also used. It was an art of delicacy, softness, and gentle charm rather than of strong effects. Francesco Bartolozzi (q.v.) and Caroline Watson were among its most noted exponents. Stipple or stippling is also used in water color, particularly in miniature painting. The application of color in dots is especially adapted to minuteness and delicacy of execution.

STIP'ULA'TION (Lat. *stipulatio*, bargain, *stipulare*, to bargain, covenant). In law, a material clause or provision in a contract. The term is also sometimes applied to an agreement between attorneys as to some matter of practice. In admiralty practice it is a bond or undertaking filed with the court by one of the parties to an action or proceeding. A libellant must file a stipulation for costs. When a vessel is attached under a libel the owner must file a stipulation for value to obtain release. See Bond.

STIRLING, stẽr'ling. A river port and capital of Stirlingshire, Scotland, on the Forth, 35 miles northwest of Edinburgh (Map: Scotland, E 3). Rich agricultural, mining, and manufacturing districts near by are the basis of its prosperity. Situated at the head of navigation of the Forth, Stirling, strongly fortified by nature, was the key to the Highlands. It owes its origin to the strong natural fortress of Castle Hill, crowned by the venerable castle, commanding a view of great beauty. From this hill north and east to the plain extends the oldest part of the town. Stirling Bridge, which existed in 1571, was until recent years the only one by which wheeled carriages could cross the Forth. Noteworthy are the East and West churches—the former erected by James IV about 1494—and Mar's Work, an incomplete and richly ornamented structure, built in 1572. Ropes, malt, leather, soap, and mineral oils are manufactured. Vessels of 150 tons can reach the port of Stirling, but its river trade has decreased since the advent of railroads. Stirling (formerly Stryvelyne or Estrivelin) is one of the most ancient and historically important towns of Scotland. Alexander I died in the castle in 1124. Near by the battle of Stirling was fought in 1297. (See Wallace, William.) The town was taken by Edward I, after a siege of three months, in 1304. In the vicinity, at Bannockburn (q.v.), the famous battle of that name was fought in 1314. The castle was the birthplace of James II and of James V. James III built the Parliament House in the castle, and improved and embellished the fortress. James V built the palace, the walls of which are profusely covered with grotesque ornamentation. In the older part of the castle is the Douglas Room, in which William, Earl of Douglas, was assassinated by James II. In 1651, after the battle of Dunbar, the castle was taken by Monk; and it withstood a siege by the Highlanders in 1745. Pop., 1901, 18,403; 1911, 21,205. Consult *History of the Chapel Royal of Stirling*, published by the Grampian Club (Stirling, 1882), and *Charters of Stirling* (ib., 1884).

STIRLING, Earl of (1726–83). See Alexander, William.

STIRLING, James (1692–1770). A mathematician, born at Garden, Stirlingshire, Scotland. He was educated at Glasgow University and Balliol College, Oxford. He was expelled from Oxford (1715) on account of his relations with the Jacobites, and went to Venice, where he took up the study of mathematics. It was during his residence in Venice that he wrote his work *Lineæ Tertii Ordinis Newtonianæ* (1717), and his paper *Methodus Differentialis Newtoniana Illustrata*, which was communicated to the Royal Society through Newton (*Philosophical Transactions*, 30: 1050). Stirling returned to London in 1725 and devoted himself to the teaching of mathematics, enjoying the friendship of Newton and corresponding with many of the noted mathematicians of the day. His greatest contribution to mathematics was his *Methodus Differentialis, sive Tractatus de Summatione et Interpolatione Serierum Infinitarum* (1730; 2d ed., 1764; Eng. trans., 1749).

STIRLING, James Hutchinson (1820–1909). A Scottish philosopher, born in Glasgow. He studied at Glasgow University and then practiced medicine for some years, but later traveled and devoted himself to the study of philosophy, especially German philosophy. His first book, *The Secret of Hegel* (2 vols., 1865; new ed., rev., 1898), was of much importance, as were later ones, in advancing idealistic thinking. A translation of Schwegler's *History of Philosophy* (1867; frequently republished) was followed by *As Regards Protoplasm* (1869); *Lectures on the Philosophy of Law* (1873); *Text-Book to Kant* (1881); *Philosophy and Theology* (1890), the first Gifford lectures at Edinburgh; *Darwinianism: Workmen and Work* (1894); *What is Thought?* (1900); *The Categories* (1903; 2d ed., 1907). Consult A. H. Stirling, *James Hutchinson Stirling* (London, 1912), with preface by Lord Haldane.

STIRLING, John William (1859–). A Canadian physician. He was born at Halifax, graduated in medicine at Edinburgh University in 1884, and studied afterward in Vienna, Berlin, and London, giving special attention to the eye and ear. He practiced in Montreal as an ophthalmological and aural surgeon, was appointed professor of ophthalmology in the University of Bishop's College, Lennoxville, and in 1906 became professor of ophthalmology in McGill University. He was appointed oculist and aurist to the Montreal General Hospital, and in 1909 was a delegate to the International Ophthalmological Congress, Naples.

STIRLING, Yates (1843–). An American naval officer, born in Baltimore. He graduated from the United States Naval Academy in 1863, served on the *Shenandoah* in the North Atlantic Blockading Squadron in 1863–65, and participated in both attacks on Fort Fisher. Subsequently he was promoted through the various grades to commander in 1880, captain in 1894, and rear admiral in 1902. He commanded the *Newark* in 1895–96 and the *Lancaster* in 1896–97; served as a member of the Lighthouse Board from 1898 to 1900; and was commandant of the Naval Station at San Juan, P. R., in 1900–02, and of the Navy Yard at Puget Sound, Wash., in 1902–03. Stationed with the Asiatic Fleet, he commanded the Philippine Squadron in 1903–04 and the Cruiser Squadron in 1904, and in 1904–05 was commander in chief of the fleet. He was retired in the latter year.

STIRLING-MAXWELL, Caroline E. S. Norton, Lady. See Norton.

STIRLING-MAXWELL, Sir William (1818–78). A Scottish author, born near Glasgow. He bore the name of Stirling until 1865, when by the death of Sir John Maxwell, his maternal uncle, he succeeded to a baronetcy and affixed the name of Maxwell. He graduated at Cambridge in 1839, and later made several visits to Spain. In 1852–68 and 1874–78 he represented Perthshire in Parliament. He was rector of St. Andrews University in 1862 and of Edinburgh in 1872, and in 1875 was elected chancellor of the University of Glasgow. He was the author of *Annals of the Artists of Spain* (3 vols., 1848; 2d ed., 4 vols., 1891); *The Cloister Life of Charles V* (1852; 4th ed., 1891); *Velazquez and his Works* (1855; Ger. trans., 1856; Fr. trans., 1865). For his wife see Norton, Caroline.

STIR′LINGSHIRE. A west-midland county of Scotland, on the border between the Highlands and the Lowlands of the country, and bounded on the north by Perthshire and by the river and Firth of Forth (Map: Scotland, D 3). Area, 451 square miles. Much of it is occupied by the carses of Stirling and Falkirk, formerly covered with unproductive moss, but now mostly converted into profitable agricultural lands. The chief elevation is Ben Lomond (q.v.). The rivers are the Forth, the Carron, and the Endrick. Loch Lomond is the only important lake. Stirlingshire is noted for its minerals, especially ironstone, which is wrought on an extensive scale at Carron, and there are extensive and valuable coal fields in the southeast. Woolen goods are manufactured at Alva and Bannockburn and in the neighborhood of Stirling. The capital is Stirling. Pop., 1801, 50,800; 1851, 86,200; 1901, 142,291; 1911, 160,991.

STIRNER, shtêr′nĕr, Max (1806–56). A German philosophical anarchist, whose real name was Johann Kaspar Schmidt. He was born at Bayreuth, studied theology and philology at Berlin, Erlangen, and Königsberg, and at Berlin became an instructor in the Gymnasium and later in the higher girls' school there. His *Der Einzige und die Eigentum* (1845; 3d ed., 1900) is considered one of the earliest and best expositions of the views of the philosophical anarchists. He wrote also *Geschichte der Reaktion* (2 vols., 1852), and translated into German J. B. Say's *Traité d'économie politique* as *Lehrbuch der praktischen Oekonomie* (4 vols., 1845–46) and Adam Smith's *Wealth of Nations* as *Untersuchungen über den Nationalreichtum* (4 vols., 1846). Consult Mackay, *Max Stirner, sein Leben und sein Werk* (Leipzig, 1898), and E. Horn, *Max Stirners ethischer Egoismus* (Berlin, 1906); also J. G. Huneker, *Egoists* (New York, 1909).

STIRRUP CUP. See Drinking Usages.

STITCHES. See Embroidery.

STITCH′WORT (*Stellaria*). A genus of annual and perennial plants of the family Caryophyllaceæ, having weak stems and white flowers, which in some are minute, and in others are large enough to be ornamental. To this genus the common chickweed is generally referred.

STITH, William (1689–1755). An American Colonial historian, born in Virginia. He went to England, studied theology, was ordained priest in the Established church, and on his return (1721) was made master of the grammar school at William and Mary College, Williamsburg, Va. He won a distinguished place among the clergymen of the Colony, was chosen chaplain of the House of Burgesses in 1738, and rector of Henrico Parish, and president of William and Mary College (1752–55). He is known for his scholarly but unfinished *History of Virginia from the First Settlement to the Dissolution of the London Company* (1747, reëdited with a bibliography 1866). This work is highly praised for its accuracy and much blamed for its diffuseness.

STOA, stō′ȧ (Gk. *στοά*, *στοιά*, a roofed colonnade, piazza, porch). One of the extended colonnades surrounding the market place and often extending through the principal streets of Greek cities. It was always roofed (for shelter in bad weather), and its floor was above the street level. At the back was usually an inclosed wall, and in front a single or double colonnade facing the street. Later, when broader spaces were to be roofed, the stoa became an independent structure. Sometimes a dividing wall was placed between the two rows of columns; the more usual form was the stoa diple, in which a row of columns replaced the wall. The forms of the stoa multiplied; two inner rows of columns were often used and additional stories were added. The stoa originated among the Ionian Greeks in Asia Minor, whence it was introduced into Greece. Celebrated examples were the simple Stoa Pœcile (many-colored) upon the market place of Athens, the walls of which were decorated with scenes from the battles of Marathon and Œnoë by Polygnotus; the stoa diple of Thoricos; the three-aisled basilica of Pæstum; and the two-storied stoa of King Attalus II at Athens. Stoas were frequently adorned with statuary and painting.

STOAT. The British name for a weasel (q.v.).

STOBÆ'US, JOANNES (Lat., from Gk. *Ἰωάννης ὁ Στοβαῖος, Iōannēs ho Stobaios*) (c.450–c.500 A.D.). A Greek writer, apparently a native of Stobi, in Macedonia. To him we owe the preservation of a large number of our fragments of over 500 early Greek poets and prose writers. This most valuable collection of excerpts, in four books, bore the name *Florilegium* (*Ἀνθολόγιον, Anthologion*), but in the course of the Middle Ages was divided into two parts, one of which is known as the *Eclogæ*, the other as the *Florilegium*. The best critical edition is by Wachsmuth and Hense (Berlin, 1884–1909). Consult Christ-Schmid, *Geschichte der Griechischen Litteratur*, vol. ii, part ii (5th ed., Munich, 1913).

STOCK (AS. *stoco*, OHG. *stoc*, Ger. *Stock*, post, trunk). In corporation law, the rights or interest which the members of a corporation, or persons who contribute to its capital, have in its assets, franchises, management, and profits. The amount fixed by the charter of a corporation as the sum which is to be paid into its treasury for use in its business operations is called the capital stock. The latter term is sometimes inaccurately applied to the actual property owned by a corporation, as the capital stock of a corporation may not represent its actual assets, even at the time of its organization. The total capital stock of a corporation is divided into shares, which are represented by certificates, and the latter are distributed to subscribers according to the amounts of their respective subscriptions. Shares of stock may be made of any value, the par value being fixed by dividing the number of shares issued into the total amount of capital stock. The usual par value is $100, but shares representing other sums, even so small as $1 each, are sometimes issued, especially in industrial enterprises. Many States require stock to be issued at its par value.

Treasury stock is that which is not allotted to subscribers, but retained by the corporation for the purpose of selling it from time to time to raise funds.

Stock may be divided into preferred and common shares. The amount in dividends which the former can receive in each year is usually fixed and certain, and if more is paid as dividend it must be paid on the common stock. Preferred stock may be cumulative or noncumulative. If the former, any deficiencies in dividends in one year must be made up later, before a dividend can be declared on the common. For example, if 7 per cent cumulative preferred stock is issued, and the earnings are only sufficient to pay 5 per cent on it in a given year, the deficiency of 2 per cent must be made up later. If such stock were noncumulative, the preferred stock would only receive 5 per cent for that year, even though the earnings the next year were sufficient to pay 15 per cent on the amount of the capital stock, and an 8 per cent dividend were declared on the common stock.

The name of each person to whom a share of stock is issued is entered upon the books of the corporation.

Shares of stock are generally considered personal property even where the sole assets of the corporation consist of real property, and they are transferable by assignment. The transferee obtains a right to have his name entered upon the books of the company as a stockholder in the place of his transferrer. Where the stockholder after having assigned the certificate fraudulently induces the corporation to place the name of another person, represented to be the true transferee, on the books as stockholder, the latter is then the stockholder and the holder of the certificate is confined to his action against the corporation for damages. For this reason a bond of indemnity is now generally required where the certificate is lost. However, shares of stock are not negotiable instruments in the strict sense of that term, but they are commonly indorsed in blank and transferred from one person to another as if such transfer were protected by the same rules of law. For this reason the courts in the United States generally protect an innocent purchaser for value, on the ground of estoppel. The English courts do not go so far in this respect, and the only safe course there is for a purchaser of stock to have the transfer entered on the books of the corporation immediately. Dividends are paid to the record owner of stock irrespective of who holds the certificates. A record owner of stock is called a stockholder. See Cook, *Treatise on the Law of Corporations* (5th ed., Chicago, 1903); Dos Passos, *The Law of Stock Brokers and Stock Exchanges* (2d ed., New York, 1905); also CORPORATIONS and authorities there cited; STOCK EXCHANGE and authorities.

STOCK (so called from its woody stem), GILLIFLOWER, or GILLYFLOWER (*Matthiola*). A genus of about 30 species of herbs or half shrubs of the family Cruciferæ, natives of the Mediterranean regions. *Matthiola incana*, in-

STOCK (*Matthiola incana*).

digenous in southern Europe, is probably the parent of the greater number of the cultivated hoary-leaved kinds known as Brompton stock, etc., while those with smooth leaves, called ten-week stock, German stock, etc., are referred to *Matthiola fenestralis*, which, perhaps, is a variety of the species *Matthiola incana*. The sandy shores of Wales and of Cornwall produce a species (*Matthiola sinuata*) the large purple flowers of which are fragrant only at night, a characteristic also of several other species. The hoary-leaved stocks are usually treated in planting as biennials, although they may almost be reckoned perennial. The smooth-leaved stocks are treated as annuals.

STOCK, Frederick August (1872–). An American composer and orchestral conductor, born at Jülich (Rhine Province). He began his musical studies under his father, a German bandmaster. From 1886 to 1891 he was a pupil of the Cologne Conservatory, where he studied violin with Japha and composition with Zöllner, Wüllner, and Humperdinck. For the next four years he was a violinist in the Municipal Orchestra of Cologne. In 1895 he came to Chicago as a member of the Theodore Thomas Orchestra (viola). In 1901 Thomas selected him as his assistant. After the death of Thomas he became the conductor. As a composer he showed a decided predilection for the larger forms, which he handled with mastery. He wrote a set of *Symphonic Variations;* several symphonic poems; an overture, *Life's Spring Tide;* a violin concerto; a Symphony in C minor; a *Festival Prologue* (for the 25th anniversary of the Chicago Symphony Orchestra, 1915); a string quartet in C minor.

STOCKADE′. A means of defense consisting of stakes, logs, timbers, tree trunks, etc., firmly set in the ground and adjoining each other, and provided with loopholes through which the fire of the defenders may be delivered. Stockades are one of the oldest forms of fortifications, having done duty since the time of arrows and javelins.

STOCK′BRIDGE. See Mahican.

STOCKBRIDGE. A town, including three villages, in Berkshire Co., Mass., 17 miles by rail south of Pittsfield, on the Housatonic River, and on the New York, New Haven, and Hartford Railroad (Map: Massachusetts, A 3). It is picturesquely situated in the Berkshire Hills. Noteworthy features are the Chimes Tower, commemorating the early Indian Mission; a fine park, the gift of Cyrus W. Field; the Edwards Monument; the Indian Burial Ground; Williams Academy; the Jackson Library and Reading Room; Prospect Hill, commanding an extended view; and Lake Mahkeenac, near which are the remains of the house where Hawthorne wrote the *House of the Seven Gables* and other works. Pop., 1900, 2081; 1910, 1933.

An Indian mission was established here in 1735, and two years later the place was incorporated as a town under its present name (from Stockbridge, England). Jonathan Edwards was a missionary here from 1750 to 1758, and here he wrote his famous *Freedom of the Will*. In 1785 the Indians moved to New Stockbridge, N. Y. Consult Jones, *Stockbridge Past and Present* (Springfield, 1854), and *History of Berkshire County* (New York, 1885).

STOCKBRIDGE, Henry (1822–95). An American political leader, born at North Hadley, Mass. He graduated at Amherst in 1845, and was admitted to the bar in Maryland in 1848. He remained with the Union during the Civil War, and in 1864 became a member of the State Legislature. He was a member of the Constitutional Convention to plan for abolition of slavery in the State, was active in securing the adoption of the constitution it framed, and defended it before the courts. It was largely by his exertions that the indentures of apprenticeship, which threatened to take the place of slavery, were omitted from the statutes, and enfranchisement fully secured to the negroes of Maryland.

STOCKDOVE (so called either because formerly regarded as the parent stock of the domestic pigeons, or because it breeds in the trunks of trees). A wild pigeon (*Columba œnas*) of Europe, gray, with a burnished metallic purple breast, scarlet eyes, orange-colored bill, and red legs. It is about 14 inches in length.

STÖCKER, shtẽk′ẽr, Adolf (1835–1909). A German theologian and politician, born in Halberstadt. He studied theology and philosophy in Halle and Berlin, entered the ministry, and in 1874 became cathedral preacher and court pastor in Berlin. In 1879 he was elected to the Prussian Chamber of Deputies, and from 1881 till 1893 he was a member of the Reichstag. During this period he was a leader of the agitation against the Jews. In 1890, because of his activity as a Socialist agitator, he was removed by the Emperor from his position as pastor of the court. Six years afterward, with a considerable number of followers, he seceded from the Conservative party, to which he had hitherto belonged, and organized the Christian Socialists. In 1892 Dr. Stöcker became the editor of the *Deutsche evangelische Kirchenzeitung*. He published *Dreizehn Jahre Hofprediger und Politiker* (1895).

STOCK EXCHANGE. An institution where sales and purchases may be made of securities of corporations and municipalities, and in some cases of certificates representing commodities of trade, such as silver bullion, petroleum, etc. In their origin stock exchanges appear to have been free to the use of any one who wished to buy or sell, and it was probably with this function in view that some of the older exchanges, notably the Paris Bourse, were located in buildings erected at the public expense. It was quickly discovered, however, that in order to enforce bargains some formal organization was necessary. Membership in stock exchanges therefore came to be limited on the general basis used by clubs or other associations. As the profits of the use of the Exchange became large, possession of membership became valuable.

The London Stock Exchange has for many generations occupied the most conspicuous place in the history of finance, as the transactions on its floor were conducted by the great aggregations of capital, home and international, located in that city. Originally confining its dealings to British government stock, the London Exchange became active, at the opening of the nineteenth century, in securities of other nations which applied to London capitalists for the placing of public loans; to these were later added railway shares. After 1888 stocks of incorporated industrial enterprises, and more recently of mining and exploration companies, grew into high favor, the Stock Exchange merely acting as the medium for the transfer of such shares from the capitalists behind the enterprise to the general public.

The New York Stock Exchange devoted itself during most of its history almost exclusively to securities of railway enterprises, even dealings in United States government bonds and other American public securities being chiefly conducted outside the Exchange. In recent years, along with the development of the London movement of industrial incorporation, the New York Stock Exchange has been largely utilized for the exploiting of shares of American companies of this nature. This movement, depressed during the hard times of the early nineties, was renewed in enormous volume during the great boom in trade which followed 1897. In the course of this time listing of industrial securities on the New York Exchange attracted an immense business to that branch of its activities. The New York Stock Exchange has never dealt to any noteworthy extent in foreign securities, thereby reflecting the general tendency of American investors. Even the large purchases of British consols by American bankers during the Exchequer's loan issues of 1900, 1901, and 1902 were disposed of privately, and were never allowed a place in the formal trading of the Stock Exchange. The same thing is true of the Anglo-French loan of 1915, and of the various lesser loans extended to the belligerents.

There has been some diversity in the business of the New York Exchange and other American exchanges. The Philadelphia Stock Exchange has long been noted as the market for various street-railway securities, as Philadelphia capitalists had interested themselves particularly in that form of investment. For similar reasons the Boston Stock Exchange, though not an organization commanding the resources and capital of New York, had for many years, and largely controls now, the trading in shares of copper-mining companies.

Stock exchanges of continental Europe have in general devoted themselves to transportation enterprises of their own countries, to their own government's securities, and to securities of other European governments coming to those markets to raise capital. More recently the stock exchanges of Paris, Berlin, and Vienna have followed London's example in taking up on a large scale shares of incorporated industrial enterprises—particularly so with Berlin, where the iron industry has been extensively exploited in this form.

History. Stock exchanges as institutions had their origin at the time of the creation of public debts on the modern plan, at the close of the seventeenth century. The incorporation of the East India Company in London further developed the possibilities of the raising of public capital for corporate uses through Stock Exchange trading. In 1720 the enormous public speculation in the shares of the South Sea Company in London and of the Mississippi Company in Paris brought stock trading to a height never before conceived. No city at that time, however, possessed a stock exchange in the sense now attached to the term. In London transactions were conducted through stock brokers, whose headquarters were at Jonathan's and Garraway's Coffee Houses in 'Change Alley. There does not appear to have been any formal organization among these brokers. The London Stock Exchange Building was not erected until 1801; the Paris Bourse not until 1826. The New York Stock Exchange membership, even after the formal organization, conducted its business in hired rooms until December, 1865, when the building was erected on Broad and Wall streets, which was replaced by the new structure on the same site, dedicated in April, 1903. The history of stock exchanges is very largely a mirror of the financial history of the community in which they are situated. The New York Stock Exchange rose to a position of real prominence only after the Civil War. Even then the fact that it did not deal in gold as a commodity threw a great part of the community's highly speculative business over to the Gold Exchange, which was formed for that purpose exclusively. The dramatic incident of this period was the gold panic on Black Friday in September, 1869, when a combination of several unscrupulous speculators, among them James Fisk, Jr., and Jay Gould, attempted to corner and put to extravagant figures the gold supply of the market. Operations on the Stock Exchange proper at that time were largely made up of the personal struggles of rival capitalists, notably in connection with the Erie and New York Central railroads.

The completion of the Pacific Railway (1869) caused extensive speculation in shares of the two transcontinental railways, and as capital increased and the railway mileage of the country extended the transactions of the Exchange became national rather than provincial. Leading operators of that time were Gould, Fisk, Daniel Drew, Cornelius Vanderbilt, and their associates. None of the capitalists named was accustomed to trade personally on the Stock Exchange; indeed, that has always been a rare exception among active financiers.

The crisis of 1873 was heavily felt on the New York Stock Exchange, which was obliged to close for two days at the height of the panic in order to stem the tide of liquidation in securities. With the great trade revival which followed the resumption of specie payments and the profitable grain harvests of 1879 the New York Exchange entered upon a period of renewed activity. During the year 1880 (the climax of the boom of that period), trading on the Exchange reached an enormous volume, and the value of seats in the Stock Exchange rose unprecedently. In 1881, when a reaction in the tide of prosperity began, the Exchange reflected the change by a contraction in volume of business and by an extensive fall in prices. Speculation by the general public was again rife in 1882, but was violently checked by the sudden fall in railway and industrial profits at the close of the year. The severe reaction of 1883 was followed by the panic of May, 1884, in which half a dozen Stock Exchange houses failed and two important banks were compelled to close their doors.

The period from 1886 to 1888 was marked by large issues of securities to provide funds for the extensive railway building then in progress. There were several excited markets on the Stock Exchange, though the tendency at the close of the period was towards depression of values, largely because of the enormous creation of new securities. The year 1890 was again marked by great activity and rising prices. This boom was checked by the Baring panic of November, 1890, in London, which was reflected by a prompt recall of English capital from the United States, and by a New York Stock Exchange panic, in the course of which two or three brokerage houses failed. From then until the outbreak of the more serious panic of 1893, a shrinkage in business was the chief characteristic of the New York Stock Exchange's history.

The panic of 1893 was in many respects one of the most dramatic episodes in financial history. During July of that year there was talk of repeating the expedient of 1873 and closing the Exchange. This turned out to be unnecessary, as foreign capital came to the market's relief in the moment of emergency. The following year, 1894, was a period of great depression, when the volume of Stock Exchange business fell to the lowest point since 1878. Recovery followed in 1895, when foreign capital was again commanded in connection with the international syndicate to float the United States government's bond issue and protect the Treasury gold reserve. A panic of smaller proportions swept over the Stock Exchange at the close of this year, in connection with the collapse of the protective operations and the international clash between America and Great Britain over Venezuela. The two ensuing years were chiefly characterized by the reorganization of the great number of important railways which had failed during 1893 and 1894, and whose new securities, largely increased in quantity, were placed through the medium of the Stock Exchange in 1896 and 1897.

The financial revival which began at the close of the last-named year introduced a new epoch in the history of the New York Stock Exchange —an epoch in all respects the most remarkable of its history. Supply of American capital available for investment purposes seemed suddenly to have become unlimited—largely because of the country's immensely profitable harvests at a time of European famine, but also on account of a wholly unprecedented increase in its general export trade, in manufactures as well as in agricultural products, which gave its markets a command over foreign capital they had never before possessed. This increase in capital was made use of by promoters of all kinds of enterprises, and their shares found active reception on the Exchange. A highly excited movement for the rise at the opening of 1899 converged chiefly on shares of industrial companies organized to buy up independent plants. Checked by the excess of the speculators and by an industrial reaction during the presidential contest of 1900, this movement was renewed with immense force at the opening of 1901. At that time all precedents of every kind in Stock Exchange history were broken. The real force underlying the movement was the purchase of stock companies by other companies which pledged their credit to raise the funds requisite to provide for the purchase. This movement culminated in the famous Northern Pacific corner of May 9, 1901, when the efforts of two rival groups of capitalists to get hold of that railroad property forced its shares to the price of $1000, the stock having never touched $100 until three weeks before. Apprehension that operators who were unable to deliver stock which they had pledged would be dealt with summarily, caused one of the most violent collapses of values in the Stock Exchange's history. Recovery was prompt, and both 1901 and 1902 were characterized by numerous sensational movements for the advance, the second of those years scoring as a rule the higher values. In the autumn of 1901 and in the fall of 1902 and the early part of 1903 severe reaction in values supervened.

After a powerful upward movement beginning in 1903 and culminating in 1906, an extraordinary decline of values set in with the panic of 1907–08. Recovery from the panic was slow and nothing of the character of a boom was experienced until after the readjustment of American business to the European War. In the period from July 31 to Dec. 7, 1914, the Stock Exchange was closed. It had been found that the sale of American stocks held abroad would be so heavy as to cause an unprecedented slump in values, and at the same time to create a commercial balance against the United States that would threaten the gold reserves of the banks. In this period stock trading was conducted privately in large volume. Upon the reopening of the Stock Exchange the privilege of fixing minimum prices was reserved by the directors, but it was found that there was no need of such action, the threatened foreign selling movement having failed to materialize. The year 1915 was characterized by a remarkable boom in so-called "war stock"—shares in companies having contracts for munitions and other war supplies.

Volume of Business. Stock exchanges keep no official record of transactions on their floor. In New York such records are carefully kept by unofficial chroniclers; but as this is not done in London or on the Continent, comparison is impossible. It is safe to say, however, that in recent years the volume of business done on the New York Stock Exchange has far exceeded that in any other institution of the world. Following is the unofficial record of sales in that institution during a series of years:

YEAR	Stocks (Shares)	Bonds (Par value)
1892	86,726,410	$352,741,950
1895	66,440,576	519,142,100
1900	138,880,184	578,253,280
1905	263,040,993	1,022,455,670
1910	163,970,440	634,746,503
1911	126,515,547	889,686,000
1912	131,051,359	677,254,000
1913	83,467,176	501,514,520
1914	47,420,327	460,949,200
1915	173,349,824	955,713,500

Method of Business. Stock exchanges as at present constituted are limited in membership and governed by strict rules which cover both methods of business, rates of commission to be charged, and conduct on the floor. The rules governing methods of business in New York prescribe a minimum commission of one-eighth of one per cent on the face value of securities purchased for outside customers, one thirty-second of one per cent for purchases made on account of fellow members, and one-fiftieth of one per cent for purchases made on the order of another member on the floor.

In London commissions vary from 1s. per hundred to 2s. 6d. per hundred, according to the nature of the security. The Paris *agents de change* charge one-fourth of one per cent. In New York the Stock Exchange member may both transact business on the floor of the Stock Exchange and solicit business from outside customers. In London these functions are divided between the two functionaries known as "jobber" and "broker." Members of the London Stock Exchange are forbidden to advertise; New York Stock Exchange houses advertise freely. *Agents de change* in Paris are forbidden to solicit outside business.

Acceptance of a bid or offer of stock makes the transaction official on a stock exchange and binds each participant to the fulfillment of his bargain. Stocks thus sold must be delivered to the buyer by 2.15 P.M. of the ensuing day. The New York Stock Exchange practices daily settlement of such accounts. In London settlements are made fortnightly, the bargain being carried for the account, i.e., on credit, during the intervening period.

No security may be dealt in on the Stock Exchange which has not been formally "listed" by the committee. In New York a statement of the company's condition with a balance sheet is required before listing; also proof that proper facilities for transfer and registry of shares have been provided, and that with bonds the mortgage has been properly drawn and recorded. Corporations unwilling to make public statements were, however, formerly allowed to obtain a place in what was called the "unlisted department." This department was abolished in 1910.

Membership Prices and Rules. With the limitation of Stock Exchange membership, title to a seat in the Exchange becomes valuable property. In New York the price of Stock Exchange seats has fluctuated with great irregularity. In 1879 their price was $9000; they rose to $20,000 in 1881 and to $37,000 in 1883, but by 1893 had declined to $15,250. During the boom of May, 1901, they sold for $66,000, and subsequently, in 1905, went as high as $95,000. In the panic of 1907 seats were sold as low as $51,000, and in 1913 there was a still lower record, $37,000. The highest price paid for a seat in 1915 was $74,000, the lowest, $38,000. Ownership of a New York Stock Exchange seat does not necessarily imply the privilege of the floor; for that the owner must apply in due form to the committee on admissions. In the London Stock Exchange applicants for admission must be recommended by three members of at least four years' standing, who pledge themselves to the extent of £500 apiece to reimburse the member's creditors in case of his default within four years. If he is of foreign birth he must have been two years naturalized. In Paris, where the number of *agents de change* is limited to 60, an applicant must be proposed by his predecessor or that predecessor's heirs, and must be approved by the governing committee and the Minister of Finance.

Stock Exchange Seat as Property. Owing to the peculiar personal nature of a member's rights and privileges, the exact legal status of a seat as a property right is not settled in all jurisdictions. By the general weight of authority, however, a seat may be considered as a species of incorporeal property held subject to such rules and regulations as may be adopted by the Exchange. This gives a seat an anomalous position in the law of property because of the qualified and restricted character of an owner's rights. As it cannot be transferred except with the consent of the Exchange, and to a person acceptable to the latter, it is held that it cannot be seized and sold upon an execution; but it seems settled in most jurisdictions where the question has arisen that a receiver appointed in proceedings supplementary to execution may apply to the court for an order requiring the judgment debtor to arrange for a transfer of his seat to a person acceptable to the Exchange and apply the proceeds to the satisfaction of the judgment. This may also be done by a judgment creditor's bill in some jurisdictions. Thus it will be seen that the courts do not assume to proceed against the seat itself, but attain the desired end through their power over the debtor. The United States Supreme Court has held that the rights of a member to his seat in an exchange pass to his assignee in bankruptcy, and the latter may take such steps as may be necessary to compel the bankrupt to procure a transfer of his seat subject to the rules of the Exchange. By the rules of probably all exchanges the claims of members must be first satisfied upon the sale of a seat. A seat cannot be bequeathed or devised by will, nor is it strictly descendible, as the person to whom it might be thus given or descend might not be acceptable to the Exchange; but the rules generally provide for the sale of a seat on the death of a member, an application of the proceeds to any claims the other members may have against the deceased, and a distribution of the proceeds to his personal representatives. The courts are loath to interfere with any reasonable rules and regulations of a stock exchange and with any action it may take to maintain discipline or enforce its rules, and their aid could probably only be invoked in cases of gross fraud or imposition upon a member.

Discipline. Strict discipline over the conduct of members is maintained by all the larger exchanges. The penalty is suspension from the privileges of the Exchange for a given period or expulsion in the case of serious offense. On the New York Stock Exchange these penalties may be imposed for fictitious sales, for trifling bids, for acceptance of smaller commissions than those prescribed by the Exchange, and for "obvious fraud." More recently discipline has been exercised for dealing with a rival exchange contrary to the regulations of the member's own exchange, and for questionable business conduct outside of the Exchange. In London the same penalties are made applicable on the general ground of failure to comply with the committee's decision or of dishonorable and disgraceful conduct. The rules of the Paris Bourse prescribe penalties in case the member "does not confine himself strictly to his duties" or "introduces injurious innovations."

Curb Trading. An institution which has grown to considerable proportions in recent years has been the so-called "curb trading," so named because the transactions are usually conducted on the street outside the entrance to the Stock Exchange. In London, Paris, and New York this trading has at times reached large proportions, though the system it represents is radically different in the three cities. In London curb trading is utilized for the sake of dealing in foreign shares whose home market is open after the official closing of the London Exchange. For example, trading in American securities is conducted in Shorter's Court, behind the London Stock Exchange, frequently until 6 P.M. or later, the New York Stock Exchange, on account of the five hours' difference in time, being actively at work at that hour. In Paris the curb market, under its French title of the Coulisse, has had a longer history. It has represented virtually a rival exchange, not subject to the numerous and rather vexatious limitations of the older Bourse. The Coulisse has frequently been suppressed by law, but has invariably revived, and has probably conducted a larger total business than the Bourse itself, except, perhaps, in government securities. At present the Coulisse conducts its operations on the portico of the Bourse and is a recognized institution. In New York curb trading devotes itself exclusively to securities which have not been admitted to the list of the Stock Exchange. In this category are comprised many important enterprises, including shares of the Standard Oil Company and of the various banks. The curb also provides a market for newly organized enterprises which have not reached a stage where they can apply for a place on the Stock Exchange list, and it gives an opportunity for fixing values of a forthcoming security before the share or bond certificates are formally issued.

Stock Exchange Clearing House. In recent years the system of "clearing" Stock Exchange transactions, on the plan of the bank clearing house, has been generally adopted by stock exchanges. As introduced on the New York Exchange in 1892, the system provides for the offsetting of securities which a broker has contracted to deliver by an equivalent amount of the same securities he may have contracted to receive. Thus, if Broker A has sold 1000 New York Central shares to B and bought 1000 of the same shares from C, the two transactions are settled by the delivery of 1000 shares by C to B. The price may vary in the two transactions, but such differences are adjusted by the clearing house, the broker being "debtor" or "creditor" on his daily sheet. The same principle is followed even where the amounts bought and sold do not agree. Thus A, in the above case, may have sold only 500 shares to B and bought 1000 from C. In that case C delivers 500 shares to A and 500 to B, and payment is made accordingly. The economy consists in the lessening of the number of individual checks which must be drawn for settlement, and against which bank balances must be maintained. The aggregate saving in checks drawn, during an ordinary year, has exceeded $500,000,000.

The plan was adopted by the Frankfort Stock Exchange in 1867, at Berlin in 1869, at Hamburg in 1870, at Vienna in 1873, at London in 1876, and by various American stock exchanges between 1880 and 1887.

Stock Exchange Terms. The Stock Exchange has a dialect or slang of its own, many of the terms in which had their origin at the time of the South Sea speculation in 1720. A "bull" is a buyer of stocks which he hopes to sell at higher prices. He may buy altogether with his own capital; but if he is merely a Stock Exchange speculator, he borrows most of the requisite funds, depositing the purchased stock as security. He can usually borrow 80 per cent of the cost value of his shares, the difference, 20 per cent, being his "margin." If the price falls, the lender calls on him to "make good his margin." If he fails to do so, and the margin continues "impaired," he is "closed out" by the sale of his collateral. A "boom" is a successful upward movement of prices; this term is of American origin. The opposite of a "boom," in Stock Exchange phraseology, is a "slump." The "bear" is a seller of stocks which he hopes to obtain, later on, at lower prices. He may be selling his own holdings and delivering them to the purchaser. But if a speculator, he may borrow stocks as the "bull" borrows money. Generally he obtains the stocks by lending their equivalent in money to the owner. He is said to be "short" of stocks, where the bull is "long." The bull "realizes" when he sells to take his profits; similarly, the bear "covers" when he buys on the market the stock in which he has been speculating, and returns the shares which he has borrowed. Stocks are said to be "carried" when they are accepted as security from a bull speculator. A "manipulated" market is one in which speculators have caused an artificial appearance of real buying or selling. A "rigged" market is much the same thing, though in a more intensified form. "Puts" are contracts sold at a fixed percentage by capitalists to bull speculators, whereby the capitalist undertakes to pay a set price for a given number of shares within a stipulated time. This insures the speculator against more than a certain amount of loss if he buys stocks. "Calls" are contracts similarly sold by capitalists, who agree within a given time, and at a set price, to deliver the shares agreed upon to the speculator. This is a guarantee against losses on a falling market. Both sorts of contracts are classified as "privileges." "Wash sales" are transactions in which buyer and seller are employed by the same person, with a view to creating a semblance of activity. They are prohibited under severe penalties by the stock exchanges, but are rarely detected and are very frequently utilized. Consult: W. C. Van Antwerp, *The Stock Exchange from Within* (New York, 1913); C. A. Legg, *Law of Commercial Exchanges* (ib., 1913); S. P. Goldman, *Handbook of Stock Exchange Laws* (ib., 1914); Douglas Campbell, *The Law of Stockbrokers* (ib., 1914).

STOCKFISH. See Hake.

STOCKHAUSEN, shtŏk′hou′zen, Julius (1826–1906). A German singing master, born in Paris. His musical talent showed itself early and was carefully fostered by his parents, both of whom were musicians of ability. Before he had reached his twentieth year he was an excellent performer upon the piano, organ, violin, and cello. In 1845 he entered the Paris Conservatoire, where he studied piano with Hallé and Stamaty and singing with Manuel García. In 1849 he again studied with García in London. He quickly won fame as a remarkable concert singer (barytone). From 1862 to 1869 he resided in Hamburg as conductor of the Philharmonic Society and Singakademie. The next five years he spent in Stuttgart as Kammersänger to the King of Württemberg. In 1874 he became conductor of Stern's Gesangverein at Berlin, where he remained until 1878, being then called to Hoch's Conservatory at Frankfort as professor of singing. Differences with Raff, the director, led to his resignation the following year and the establishment of his own school, which immediately became world famous. After Raff's death, in 1882, he again returned to the conservatory, but continued his own school. Many of the most famous German singers were his pupils. He wrote an excellent *Gesangsmethode* (1886), translated into English by his pupil Sophie Löwe (new ed., 1907).

STOCK′HOLD′ER. In the strict sense of the term, a person who owns one or more shares of stock in a corporation, and who has been recognized by the latter as having the rights commonly incidental to such ownership. Entry of a person's name on the books of a corporation as the owner of stock is the best evidence of his standing as a stockholder, and as long as his name remains there he may generally exercise all a stockholder's privileges. However, a person to whom shares of stock have been transferred, but whose name has not yet been entered on the books, is sometimes treated as if he were a stockholder and spoken of as such. A corporation is protected in paying dividends to a person whose name remains on its books as a stockholder, even if he has transferred his shares of stock, provided the purchaser has not given notice of that fact. A stockholder of record has the right to vote in certain meetings, the most important of which, perhaps, is one for the election of officers. Each stockholder may vote the number of shares he owns, and thus one person owning the majority of the stock of a corporation may control its elections and policy against the wishes of a great number of holders of a small number of shares aggregating less than the majority. Among the rights of a stockholder are: the right to protest and invoke the aid of the courts against a misuse of the funds of the corporation, or against fraud by the majority stockholders or the officers; to object to a change in the kind of business which the charter authorizes it to carry on; the right to inspect all or any of the books of the corporation at reasonable times and places; and to receive dividends out of the earnings, when a surplus has accumulated, which is not needed for running the business or for improvements. In many States a stockholder is only liable for the debts of the corporation to the amount of his stock, that is, he only loses what he has paid in, assuming he has paid in the par value of his stock, in case of insolvency of the corporation. If a subscriber to the stock of a corporation has not paid in the full par value of the amount of stock subscribed for by him, creditors of the corporation may hold him for the balance remaining unpaid. A stockholder is not strictly a creditor of the corporation to the amount of his stock, as he is deferred to corporate creditors on a final distribution of assets; but he may become a creditor by a loan of money or sale of goods, and thus stand on an equal footing with the others as to such claims, in most jurisdictions. In the case of banking corporations a creditor is generally given a statutory right to recover from stockholders in addition to the amount unpaid on their stock, the full amount of the par value thereof. This right is also given in many States to laborers and wage earners who become creditors of ordinary corporations. See CORPORATION; STOCK; and consult authorities there referred to.

STOCKHOLM, stŏk′hōlm. The capital of Sweden, situated at the outlet of the Mälar Lake into the Baltic Sea (Map: Sweden, F 7). The city is built partly on a number of islands, partly on peninsulas cut off from the mainland by deep fiords, while the waterways both towards the Mälar and towards the sea lead through labyrinths of fiords and islands. Stockholm has been called the "Venice of the North," but its aspect is entirely different from that of Venice. Both the islands and the mainland are rocky and hilly, with granite knolls exposed on all sides, while a primeval forest penetrates almost to the heart of the city. The old nucleus, known as Staden (The City), is built on an island lying across the mouth of the Mälar channel, and connected by bridges with the northern and southern shores and with the little Riddarholm (knight's island) on the west. It has narrow streets falling steeply on all sides from the central Stortorget. Skeppholmen, to the east of Staden, is almost wholly occupied by military and naval depots. The remaining parts of the city, Södermalm on the south shore, Norrmalm and Oestermalm on the north shore, and Kungsholmen in the northwest, are for the most part regularly laid out with broad and straight streets. Here are also a number of handsome squares, parks, and promenades, such as the Gustaf Adolfs Torg, with an equestrian statue of Gustavus Adolphus, the Kungsträdsgård on the water front with a handsome fountain, and the Humlegård, a large and beautiful pleasure garden, containing a colossal bronze statue of Linnæus. From Oestermalm a bridge leads to the easternmost part of the city—an island about two miles long and three-fourths of a mile wide, known as Djurgården from its having formerly been a deer park. It is now laid out as a city park.

The principal churches are the Storkyrka (great church), founded about 1264 by Birger Jarl, rebuilt in the eighteenth century and restored in 1892; the Riddarholms Kyrka, founded about 1280 by Magnus Ladulås, a Gothic structure with a perforated iron spire 290 feet high, and the burial place of Swedish kings; the Tyska Kyrka (German Church), a German Renaissance building of the seventeenth century; and the conspicuous Katarina Kyrka crowning the heights of Södermalm. The royal palace, on the northeast corner of the Stadsholm, was begun in 1697 in the Italian Renaissance style, and is a large and beautiful rectangular building with four wings inclosing a quadrangle. At the west end of the island stands the Riddarhus (knight's house), containing portraits and armorial bearings of Swedish nobles. Noteworthy also are the opera house; the handsome Renaissance building of the National Museum, built in 1850–66, opposite the royal palace on the Blasieholm; and the large and imposing building of the Northern Museum, in the Djurgård.

Although Stockholm has no university, it has numerous establishments for higher technical and popular education and an excellent elementary school system. The Royal Library had in 1913, 400,000 volumes, 1,000,000 pamphlets, and 11,000 manuscripts. There are the National Museum, containing fine-art collections and a collection of Swedish antiquities; the Northern Museum (Nordiska Museet) for Scandinavian ethnology and archæology; a museum of natural history; a biological museum showing groups of Scandinavian mammals in their natural surroundings; an astronomical observatory; and numerous scientific and literary associations, the principal of which are the Swedish Academy, the Academy of Sciences, and the Academy of Fine Arts, History, and Archæology.

Stockholm is the largest industrial and commercial centre of Sweden. There are iron foundries and machine shops, breweries, sugar and cotton mills, and tobacco factories, and manufactures of furniture, soap, food products, and miscellaneous articles, while shipbuilding is also carried on. The city ranks first among Swedish ports in the value of imports, and second in exports; the imports in 1910 amounted to $179,102,000, and the exports to $158,097,000. The chief exports are iron and timber. In 1910 the shipping at the port amounted to 2046 entries and clearings with a total of 999,810 tons, but in the number and tonnage of its home vessels the city is exceeded by Göteborg. The approaches to the harbor are intricate and rendered somewhat dangerous by rocky reefs, but the harbor itself is good, and provided with dry docks and extensive wharfage accessible for large ships. An ice breaker keeps the harbor open. The city in general is very progressive in the matter of public works. Pop., 1850, 93,000; 1890, 246,454; 1910, 342,323; 1913 (est.), 382,085.

Stockholm was founded in 1250 by Birger Jarl, and was for centuries confined to the Stadsholm and Riddarholm, which were fortified. It was several times besieged and taken by Danish armies, and its wooden buildings were often destroyed by fire until they were supplanted by stone structures. In 1520 the city was the scene of the "Stockholm Blood Bath," when the Danish King Christian II, in order to strengthen his position in Sweden, had a large number of Swedish nobles decapitated on the Stortorg. Consult Wattenbach, *Stockholm, ein Blick auf Schwedens Hauptstadt* (Berlin, 1875), and Beyron Carlsson, *Hela Stockholm* (Stockholm, 1912).

STOCKING FRAME. See KNITTING.

STOCKINGS. See HOSIERY.

STOCK'PORT. A manufacturing town in Cheshire, England, on the Mersey, at the junction with the Tame, 6½ miles southeast of Manchester (Map: England, D 3). Its prosperity is of modern date. The streets lie on the slopes of a narrow gorge, and are irregular and occasionally precipitous; to the south they rise in terraces above the river. The principal buildings are the courthouse, market hall, mechanics' institute, infirmary, and the institution for the blind, deaf, and dumb. The free grammar school was founded and endowed in 1487. The town possesses seven fine parks, the chief of which is Vernon Park, which contains a museum. Stockport owns an electric-lighting plant, street railways, sewage works, gas, water supply, and markets. It has extensive manufactures of cottons, woolens, silks, hats, machinery, brass and iron goods, shuttles, and brushes. Pop., 1901, 92,832; 1911, 108,693.

STOCK-QUOTATION TELEGRAPH. See TELEGRAPHY.

STOCKS. An apparatus of wood, formerly used for punishment. The culprit was placed on a bench, with ankles fastened in holes under a board, fixed, but removable later. The first use of stocks in England is uncertain, but in the second Statute of Laborers, 25 Edward III (1350), provision is made for applying them to unruly artificers. Sometimes a whipping post was combined. The use of stocks was general in the English colonies of North America—employed often as punishment for common scolds.

STOCKS AND BONDS. See RAILWAYS, *Railway Capitalization and Finance.*

STOCK'TON. A city and the county seat of San Joaquin Co., Cal., 78 miles east by north of San Francisco; on an arm of the San Joaquin River, at the head of navigation, and on the Atchison, Topeka, and Santa Fe, the Southern Pacific, the Stockton Terminal and Eastern, the Tidewater Southern, and the Western Pacific railroads (Map: California, D 4). The State Hospital for the Insane is here, and there are also a public library with over 70,000 volumes, the San Joaquin County Law Library, St. Mary's College, and St. Agnes Academy. The county courthouse, the high school, the post office, county jail, opera house, Masonic Temple, St. Joseph's Home, the County and the Dameron hospitals, and the mineral baths are noteworthy features. In addition to having large grain, live-stock, and fruit interests, Stockton is important industrially. Agricultural and mining machinery and implements, flour, foundry products, boxes, lumber, leather, beer, wine, canned goods, and soap constitute the leading manufactures. The commission form of government was adopted in 1911. Stockton was founded in 1847 by Charles M. Weber, the owner of a large Mexican grant, and was named in honor of Robert Field Stockton, of the United States navy, who took possession of California for the United States. In its early days it was the starting and outfitting point for miners bound for Calaveras, Tuolumne, and Mariposa counties. Pop., 1900, 17,506; 1910, 23,253; 1915 (U. S. est.), 34,508. This does not include a considerable portion of the outlying territory which was incorporated in the city limits in 1914.

STOCKTON, CHARLES G. (1853–). An American physician. He was born at Madison, O., and graduated M.D. from the University of Buffalo in 1878. Settling in Buffalo, he was professor of materia medica and therapeutics at Niagara University from 1883 to 1887, when he became professor of medicine at the University of Buffalo. He was a president of the Medical Society of the State of New York. His writings deal especially with diseases of the stomach.

STOCKTON, CHARLES HERBERT (1845–). An American naval officer, educator, and international law scholar. He was born in Philadelphia. In 1865 he graduated from the United States Naval Academy, and subsequently was promoted through the various grades to commander in 1892, captain in 1899, and rear admiral in 1906. He was a member of the Naval War College in 1891–94, and its president from 1898 to 1900. In 1901–03 he commanded the *Kentucky*, and in 1903–05 was naval attaché in London. He then served as president of the Board of Inspection and Survey in 1906, and of the Naval Examining and Retiring Boards in 1906–07. In the latter year, after commanding the Special Service squadron that visited Bordeaux, France, he was retired. In 1911 Stockton became president of George Washington University. He is author of the United States Naval War Code; *A Manual of International Law* (1911); *Outlines of International Law* (1914).

STOCKTON, FRANCIS RICHARD (1834–1902). A popular American writer of humorous tales, born in Philadelphia; generally known as Frank R. Stockton. In early life he was a wood engraver and designer. Meanwhile he busied himself also with literary and journalistic work. He was first employed on the Philadelphia *Morning Post*, and in 1872 gave up designing to join the New York *Hearth and Home*. Soon he joined the staff of the *Century Magazine* (then *Scribner's Monthly*) and in 1873 was made assistant editor of the newly founded magazine for children, the *St. Nicholas*, remaining here till about 1880. He was a prolific writer. His books for children include: *Roundabout Rambles* (1872); *What Might Have Been Expected* (1874); *Tales Out of School* (1875); *A Jolly Fellowship* (1880); *The Floating Prince* (1881); *The Story of Viteau* (1884); and *Personally Conducted* (1889). Other books of his are: *Rudder Grange* (1879), which brought him into prominence; *The Lady or the Tiger?* (1884), perhaps his most popular story; *The Late Mrs. Null* (1886); *The Christmas Wreck* (1886); *The Casting Away of Mrs. Lecks and Mrs. Aleshine* (1886); *The Bee-Man of Orn* (1887); *The Hundredth Man* (1887); *The Dusantes* (1888); *Amos Kilbright* (1888); *Ardis Claverden* (1890); *The House of Martha* (1891); *The Squirrel Inn* (1891); *The Watchmaker's Wife* (1893); *The Girl at Cobhurst* (1898); *Afield and Afloat* (1900); and *The Captain's Toll-Gate*, with memoir by his wife (1903). A collected edition of his works, *Novels and Stories* (New York, 1899–1904), appeared in 23 volumes. Stockton's humor has a flavor all its own. His situations are whimsical and his characters often grotesque. There is little beneath the surface of his work, which is, however, genuinely ingenious and entertaining.

STOCKTON, RICHARD (1730–81). An American lawyer, and a signer of the Declaration of Independence. He was born near Princeton, N. J., graduated at the College of New Jersey (Princeton) in 1748, was admitted to the bar in 1754, visited England in 1766–67, where he made the acquaintance of many distinguished men, and in 1774 became a judge of New Jersey's Supreme Court. He at first advocated a reconciliation between the colonies and England, and in December, 1774, wrote to Lord Dartmouth, proposing a scheme of colonial self-government; but he soon began to take an active part in the opposition to the British Ministry and as a member of Congress in 1776 voted for and signed the Declaration of Independence. Consult John Sanderson, *Biography of the Signers to the Declaration of Independence* (new ed., Philadelphia, 1847).

STOCKTON, ROBERT FIELD (1795–1866). An American naval officer, grandson of Richard Stockton (q.v.). He was born at Princeton, N. J., studied there for a time and in 1811 became United States naval midshipman. He joined Commodore Rodgers on the frigate *President* in 1812, was for a time an aide to the Secretary of the Navy, took part in the defense of Baltimore, and was promoted to be lieutenant in September, 1814. In 1815 he distinguished himself in the Algerine War on the *Spitfire*. He returned home in command of the *Erie* in 1821, and in the fall of that year sailed in the *Alligator* for the African coast, where he negotiated successfully for the land upon which the American Colonization Society founded Liberia (q.v.). Early in the Mexican War he commanded the Pacific squadron. To his energy, and that of Frémont, with whom he coöperated, was due the success of the American operations on the coast. He captured Los Angeles and San Diego, organized a civil government for California, and installed Frémont as Governor, relinquishing the command to Shubrick in 1847. He resigned from the navy in 1850, and was a United States Senator from New Jersey (1851–53). Resigning in 1853, he became president of the Delaware and Raritan Canal Company. Consult *Life and Speeches of Robert Field Stockton* (Philadelphia, 1856).

STOCKTON, SOUTH. See THORNABY ON TEES.

STOCKTON, THOMAS HEWLINGS (1808–68). An American clergyman, born at Mt. Holley, N. J. He first studied medicine, but in 1829 entered the ministry of the Methodist Protestant church, which his father, W. H. Stockton, had helped to found. He was chaplain of the national House of Representatives from 1833 to 1835 and from 1859 to 1861, and in 1862 was chaplain of the Senate. From 1856 until his death he was pastor of the Church of the New Testament in Philadelphia. For some years he edited the *Christian World* and also the *Bible Times*. He was an ardent antislavery advocate and social reformer, and wrote on religious and other subjects. Consult Alexander H. Clark, *Memory's Tribute to the Life, Character, and Work of Rev. Thomas H. Stockton* (New York, 1869), and J. G. Wilson, *The Life, Character, and Death of Rev. Thomas H. Stockton* (Philadelphia, 1869). T. H. Stockton was a half-brother of Frank R. Stockton, the novelist.

STOCKTON-ON-TEES. A seaport in the County of Durham, England, 11 miles east-northeast of Darlington, on the left bank of the Tees (Map: England, E 2). The broad and handsome High Street is nearly a mile in length. A new town known as South Stockton has sprung up on the right bank of the river, the two being connected by an iron bridge of three arches, built in 1887. Shipbuilding, chiefly in iron, is carried on; and blast furnaces, foundries, engine works, extensive potteries, and iron works are in operation. Sailcloth, ropes, and linen are manufactured; and there are corn mills and spinning mills. At Stockton the Tees is navigable for vessels of large tonnage. The moated Norman castle, long an episcopal residence, was taken for the Parliament in 1644, and totally destroyed by the Roundheads in 1652. At the Restoration it had become so poor a place that it contained only 120 houses. Its growth and prosperity date from the development of the iron and steel industry. The Stockton and Darlington Railway, the first line to convey passengers as well as goods, was opened Sept. 27, 1825. Pop., 1901, 51,500; 1911, 52,154.

STOD'DARD, CHARLES AUGUSTUS (1833–). An American Presbyterian clergyman, born in Boston. After graduating from Williams College in 1854, he studied at Edinburgh in the University and Free Church Seminary, and graduated from Union Seminary, New York, in 1859. He was pastor of the Washington Heights Presbyterian Church, New York City, from 1859 to 1883. In 1869 he became connected with the New York *Observer*, and in 1885 succeeded Samuel I. Prime as editor, retiring in 1902. His publications include: *Across Russia from the Baltic to the Danube* (1891); *Spanish Cities, with Glimpses of Gibraltar and Tangier* (1892); *Beyond the Rockies* (1894); *A Spring Journey in California* (1895); *Cruising among the Caribbees* (1895; 2d ed., 1903).

STODDARD, CHARLES WARREN (1843–1909). An American traveler and author, born at Rochester, N. Y. As a youth he was in business in San Francisco, Cal., and in 1864 visited the Hawaiian Islands, where he subsequently lived for long periods. He traveled much about the world from 1873 to 1878 as correspondent of the San Francisco *Chronicle*. In 1885 and 1886 he was professor of English at Notre Dame College, Ind., then spent some time in travel, and became lecturer on English literature in the Catholic University at Washington, D. C. His books were chiefly poetry and sketches of travel, and include: *Poems* (1867); *South Sea Idyls* (1873); *Mashallah: A Flight into Egypt* (1880); *The Lepers of Molokai* (1885); *A Troubled Heart* (1885); *Hawaiian Life; or Lazy Letters from Low Latitudes* (1894); *The Wonder Workers of Padua* (1896); *A Cruise Under the Crescent* (1898); *Over the Rocky Mountains to Alaska* (1899); *In the Footprints of the Padres* (1902); *Exits and Entrances* (1903); *The Island of Tranquil Delights* (1904). Consult G. W. James, "Appreciation of Charles Warren Stoddard," in *Apostrophe to a Skylark*, etc. (Los Angeles, 1909).

STODDARD, JOHN L(AWSON) (1850-). An American traveler and author, born at Brookline, Mass., graduated from Williams College in 1871, and later studied at Yale Divinity School. He traveled extensively and for nearly 20 years gave himself largely to lecturing in the United States on travel subjects. In 1897 he retired from the lecture platform. He published: *Red Letter Days Abroad* (1884); *Glimpses of the World* (1892); *Stoddard Lectures on Travel Abroad and in America* (15 vols., 1898-1909); *The Stoddard Library*, an anthology (12 vols., 1910); *Poems* (1913); *Poems on Lake Como* (1914).

STODDARD, JOHN TAPPAN (1852-). An American chemist, born in Northampton, Mass. He graduated from Amherst in 1874 and took his Ph.D. at Göttingen in 1877. He became professor of physics and mathematics at Smith College in 1878, of physics and chemistry in 1881, and of chemistry in 1897. He published many papers on inorganic and electrochemistry, and the following books: *Outlines of Qualitative Analysis* (1883); *Lecture Notes on General Chemistry* (2 vols., 1884-85); *Quantitative Experiments in General Chemistry* (1908); *Introduction to General Chemistry* (1910); *Introduction to Organic Chemistry* (1914).

STODDARD, RICHARD HENRY (1825-1903). An American poet, critic, and journalist, born at Hingham, Mass. He was educated in the public schools of New York City, worked in an iron foundry, gained attention in 1849 by a privately printed volume of verse, *Footprints*, obtained a place in the Custom House (1853-70), and was confidential clerk to George B. McClellan (1870-73). During this period he was also a literary reviewer. Among his numerous publications are: *Songs of Summer* (1857); *The Children in the Wood*, verse (1865); *Abraham Lincoln*, a commemoration ode (1865); *Putnam the Brave* (1869); *The Lion's Cub and Other Poems* (1890); and *Under the Evening Lamp* (1892). A collected edition of his verses was issued in 1880. Stoddard also edited several anthologies, among them *Poets and Poetry of America* (1872) and *Female Poets of America* (1874). For many years he was a prominent figure in the literary life of New York. His wife, ELIZABETH (BARSTOW) (1823-1902), collaborated with him in editorial work and wrote three novels, *The Morgesons* (1862), *Two Men* (1865), and *Temple House* (1867). Her *Poems* were collected in 1895. Consult Stoddard's *Recollections Personal and Literary*, ed. by R. Hitchcock (New York, 1903).

STODDARD, WILLIAM OSBORN (1835-). An American author and journalist, born at Homer, N. Y., and educated at the University of Rochester, where he graduated in 1858. After three years of farming and newspaper work in Illinois, where he edited the Chicago *Daily Ledger* and the *Central Illinois Gazette*, and three months' service as a volunteer at the outbreak of the Civil War, he acted from 1861 to 1864 as private secretary to President Lincoln and then engaged in literary work. His publications include: *The Heart of It* (1880); *Abraham Lincoln* (1884); *Lives of the Presidents* (10 vols., 1888-89); *The White House in War Time* (1890); *Table Talk of Lincoln* (1892); *The Swordmaker's Son* (1896); *With the Black Prince* (1898); *Lincoln at Work* (1899); *Jack Morgan* (1901); *The Boy Lincoln* (1905); *Two Cadets with Washington* (1906); *In the Open* (1908); *Dab Kinzer* (1909); *The Captain of the Cat's-Paw* (1914).

STOD'DART, J. H. (1827-1907). An actor, born in Yorkshire, England. He was the son of an actor and during his youth in Glasgow he often took juvenile parts with his father. He came to the United States in 1854 and became a member of Wallack's company. Afterward for a time he played with Laura Keene; then with Dion Boucicault; and subsequently for 20 years was under the management of A. M. Palmer. Among his most popular characters were Mr. Moneypenny in *The Long Strike*, Colonel Preston in *Alabama*, the curate in *Saints and Sinners*, and later Lachlan Campbell in *The Bonnie Brier Bush* (1901). He wrote *Recollections of a Player* (New York, 1902). Consult McKay and Wingate, *Famous American Actors of To-day* (New York, 1896).

STODDERT, BENJAMIN (1751-1813). An American soldier and cabinet officer. He was born in Charles Co., Md., joined the Continental army in 1776, became a captain in January, 1777, and was severely wounded at Brandywine in September, resigning his command in April, 1779. He then served as secretary of the Board of War until 1781, and from 1798 to 1801 was Secretary of the Navy, being the first to discharge the duties of this office.

STOESSEL, shtĕs'sel, ANATOLY MIKHAILOVITCH (1848-1915). A Russian soldier, born in St. Petersburg. In 1904 he was placed in command of the Russian garrison at Port Arthur, was defeated by General Oku at Kinchow or Nan-shan, May 26-27, 1904, and surrendered Port Arthur to General Nogi on Jan. 2, 1905. (See RUSSO-JAPANESE WAR.) He was tried by court-martial in 1906 and sentenced to death. This sentence was commuted to ten years' imprisonment in 1908 and a year later he was pardoned and permitted to resign from the service. He died from paralysis.

STOHMANN, shtō'mȧn, FRIEDRICH KARL ADOLF (1832-97). A German agricultural chemist, born in Bremen, and educated at Göttingen and London. He was Graham's assistant at University College, London, from 1853 to 1855, and afterwards assisted Henneberg at Weende. In 1862 he started the agricultural experiment station at Brunswick. He was called to Halle in 1865 and in 1871 to Leipzig, where he was director of the agricultural physiological institute of the university. He wrote: *Handbuch der technischen Chemie* (1872 and 1874); *Biologische Studien* (1873); *Handbuch der Zuckerfabrikation* (1878; 4th ed., 1899); *Die Stärkefabrikation* (1878); *Die Milch- und Molkereiproducte* (1898).

STO'ICS (Lat. *stoicus*, relating to a colonnade, stoic). The name of the school of ancient philosophers opposed to the Epicureans in their views of human life. The stoical system dates from the end of the fourth or beginning of the third century B.C.; it was derived from the system of the Cynics, whose founder, Antisthenes, was a disciple of Socrates. Indeed, the doctrines, but still more the manner of life, and most of all the death of Socrates, were the chief foundations of the stoical philosophy.

The founder of the system was Zeno (q.v.), who opened his school in a portico called the Stoa Pœcile ("painted porch") at Athens, whence the origin of the name of the sect. Zeno had as disciple Cleanthes, from Assus, in the Troad (died c. 220 B.C.), whose Hymn to Zeus is the only fragment of any length that has come down to us from the early Stoics, and is a remarkable production, setting forth the unity of God, His omnipotence, and His moral government. Chrysippus, from Soli in Cilicia (c. 280–207 B.C.), followed Cleanthes, and both defended and modified the Stoical creed. He was regarded as a second founder of the school. Chrysippus was succeeded by Zeno of Tarsus and Diogenes of Babylon; then followed Antipater of Tarsus, who taught Panætius of Rhodes (died B.C. 112). Panætius introduced Stoicism to Rome, and also made such modification in the system that it is customary to regard Stoicism as entering with him upon a second period, characterized by "near approach to the Peripatetic and Platonic teaching" (Windelband). Among the most prominent Stoics of this period are to be mentioned Boëthius of Sidon and Posidonius of Apamea in Syria. The third period of Stoicism is the Roman period, represented by L. Annæus Cornutus, L. Annæus Seneca, Epictetus, and the Emperor Marcus Aurelius Antoninus.

Stoicism was mainly an ethical theory, but it had a logic and a physics as well. Under logic it included both dialectic and rhetoric. Dialectic was predominantly a theory of knowledge. The main question here was: How can we test truth? In answer to this question the Stoics worked out a sensationalistic epistemology. The soul is originally like a blank wax tablet. Things cause alterations or impressions on the soul, and those alterations or ideas which refer to particular things compel assent. These impressions are kept in memory, and, partly without and partly with conscious intention, concepts arise. These are entirely subjective. The highest value is attached to the involuntarily formed concepts, for these compel assent from all men (*consensus gentium*).

Physics included, for the Stoics, cosmology, psychology, and theology. All reality is corporeal, but falls into two classes, the active and the passive, which, however, are inseparable. The active principle is sometimes represented as fire, sometimes as spirit. The spirit fire is God, and is self-conscious. Out of it is developed air, water, earth, the whole universe of separate beings; hence all nature is rational. Every individual soul is a part of the universal world soul for a time individualized, but ultimately to be absorbed into the world soul again, at the time when all the differentiation of the universe is consumed in all-devouring fire. This process takes place by Fate, i.e., in accordance with irreversible laws, but is also purposeful, —that is, mechanism is conceived of as compatible with teleology. When one cycle of differentiation and absorption is complete, another begins.

The Stoic ethics was the ethics of apathy. The soul or the divine principle in man should not allow itself to be carried away by the passions aroused in it by external things. A man must be self-controlled. The passions are due to false judgments and mental disturbances, hence they can be overcome by wisdom and by a refusal to yield to their dictation. A man is not, indeed, master of his fate but he can be master of himself. The Stoic formula was a life in accordance with nature, or as nature is all rational, to live in accordance with nature was to live in accordance with reason. Such a life is happy. Pleasure is an accessory, not an end, of a reasonable life. The Stoics took a very rigorous view of virtue, which they claimed admitted of no degree. One may be virtuous, but if he is not thoroughly so he is not so at all. Only very few men are virtuous; the vast majority are fools. The four cardinal virtues of the Stoic system are insight, courage, temperance, and justice, a classification which in essence does not depart from the Platonic. One very distinctive feature of Stoicism was its cosmopolitanism. Because all men are manifestations of the one universal Spirit, they should live in brotherly love and in readiness to help each other. Differences of rank and wealth are external, and should not interfere with social relations. Thus, long before Christianity Stoicism had recognized and lived up to the brotherhood of man.

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STOJOWSKI, stô-yôf'skĭ, Sigismund (1870–). A Polish-American pianist and composer, born at Strelzy. He began his musical studies with Zelenski in Cracow, and in 1890 went to Paris, where he studied piano under Diémer and Paderewski and composition under Dubois and Massenet. Having won an excellent reputation as a concert pianist on his tours of France, Belgium, Russia, and England, he was engaged, in 1906, as principal professor of pianoforte at the Institute of Musical Art in New York. In 1913 he resigned and accepted a similar position with the Von Ende School of Music. His tours of the United States were very successful, especially his series of historical recitals. His compositions include: a *Symphony in D minor;* a *Suite* for orchestra; three piano concertos; a violin concerto; a *Konzertstück* for cello and orchestra; a *Romanza* for violin and orchestra; several violin sonatas; a choral work with orchestra, *Der Frühling;* studies and pieces for piano.

STOK, stŏk, JOHANNES PAUL VAN DER (1851–). A Dutch meteorologist, born in Zuylen. He was director of the Royal Magnetic and Meteorological Observatory in Batavia from 1882 to 1889 and thereafter was director of the Royal Dutch Meteorological Institute at Bilt. He became a member of the International Polar Commission, and an officer of the Orange Nassau. He wrote on the seasons in the Dutch East Indies and on the climate of the North Sea and Dutch coast.

STOKE-ON-TRENT. A manufacturing town in Staffordshire, England, 15 miles north of Stafford (Map: England, D 4). The principal public buildings are the town hall, New Market hall, and Minton Memorial building. There are statues to Wedgewood, Minton, and Colin Minton Campbell. The town is the centre of the "Potteries" district, and owes its importance to porcelain and earthenware manufactures, carried on in about 360 factories. It has manufactures of iron, engines, machinery, and bricks, and in the vicinity are numerous coal and iron mines. The town of Stoke-upon-Trent was incorporated in 1874, in 1910 it amalgamated with Burslem, Fenton, Hanley, Longton, and Tunstall and its name was changed to Stoke-on-Trent. Pop., 1901, 30,450; 1911, 234,553.

STOKER, AUTOMATIC MECHANICAL. A mechanical appliance driven by power, for supplying fuel to a furnace, and for cleansing the fire and grates from ash and clinker. The fuel is usually supplied to the furnace mouth by gravity. Here it is received and mechanically spread over the surface of the stationary fire on fixed grates; or it is delivered in a layer of uniform and controlled thickness on the first grate bar of an endless chain of such bars which lie across the furnace from side to side. These bars are mechanically propelled or travel from the front of the furnace towards the rear, and are close enough together so as to leave no vertical interstices through which fuel can drop unconsumed. The travel of the bars and the thickness of the fuel on each are so adjusted that combustion shall be completed just before the bar and its load reach the back of the furnace. The ash and incombustible matter remaining on the bar are dumped off the bar as it turns around the supporting drum of the endless chain (or traveling grate) at the back. For softer and caking coals, the grate-bars are a series or flight of steps, and each bar tilts its contents at intervals to a next lower step, the last or lowest one carrying only ash and incombustible residue. The air passes in between the steps in the spaces which separate them. In a third form, the fuel is fed by a screw or a piston element working in a steel tube below the centre of grate level, and forcing the fuel upwards so that it is continually rolling down the slope from the high centre to the lower sides.

The mechanical stoker feeds fuel uniformly and constantly, with no opening of fire doors with attendant cooling and stresses upon plates and tubes of the boiler. Their use therefore will diminish or eliminate smoke from chimneys. They can handle more fuel than men can in a given time, or in a limit or space where enough men could not be gotten together for the necessary work. In heavy firing of great locomotives carrying trains over long divisions of track, the service of mechanical stokers is a great boon.

The firing of liquid fuel or gas supplied under pressure is mechanical stoking, but the term is usually restricted to the mechanical supply of solid fuel. If the speed of the engine driving the grate and regulating the supply of air is interconnected to the steam pressure, so that a rise of pressure lowers the rate of combustion and of fuel supply, and a fall of pressure speeds up both fuel and air supply, the stoker becomes an automatic mechanical stoker. Mechanical and automatic stokers are rarely supplied in installations of less than 1000 horse power on account of the expense of installation.

STOKES, stōks, ANSON PHELPS (1838–1913). An American banker and reformer, father of J. G. Phelps Stokes. He was born in New York City. He became a partner in Phelps, Dodge and Company, merchants, and later in Phelps, Stokes and Company, bankers, and was connected with many other important financial interests. Stokes was the first president of the Reform Club of New York City, vice president for a time of the Civil Service Reform Association, and president in 1900 of the National Association of Anti-Imperialists Clubs. He did much to better social conditions and gave large sums to charity, and was prominent in the movement for tariff reform in the direction of free trade. He was author of *Joint-Metallism* (1894; 5th ed., 1896); *Cruising in the West Indies* (1902; 2d ed., 1903); *Cruising in the Caribbean with a Camera* (1903).

STOKES, FREDERICK ABBOT (1857–). An American publisher, born in Brooklyn, N. Y., and educated at Yale University, where he graduated in 1879. In 1881 he founded the publishing house of White and Stokes, which became successively White, Stokes, and Allen (1883), Frederick A. Stokes (1887), Frederick A. Stokes and Brother (1888), and the Frederick A. Stokes Company (1890), of which he became president. He served as president of the American Publishers' Association in 1912–14, and as president of the MacDowell Club from 1913. A book, *College Tramps*, came from his pen in 1880. He also edited *The Poems of Sir John Suckling* (1886) and from 1898 to 1901 was editor of the *Pocket Magazine*.

STOKES, SIR GEORGE GABRIEL (1819–1903). A British mathematician and physicist, born in Skreen, County Sligo, Ireland. He was educated at Cambridge, became fellow of Pembroke College in 1841, and was elected in 1849 to fill the Lucasian chair of mathematics at Cambridge. His jubilee celebration in 1899 was attended by many European and American scientists. From 1887 to 1892 he represented the university in Parliament and in 1902 was elected master of Pembroke. In 1885 he became president of the Royal Society, of which he had been secretary for 30 years. He was created a baronet in 1889. Stokes was the first to explain in his lectures the scientific principles on which spectrum analysis depends, while to him is due also the first thorough study and explanation of the phenomena of fluorescence, in his paper *On the Change of the Refrangibility of Light* (*Philosophical Transactions* for 1852–53), for which he received the Rumford medal. He greatly extended and improved the application of mathematics to physico-mathematical treatment of questions connected with the distortion of elastic solids, the motion of waves in water, and undulatory theory of light, the summation of series, the internal friction of fluids, and other subjects in hydrodynamics, etc. He also discussed the variation of gravity over the surface of the earth and wrote an important paper on the nature of Röntgen rays. For his work in optics Stokes stood preëminent among the scientists of the nineteenth century, and he did much to mold current thought and theory in this field. His works include: *On Light* (1887), Burnett lectures; *Natural Theology* (1891), Gifford lectures; *Memoirs Presented to the Cambridge Philosophical Society* (1900); and *Mathematical and Physical Papers* (5 vols., 1880–1905), vol. v containing an obituary notice by Lord Rayleigh. In 1907 appeared (2 vols.) *Memoir and Scientific Correspondence of the Late Sir George Gabriel Stokes*, edited by Sir Joseph Larmor. Consult also biographical sketch by E. W. Brown, in Smithsonian Institution, *Annual Report, 1904* (Washington, 1905).

STOKES, George Thomas (1843–98). An Irish divine and author, born in Athlone, Westmeath, Ireland. He was educated at Queen's College, Galway, and Trinity College, Dublin, and was vicar at Newtown Park, County Dublin, from 1869 until his death. In 1883 he was called to the chair of ecclesiastical history in Dublin University, and in 1893 he was elected prebend and canon of St. Andrew by the chapter of St. Patrick's Cathedral, Dublin. Among his publications are: *Ireland and the Celtic Church* (1886); *Sketch of Mediæval History* (1887); *Ireland and the Anglo-Norman Church* (1889); *Bishop Pocock's Tour around Ireland in 1752* (1891); *The Acts of the Apostles* (1891); *Greek in Gaul and Western Europe down to A.D. 700* (1892); and, with H. C. G. Wright, *The Writings of St. Patrick*, an annotated translation (1887).

STOKES, Henry Newlin (1859–). An American chemist. He was born at Moorestown, N. J., and was educated at Haverford College and at Johns Hopkins, Munich, and Zurich. In 1889–92 he was an assistant chemist in the United States Geological Survey, to which he returned after a year as assistant professor in the University of Chicago. He was associate chemist in the Bureau of Standards from 1903 to 1909. His researches include studies in inorganic chemistry, especially on phosphimic and metaphosphimic acids and the compounds of silicon.

STOKES, James Graham Phelps (1872–). An American Socialist and social worker, earlier known as a capitalist. He was born in New York City, a son of Anson Phelps Stokes (q.v.), and graduated from the Sheffield Scientific School, Yale (1892), and from the College of Physicians and Surgeons, New York (1896), and then took up graduate work in political science at Columbia. He rapidly rose to high office and responsibility in many of the corporations in which his family was interested. He became deeply interested in the problems of the poor and identified himself with various charitable organizations. Although a capitalist, he began to criticize the capitalistic system severely as unsocial. After 1906 he was an active member of the Socialist party. In 1904 he ran for the presidency of the Board of Aldermen of New York City and in 1908 for the New York Assembly. He published many articles in defense of his party and in support of social work.

His wife, Rose Pastor Stokes (1879–), was born at Augustava, Suvolk, Russia, and in 1883–90 lived in London, where she attended the Jewish Free School in 1887–89. She came to the United States in 1890, was a cigar maker at Cleveland, Ohio, from 1890 to 1903, and then for two years served as assistant editor of the New York *Jewish Daily News*. After her marriage to Mr. Stokes in 1905 she became identified with Socialist propaganda.

STOKES, Whitley (1830–1909). A British Celtic scholar and authority on Anglo-Indian law. He was born in Dublin, a son of William Stokes (q.v.), was educated at Trinity College, Dublin (1847–51), and became a barrister of the Inner Temple in 1855. In 1862 he went to India, where he occupied various legal positions under the government. He drafted the Anglo-Indian codes (4 vols., 1887–91) and did other important legal work, but became best known for his contributions to Celtic scholarship, a branch of research which he took up before he went to India, and continued during his sojourn there. The greater part of his work deals with early Irish, but his studies included the other Celtic languages, such as Cornish and Breton. It is probable that his researches have done more than those of any other scholar to make accessible the literary and historical monuments of the ancient Irish language. His writings are intended mainly for scholars, but some of his translations deserve mention for their literary worth. Conspicuously good are his renderings of the "Death of the Sons of Usnach" (*Irische Texte*, vol. ii) and of the "Bruden Da Derga" (*Revue celtique*, vol. xxii). His principal publications are: *Irish Glosses* (1859); *Three Irish Glossaries* (1862); *The Passion, a Middle-Cornish Poem* (1862); *The Creation of the World: A Cornish Mystery* (1864); *Goidelica* (2d ed., 1872); *The Life of St. Meriasek* (1872); *Middle-Breton Hours* (1876); *The Calendar of Œngus* (1880); *The Tripartite Life of Saint Patrick* (2 vols., 1887); *Lives of Saints from the Book of Lismore* (1890); *Urkeltischer Sprachschatz* (1894), with Bezzenberger; *The Martyrology of O'Gorman* (1895); *Thesaurus palæohibernicus* (2 vols., 1901–03), with John Strachan; and, in collaboration with E. Windisch, the *Irische Texte* (5 vols., 1880–1909), the last volume of which contains a posthumous work, being an edition of the Irish prose version of Lucan's *Pharsalia*, known as *Cath Catharda*.

STOKES, William (1804–78). A British physician, born in Dublin and educated there and in Edinburgh (M.D., 1825). In 1845 he succeeded his father, Whitley Stokes (1763–1845), as Regius Professor of Medicine at Dublin University. In 1861 he was appointed physician-in-ordinary to the Queen in Ireland. Six years later he was elected president of the British Medical Association and in 1874 president of the Royal Irish Academy. Stokes was one of the most distinguished British physicians of the nineteenth century, being not only a great practitioner and diagnostician, but also a teacher, writer, and observer of diseases and their symptoms. He introduced auscultation into England in 1825—*An Introduction to the Use of the Stethoscope;* wrote on typhus fever and cholera, ravaging epidemics of which he observed respectively in 1826–27 and 1832. But he is best known through his report on the so-called "Stokes-Adams disease," which appeared in 1846 in the *Dublin Journal of Medical Science* (see Heart, Diseases of the, *Heart Block;* Cheyne-Stokes Respiration). Stokes was an authority on diseases of the heart and lungs. His best-known works are: *A Treatise on the Diagnosis and Treatment of Diseases of the Chest* (1837); *Lectures on the Theory and Practice of Physic* (1838); *The Diseases of the Heart and Aorta* (1854); *Lectures on Fevers* (1854), edited by John William Moore, all of which have seen many editions and have been translated into German, French, and other languages. In 1834 Stokes became editor of the *Dublin Journal of Medical Science*. He was the father of the Celtic scholar Whitley Stokes (q.v.).

STOKES, Sir William (1839–1900). A British surgeon. The son of William Stokes (q.v.), he was born in Dublin, studied medicine there (M.D., 1863) and at Berlin, London, Paris, and Vienna, and in 1871 became professor of surgery at the Royal College of Surgeons of Ireland. Of this institution he served as president in 1886–87. In 1886 he was knighted and in 1892 was appointed surgeon in ordinary to the Queen in Ireland. In 1900 he went to South Africa as consulting surgeon to the British forces in the war against the Boers. While there he was attacked with pleurisy, and he died in Pietermaritzburg. He wrote, among other works, *Contributions to Practical Surgery* (1865 et seq.) and *Selected Papers on Operative and Clinical Surgery* (1902), edited by William Taylor.

STOKES-ADAMS DISEASE or SYNDROME. See Heart, Diseases of the, *Heart Block*.

STOKE-UPON-TRENT. See Stoke-on-Trent.

STOKOWSKI, stô-kŏf′skĭ, Leopold (1882–). An American orchestral conductor, born of Polish parentage in London. After graduating from Queen's College, Oxford, he entered the Paris Conservatoire. In 1905 he came to New York, where for three years he occupied the position of organist and choirmaster at St. Bartholomew's. In 1908 he conducted a series of concerts in London, and returned the following year to the United States as conductor of the Cincinnati Symphony Orchestra. He succeeded Carl Pohlig in the conductorship of the Philadelphia Symphony Orchestra in 1912. Among many novelties which he introduced in the United States his first performance of Mahler's Eighth Symphony, in 1916, with a body of 1000 instrumentalists and singers, was especially noteworthy. In 1911 he married the pianist Olga Samaroff (q.v.).

STOLBERG, shtôl′bĕrk, Christian, Count (1748–1821). A German poet, born at Hamburg, of an ancient family, originally from Thuringia. He studied at Göttingen (1769–74), where he and his brother Friedrich joined the literary Hainbund, for 23 years was in the public service, and lived after 1800 on his estate near Eckernförde, Schleswig. He translated Sophocles (1787), and wrote several volumes of poems (*Gedichte*, 1779, 1782, 1787, 1810) noteworthy for their pictures of family life. All of his poetic works appeared with those of his brother in *Werke der Brüder Stolberg* (20 vols., Hamburg, 1820–25).

STOLBERG, Friedrich Leopold, Count (1750–1819). A German poet and translator, brother of Christian. He was born at Bramstedt, Holstein, studied at Halle and Göttingen, and from 1777 to 1780 was Ambassador of the Prince-Bishop of Lübeck at Copenhagen. He became Ambassador of the Danish court at Berlin in 1789, and filled other official positions until in 1800, with his whole family, he became a convert to Roman Catholicism. During his later years he lived in comparative retirement, devoted mainly to literary work ranging from verse to translations of Greek authors, prose romance, travels, and a fifteen-volume history of Christianity (1807–18). Consult biographical studies by T. Menge (Gotha, 1862), J. H. Hennes (Frankfort, 1876; Mainz, 1875), and J. Janssen (3d ed., Freiburg, 1900).

STOLE (Lat. *stola*, long robe). A narrow band of silk worn over the shoulders by the clergy of the Roman Catholic and Anglican communions. See Costume, Ecclesiastical, and Plate.

STOLEN GOODS. In law, chattels which have been the subject of larceny and have not been restored to the possession of their owner. Inasmuch as the larceny does not divest the owner of his property in the stolen goods, a buyer cannot acquire title to them even if the purchase be made in good faith. In England, however, this rule does not apply if stolen goods were bought in market overt (q.v.), and the owner had not prosecuted the thief, in which case the bona fide purchaser acquires valid title. In the United States there are no markets overt, and any person buying stolen goods acquires no better title to them than the thief has. That is, the owner has a right to take them wherever he may find them. This rule is subject to the qualification that current money and negotiable papers payable to bearer or indorsed in blank may pass to and become the absolute property of a bona fide purchaser even if they have been stolen from their lawful owner. See Negotiable Instruments.

Where goods are stolen by means of false pretenses, an innocent purchaser from the thief acquires good title, since the former owner actually intended to transfer the property to the wrongdoer. Thus to constitute the crime of receiving stolen goods, the goods must have been stolen and not acquired by embezzlement or false pretenses. The receiver must either know that they have been stolen or have reasonable grounds for believing that they have been unlawfully taken from their owner. The crime becomes complete when the receiver takes them into his possession or they are taken for him with his knowledge by a servant or agents. If the goods after being stolen come back into the possession of the owner or are delivered to the receiver by the owner's authority, they cease to be stolen goods.

In England it early became the law that if goods were stolen in one county and carried into another by the thief, he was deemed to have committed larceny in both counties, and could be indicted and placed on trial in either. As the offense, wherever committed, was an offense against the same sovereignty, this rule as to larceny amounted simply to a convenient method of determining the place of trial. The English courts refused to apply the rule where goods were stolen in a foreign country and brought to England. Courts in many of the United States have somewhat illogically applied this rule to the several States, holding that if goods are stolen in a sister State and then brought within the State larceny is committed in both States, notwithstanding the fact that the original offense was committed against an independent sovereignty so far as the administration of the criminal law is concerned, and that the having in possession of stolen goods is a very different offense from the larceny of the goods. (See Larceny.) The crime of receiving stolen goods is now generally defined by statute and the punishment imposed varies in the different States. In most States the offense is deemed a felony. See Crime; Jurisdiction; Receiving Stolen Goods.

STOLO, Gaius Licinius. See Licinius Stolo, Gaius.

STOLP, shtōlp. A town in the Province of Pomerania, Prussia, on the Stolpe, 12 miles from the Baltic Sea, and 65 miles west by north of Danzig (Map: Germany, G 1). The fourteenth-century Marienkirche, with its lofty tower, is worthy of note. Its most important industries are amber turning and carving, and linen weaving. Machinery, furniture, leather, and cigars are also manufactured. Stolp was a member of the Hanseatic League, and belonged to the dukes of Pomerania until 1637, when it passed to Brandenburg. Pop., 1900, 27,272; 1910, 33,762.

STOLYPIN, stôl-yĕ'pên, Peter Arkadievitch (1862–1911). A Russian statesman. He studied law at the University of St. Petersburg, and in 1885 entered the Department of Public Domains, transferring later to the Interior Department. In 1889 he settled in the Government of Kovno, where he rose to be president of the provincial court and marshal of the nobility. In 1902 he was made Governor of Grodno and in the following year Governor of Saratov. In May, 1906, he became Minister of the Interior under Goremykin, the first constitutional Premier, and on July 22, after the dissolution of the first Russian Duma, succeeded Goremykin. He initiated a policy of "liberal pacification," in accordance with which the greater part of the Empire was placed under military law. On August 25 a bomb was exploded in his residence, killing a large number of persons but leaving the Premier unharmed. He did meet a violent death, however, in 1911, when he was assassinated. See Russia, *History*.

STOLZ, shtōlts, Friedrich (1850–). An Austrian classical scholar, born at Hall, Tirol, and educated at Innsbruck and Leipzig. He became docent at the University of Innsbruck in 1879, and was appointed associate professor in 1887 and professor in 1890. Besides his great work, the first volume of the *Historische Grammatik der lateinischen Sprache* (1894–95), he wrote *Zusammengesetzte Nomina in den homerischen und hesiodischen Gedichten* (1874); *Die lateinische Nominalkomposition* (1877); *Studien zur lateinischen Verbalflexion* (1882); *Lateinische Laut- und Formenlehre* (in Müller's *Handbuch*, 4th ed., 1910); *Homeri Odysseæ Epitome* (1893); *Entwickelung der indogermanischen Sprachwissenschaft* (1899); an ethnographical study, *Die Urbevölkerung von Tirol* (2d ed., 1892); *Geschichte der lateinischen Sprache* (1910).

STOMACH, stŭm'ak (Lat. *stomachus*, from Gk. *στόμαχος*, throat, stomach, from *στόμα*, *stoma*, mouth). The principal organ of digestion, receiving the food through the œsophagus, and, after certain digestive changes have taken place, emptying it into the intestines, where the process is completed. The stomach is irregularly conical, curving somewhat upon itself so that the lower curvature is much greater than the upper curvature. The size varies according to the amount of food received, but when empty the walls are in apposition. It lies in the left hypochondriac and epigastric regions, behind and partly protected by the ribs and in close relation with the left lobe of the liver and the diaphragm. The stomach has an external peritoneal coat, a muscular coat consisting of longitudinal, circular, and oblique fibres, a submucous or areolar layer, and a lining mucous membrane. In this mucous membrane are the so-called pyloric and peptic glands, which secrete the gastric juice. The main blood supply is through the gastric artery, and the nerve supply is derived from the pneumogastric nerves and the sympathetic system. See Alimentary System; Digestion; Food; Gastritis.

STOMACH, Diseases of the. The organic diseases of the stomach with constant lesions include gastritis (q.v.), ulcer, erosions, and cancer. The functional diseases, with variable lesions, include hyperchlorhydria, gastrosuccorrhœa, achylia gastrica, and isochymia.

Ulcer of the stomach is usually characterized by a deep circumscribed loss of substance of the mucous membrane lining the stomach, the wound refusing to heal, and occasioning pain after taking food, vomiting, and hemorrhage. It is twice as frequent in females as in males, and occurs most generally during middle life. Ulcers generally occupy the posterior surface, the lesser curvature, and the pyloric sac. When they heal they leave behind scars with contractile tendency. When they do not heal, corrosion of neighboring blood vessels may ensue, with hemorrhages, possibly fatal; or there may arise adhesions to neighboring organs, or perforations. The symptoms named increase in severity till death occurs from perforation, hemorrhage, or starvation; or, they gradually disappear and the patient recovers. The prognosis is good if the condition is recognized early. Modern surgery has materially reduced the mortality. The treatment of ulcer calls for absolute rest in bed, a period of fluid, but nourishing diet, followed by a "soft" diet of nonirritating and easily digested food. Rectal feeding may be tried for a short time, but the amount of nourishment absorbed by this means is practically negligible. The stools should always be examined for occult blood, and if this is found repeatedly, surgical measures are indicated. The ulcer may be simply excised, or, better, an anastomosis between the stomach and intestine—gastrojejunostomy—may be performed.

Erosions of the stomach consist really of small, superficial ulcers of the mucous lining. They occur commonly in chronic gastritis. The patient may suffer from erosions for many years. The treatment consists of the use of silver nitrate, intragastric galvanization, diet, general hygiene, and out-of-door exercise.

Cancer of the stomach is very common and is apparently on the increase. In the United States registration area, during the decade from 1904 to 1913, there was an increase of 19 per cent in the mortality from cancer of the stomach and liver, as against a general increase in the cancer mortality of 12.5 per cent. Gastric cancer occurs more frequently at the age of 50; it is rare before 30. It is more frequent in men than women. The tendency to cancer is possibly hereditary and the most constant factor in its production is ulcer of the stomach. The new growth may be an epithelioma, a medullary carcinoma, a scirrhus, or a colloid carcinoma. See Tumor.

The general symptoms of cancer of the stomach (appearing after a more or less indefinite period of indigestion) are pain, loss of appetite, vomiting, hemorrhage, tumor, constipation, a decided cachexia, and a moderate leucocytosis. Examination of the stomach contents after a test meal reveals decrease of the free hydrochloric acid as well as of the total acidity, and the presence of lactic acid. The prognosis is hopeless for cure. If the disease be of slow progress and diagnosed early the patient may gain relief enough from surgical interference to live several years. The medical treatment is purely symptomatic. The diet should be at once nutritious and easily digested.

Of the functional diseases, hyperchlorhydria is a condition in which the gastric juice possesses more acidity and ferments than it should. A test of the stomach contents decides the diagnosis, and the condition is met by hygiene, diet, alkalies, bromides, and in some cases opiates and electricity.

Gastrosuccorrhœa is a periodical and continuous production of the normal gastric juice, causing vomiting and intense pain, restlessness, nausea, and a feeling of pressure in the epigastrium. The treatment of this rare affection is almost exclusively dietetic and hygienic. The most useful drug is atropine; galvanization and lavage have also been employed.

Achylia gastrica is a condition in which there is a constant absence of gastric juice, accompanied by atrophy of the stomach, and following severe catarrhal disease of that organ. The gastric contents decide the diagnosis. Lavage, faradization of the stomach, and attention to diet constitute the treatment. Diet must be soft or fluid and adapted to intestinal digestion, since the small intestine acts vicariously for the stomach.

Isochymia is a distressing condition in which food is always found in the stomach, even when fasting. The stomach is dilated and the mechanical insufficiency of the organ is so great as to fail of emptying the chyme into the intestines. Paresis of the gastric muscular coat or contraction of the pylorus is the cause of this condition. See Cardialgia; Indigestion; Sarcina. Consult C. G. Stockton, *Diseases of the Stomach* (New York, 1914), and H. J. Paterson, *Surgery of the Stomach* (ib., 1914).

STOMACH, Rupture of. See Horse.

STOMACH PUMP. An instrument used to remove poisons from the stomach, to feed persons who cannot swallow or who attempt to starve themselves, or to wash out the stomach during disease. It is a flexible rubber tube, inserted into the stomach through the œsophagus, by which fluid is injected and removed. See Lavage.

STOMACH STAGGERS. See Horse.

STO'MATA (Neo-Lat. nom. pl., from Gk. *στόμα, stoma,* mouth). The so-called breathing pores especially numerous in foliage leaves and developed in any epidermis overlying green tissue. Each stoma consists of two crescentic guard cells whose concave surfaces face one another, leaving a slit which is opened or closed as required by the plant, hence the name "automatic gateway." See Aëration; Leaf.

STO'MATI'TIS (Neo-Lat., from Gk. *στόμα, stoma,* mouth + *-itis*). An inflammation of the mucous membrane lining the mouth, assuming many forms and occurring in various degrees of severity. For a detailed description of the clinical varieties of stomatitis with their pathology and treatment, see Mouth, Diseases of the.

STO'MATOL'OGY. See Dentistry.

STOM'ATOP'ODA, or **STOMAP'ODA.** See Crustacea; Mantis Shrimp.

STONE. See Building Stone.

STONE. A British unit of weight equivalent to 14 pounds. See Weights and Measures.

STONE. See Calculus.

STONE, Amasa (1818–83). An American railroad builder and philanthropist. He was born at Charlton, Mass., and early engaged in the building of railroads and bridges, being made superintendent of the New Haven, Hartford, and Springfield Railroad in 1845. He was one of the contractors for building the Cleveland, Columbus, and Cincinnati and the Cleveland and Erie railroads, and during the Civil War he was often an adviser of the government in matters of transportation of men and material. Stone gave $600,000 to Adelbert College of the Western Reserve University at Hudson, on condition of its removal to Cleveland, and also made many charitable benefactions in the city of Cleveland. Consult *Amasa Stone, a Memorial* (New York, 1883).

STONE, Artificial. The name given to various artificial compositions of which the basis is hydraulic cement or plaster of Paris, which are plastic when first made and by hardening assume a stonelike hardness and consistency. Some of these compositions possess undeniable merit for certain kinds of work and are considerably used. Among the older well-known stones of this type was the Béton-Coignet, Portland stone, McMurtrie stone, Ransome stone, and Sorel stone. Béton-Coignet was invented by Coignet, a Frenchman, and as made by him was composed of Portland cement, siliceous hydraulic cement, and clean sand very thoroughly mixed with a small amount of cold water. This plastic mixture is then placed in molds to harden for use. Portland stone is a mixture of Portland cement and sand or sand and gravel wet to make a plastic mixture and rammed into molds to harden. Under various trade names Portland stone has been used in the United States. McMurtrie stone is formed by adding alum and potash soap to the mixture for Portland stone. Ransome stone is made by mixing sand and silicate of soda, molding the mixture into blocks or slabs, and setting them to harden under pressure in a hot solution of chloride of calcium. Sorel stone is a French product, and is made by adding to oxide of magnesium a solution of chloride of magnesium; it is, in other words, an oxychloride type of cement. Artificial sandstone, Caen stone, and artificial marble, made of plaster of Paris or its derivatives, are the most widely used stones of this class in the United States. Consult H. H. Rice, *Concrete-Block Manufacture* (New York, 1906); I. O. Baker, *Treatise on Masonry Construction* (10th ed., ib., 1909). See Concrete; Pavement.

STONE, Charles Pomeroy (1825–87). An American soldier, born at Greenfield, Mass. He graduated at West Point in 1845, entered the ordnance department, and served under General Scott during the Mexican War. On the outbreak of the Civil War he organized the District of Columbia Volunteers, and in May, 1861, was made brigadier general. He was in several actions during June and July, 1861, took part in General Patterson's operations in the Shenandoah valley, and commanded at the disastrous affair at Ball's Bluff (q.v.). Though charges were never preferred, he was confined for six months in military prisons. In 1862 he was released, and in May, 1863, was assigned to the Department of the Gulf. He served at Port Hudson in 1863, and then for nearly a year was chief of staff to Major General Banks. On Aug. 21, 1864, he was given command of a brigade before Petersburg, and on Sept. 13, 1864, resigned his commission. In 1870 he entered the service of the Khedive of Egypt as chief of staff and with the rank of brigadier general, was later general aid-de-camp to the Khedive. In 1883 he returned to the United States.

STONE, Darwell (1859–). An English clergyman and author. Educated at Merton College, Oxford, he was vice principal and then principal of Dorchester Missionary College between 1885 and 1903; was Pusey librarian (1903–09); and in the latter year became principal of Pusey House, Oxford. In 1912–14 he served as examiner in the Theological Honour School, Oxford University. His publications include: *Outlines of Christian Dogma* (1900); *The Church, its Ministry and Authority* (1902); *The Invocation of Saints* (1903); *An Appeal to Facts and Principles* (1903), with Canon Newbolt; *The Discipline of Faith* (1904); *A History of the Doctrine of the Holy Eucharist* (1909); *Episcopacy and Valid Orders* (1910); *Divorce and Remarriage* (1913); *The Authority of the Church* (1914).

STONE, Edward James (1831–97). An English astronomer, born in London. He was educated at Queens' College, Cambridge, and in 1859 was elected fellow of the college. In 1860 he became chief assistant at the Royal Observatory at Greenwich. From 1866 to 1870 he was secretary of the Royal Astronomical Society, and president from 1882 to 1884; he was awarded the gold medal of the society in 1869. In 1870 he was appointed her Majesty's astronomer at the Cape of Good Hope, and in 1879 Radcliffe observer at Oxford, which position he retained till his death. From observations made in 1862 Stone deduced a value of the solar parallax, which fixed the solar distance as slightly over 91,000,000 miles. The reversal of the Fraunhofer spectrum, a confirmation of Young's spectroscopic discovery of the reversing layer of the sun, was observed by him during the solar eclipse at Klipfontein in 1874.

While at the Cape Observatory he prepared a catalogue of 12,441 stars (1880), containing all stars down to the seventh magnitude between the South pole and 25° S. declination, for which he was awarded the Lalande prize of the French Academy in 1881. This survey of the southern heavens was completed in the *Radcliffe Catalogue* for 1890, in which he gives the places of 6424 stars to the seventh magnitude between the equator and 25° S. declination. Consult Royal Society, *Catalogue of Scientific Papers* (London, 1867–1902).

STONE, Ellen Maria (1846–). An American missionary teacher, born at Roxbury, Mass. She taught school at Chelsea, Mass., in 1866–67, and was a staff member of the Boston *Congregationalist* in 1867–78. In the latter year she became a Congregational missionary at Samokov, Bulgaria, later was stationed at Philippopolis, and in 1898 removed to Salonica, Macedonia. In 1901 Miss Stone and Madame Tsilka, the wife of an Albanian Protestant preacher, were kidnapped by brigands on a mountain road between Bansko and Djumia, Macedonia, in European Turkey. The brigands demanded a ransom of $110,000, and a sum of nearly $65,000 was finally raised by subscription in the United States and paid. The captives were then released after nearly six months of captivity. Miss Stone published the story of her captivity in *McClure's Magazine* in 1902. Subsequently she lectured and contributed articles on foreign missions, and raised money for missions in Bulgaria, Macedonia, and Albania.

STONE, George (1708–64). An English archbishop, born in London. He was educated at Christ Church, Oxford; in 1733 was appointed dean of Ferns; and in the following year was transferred to the deanery of Derry. He served as Bishop of Ferns (1740–43), of Kildare (1743–45), and of Derry (1745–47), and thenceforth as Archbishop of Armagh. Active in politics, he was a rival of Boyle (afterward Earl of Shannon), and supported the claim of the crown to the surplus revenues in 1749–53. He was excluded from participation in the government in 1756, but after 1758 shared control of Irish affairs as lord justice along with Shannon and John Ponsonby.

STONE, Harlan Fiske (1872–). An American legal scholar and educator, born at Chesterfield, N. H. He graduated at Amherst College in 1894, and at Columbia Law School in 1898. Admitted to the bar, he became a member of the firm of Satterlee, Canfield, and Stone, and also gained interests in certain corporations. From 1898 to 1902 he was lecturer in law at Columbia, from 1902 to 1905 he was professor of law, and in 1910 he became dean of the law school of the university. He contributed to law journals and published *Law and its Administration* (1915), Hewitt lectures at Cooper Union.

STONE, John Timothy (1868–). An American Presbyterian clergyman. He was born in Boston and graduated at Amherst College (1891) and at Auburn Theological Seminary (1894). He was pastor of churches at Utica and Cortlandt, N. Y., until 1900; then of the Brown Memorial Church, Baltimore, until 1909; and in that year became pastor of the Fourth Presbyterian Church, Chicago. In 1913–14 he was moderator of the general assembly of the Presbyterian church. He published: *Footsteps in a Parish* (1908); *Recruiting for Christ* (1910); also monographs on educational and religious subjects.

STONE, Lucy (1818–93). A pioneer American woman suffragist. She was born at West Brookfield, Mass., and graduated at Oberlin College in 1847. She went to Oberlin because she wished to learn Hebrew and Greek in order to know at first hand whether the biblical texts quoted against the equal rights of women were true translations. In 1848 she lectured on woman's rights at Gardner, Mass., and in the same year toured the New England States and Canada in behalf of the antislavery movement. She married Henry B. Blackwell, brother of Elizabeth Blackwell (q.v.), in 1855, but retained her maiden name with her husband's consent. In 1857 she removed to New Jersey, where the seizure of her property for taxes caused her to write a pungent protest, using as a logical weapon the motto of the Revolution, "no taxation without representation." She lectured during the political campaigns for the woman's suffrage amendments (1867–82), took the most prominent part in founding the American Woman's Suffrage Association in 1869, was president thereof in 1872, and was chairman of its executive committee in 1869–89. In 1870–72 she was coeditor of the Boston *Woman's Journal,* and from 1872 to the year of her death she was its editor in chief, assisted by her husband and her daughter, Alice Stone Blackwell (q.v.). She died at Dorchester, Mass.

STONE, Melville Elijah (1848–). An American newspaper executive, born at Hudson, Ill., and educated in the Chicago public schools. In 1864 he was a reporter for the Chicago *Tribune,* and in 1869–71 conducted a foundry and machine shop. He was then editor successively of several Chicago dailies until 1874, in 1875 he established the Chicago *Daily News,* and in the following year became a partner of Victor F. Lawson (q.v.), together with whom he established the Chicago *Morning News* (later known as the *Record-Herald*) in 1881. After selling out his interest to Lawson in 1888, he spent three years in Europe. Of the Globe National Bank, which he organized in 1891, he was president until it was consolidated with the Continental Bank in 1898. After 1893 he was general manager of the Associated Press, with headquarters at New York.

STONE, Thomas (1743–87). A signer of the Declaration of Independence. He was born in Charles Co., Md., studied law at Annapolis, began practice at Frederickton in 1764, and was a delegate to the Continental Congress in 1775–77, and again in 1783–84, being president pro tempore in 1784. He was a member of the Committee on Confederation in 1776–77, and, returning to Maryland in 1777, urged the State Convention to ratify the Articles of Confederation. Consult Sanderson, *Signers of the Declaration of Independence,* vol. ix (Philadelphia, 1823–27).

STONE, Walter King (1875–). An American illustrator. He was born at Barnard, Monroe Co., N. Y., and studied at Rochester (N. Y.) Mechanics' Institute and at Pratt Institute, Brooklyn. For leading magazines, such as *Harper's, Scribner's,* and the *Century,* he did many illustrations, crisply individual, and decorative in style. He also designed many book covers and illustrated a number of books.

STONE, Warren Sanford (1860–). An American labor leader. He was born at Ainsworth, Ia. In 1879 he became a fireman on the Rock Island System, and in 1884 was promoted to engineer. In 1903 he was appointed to succeed Peter M. Arthur as grand chief of the International Brotherhood of Locomotive Engineers, was elected to that office in 1904, and reëlected for a term of six years in 1912. Stone became also a member of the Industrial Peace Committee.

STONE, William Joel (1848–). An American lawyer and statesman, born in Madison Co., Ky., and educated at the University of Missouri. After 1869 he practiced law at Jefferson City, Mo. A Democrat, he became prominent in politics, serving in Congress from 1885 to 1891. His administration as Governor of Missouri (1893–99) was progressive and able. Elected United States Senator in 1902, he was reëlected in 1908 and 1914. As Senator, he became known for quiet persistency. After 1913 he was chairman of the committee on foreign relations and thus was consulted in many of the important problems arising from the great war of 1914. He was thought to be a spokesman for President Wilson, whose legislative programme received his support. But in January, 1916, he stated that he had supported the policy of "watchful waiting" towards Mexico against his convictions, and later he championed the view that Americans should be warned not to take passage on armed belligerent merchant vessels.

STONE, William Leete (1792–1844). An American journalist and historical writer, born at New Paltz, New York. After editing several provincial journals he became editor of the New York *Commercial Advertiser* in 1821. He earnestly furthered a plan for collecting the Colonial documents of New York, and was defendant in a famous suit brought by James Fenimore Cooper (q.v.) for criticisms that had appeared in his journal on the novelist's *Home as Found* and the *History of the Navy.* Stone was active in furthering benevolent institutions for the deaf and dumb and for juvenile delinquents. Among his many publications the Revolutionary *Tales and Sketches* (2 vols., 1834), *Maria Monk and the Nunnery of the Hôtel Dieu* (1836), and a social satire *Ups and Downs in the Life of a Distressed Gentleman* (1836), are still not without interest. Better known probably are his *Life of Joseph Brant* (1838); *Life of Red Jacket* (1840); and *Uncas and Miantonomeh* (1842). An account of his other works is given in *Life and Writings of Col. William L. Stone* (1866), by his son, William Leete Stone, Jr. (1835–1908), himself the author of many works of antiquarian research connected with the Revolutionary epoch, among which the more noteworthy are: *The Life and Times of Sir William Johnson, Bart.* (1865); *The Campaign of Gen. Burgoyne* (1877); *History of New York City* (1872); *Reminiscences of Saratoga and Ballston* (1875); and *Washington County, New York: Its History* (1901). He edited also *Ballads Relating to the Burgoyne Campaign.*

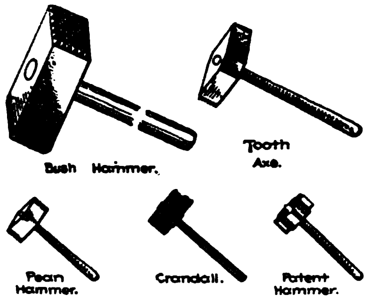
STONE AGE. A term commonly used to denote the earliest recognized stage in the development of human culture as defined by the materials used by man for weapons, utensils, etc. The phrase is somewhat misleading, since it is probable that primitive man made use of wood and other perishable materials to a far greater extent than of stone, and consequently the stage is defined by the prevailing material of the relics, not by that of actual implements in common use.

The term Stone age represents in no sense a chronological division of human progress, but is a loose equivalent for a stage of cultural development varying widely in duration in different parts of the world. There are, e.g., tribes still in the Stone age, while, on the other hand, some groups had outgrown it before the dawn of history. It is also worth noting that some tribes commonly classed as belonging to the Stone age produced objects of a superior artistic and industrial merit to those who had advanced to the use of metals. The evidence for the existence of such an age in most parts of the world is conclusive, but it is from the prevalence and character of the relics in certain parts of Europe rather than in America that the idea and term have come into general use. Consult

H. F. Osborn, *Men of the Old Stone Age* (New York, 1915). See ARCHÆOLOGY, AMERICAN; NEOLITHIC PERIOD; PALEOLITHIC PERIOD.

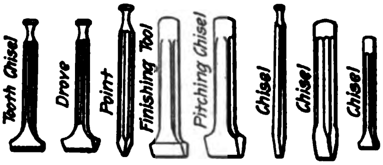
STONE CAT. See CATFISH.

STONE CUTTING AND DRESSING. Processes employed in preparing quarried stone for structural and ornamental purposes. These processes range in character from rough shaping of the stone into squared blocks, generally performed at the quarry, to the cutting and polishing of carefully modeled and ornamental pieces such as columns, cornices, moldings, and balustrades, and they may be carried out either by means of hand tools or by stone-working machines. The hand tools used in stone cutting and dressing are variously shaped hammers and chisels and simple forms of measuring instruments, templates, and gauges.


Bush Hammer.
Tooth Axe.
Pean Hammer.
Crandall.
Patent Hammer.

STONE-WORKING HAMMERS.

After a block is broken from its bed by one of the methods described in QUARRY, QUARRYING, it is trimmed to the desired size and shape by a variety of means according to the hardness of the stone and the finish desired. By means of the pitching chisel the rough block is trimmed down to a line, then the irregular surface is worked down by the point, after which it is finally dressed. If the stone is to be polished it is first scoured with wet sand. Small blocks are now usually ground with wet sand on a revolving iron bed, while large blocks are ground by dragging a slab of stone back and forth across them with wet sand as an abrasive. For securing finer polish, emery, hones, pumice stone, and polishing putty (oxide of tin) are used. A high grade of polish can be secured by skilled workmen only, each man using his own peculiar method.



STONE-WORKING CHISELS.

In most large establishments grinding and polishing machines are much employed. For flat surfaces a circular horizontally revolving iron plate or grating, attached to the lower end of a vertical shaft, with an elbow joint, is used, the workman guiding the plate to various parts of the surface, and using sand or emery for abrading material. By attaching felt to the plate the same machine is used for polishing. Blocks of such small size as can be handled by the workmen are usually ground upon horizontally revolving iron beds eight or ten feet in diameter. Pendulum machines are used for polished simple moldings. The moldings being first cut as smoothly as possible with the chisel, a plate of cast iron, fitted as accurately as possible, is made, by means of a long arm, to travel back and forth along the molding, with sand, emery, putty powder, or other abrasive.

For turning posts and pillars lathes are now generally used. For the softer stones a simple pointed cutting tool similar to that used in turning metals and held and operated by a similarly constructed machine is employed. In turning hard stones like granite the cutting tool is in the form of a thin steel disk some 6 inches or 8 inches in diameter, so arranged as to revolve with the stone when pressed against it at a sharp angle. Lathes of this type are used, capable of turning a block 25 feet long and 5 feet in diameter to a perfect column. Planers for rough work, such as flagstone, resemble the same machine for planing metals. See METAL-WORKING MACHINERY.

Stone-sawing machines are made in various forms, the most familiar consisting of a smooth flat blade of soft iron which is given a reciprocating motion by machinery and fed with sharp sand and water. Such saws are commonly worked in gangs of ten or a dozen blades set parallel the desired distances apart and operated by a single saw frame. This method of sawing is not applicable to cutting granite, on account of its hardness. Frequently, in place of sand, use is made of small globules of chilled iron or of crushed steel as an abrasive. Circular saws set with diamonds have proved very efficient tools, but their use is generally too expensive. Slate is sawed by circular saws such as are used for sawing lumber. In Europe considerable use has been made of twisted cords of steel made to run around pulleys like a band saw. Among other machines for stone cutting and dressing mention may be made of pneumatic hammers and the sand blast. Consult: G. P. Merrill, *Stones for Building and Decoration* (3d ed., New York, 1903); I. O. Baker, *Treatise on Masonry Construction* (10th ed., ib., 1909); W. G. Renwick, *Marble and Marble Working* (ib., 1909); T. N. Dale, "Slate Deposits of United States," in *United States Geological Survey, Bulletin No. 586* (Washington, 1914).

STONE FALCON. See MERLIN.

STONE FLY. One of the aquatic insects of the family Perlidæ and order Plecoptera—flat-bodied insects with two pairs of wings. The hind wings are very broad and when folded lie flat on the back of the insect. The larvæ live in water, clinging to the under sides of stones, and in general appearance are much like the adult insects, except in the lack of wings and ocelli; they are carnivorous, living largely upon the nymphs of May flies (q.v.). The well-aërated water in which the nymphs live is correlated with a peculiar rudimentary tracheal system for breathing. The eggs are produced in enormous numbers and a single female may deposit more than 5000; they are small, and are probably dropped during flight upon the surface of the water as with the May flies.

STONE'HAM. A town in Middlesex Co., Mass., 8 miles north of Boston, on the Boston and Maine Railroad (Map: Massachusetts, E 3). It has a large public library, a fine high school building, sanitarium, State armory, and a public park and zoo. Boots and shoes, boxes, paper sizing, and laboratory supplies are manufactured. Pop., 1900, 6197; 1910, 7090. Settled about 1670, Stoneham was under the jurisdiction of Charlestown and was called Charlestown End until 1725, when it was incorporated under its present name. Consult Stevens, *History of Stoneham* (Stoneham, 1890).

STONE′HENGE (AS. *Stanhengist*, hanging stones). A celebrated stone circle, or cromlech, the ruins of which stand on Salisbury Plain, 1½ miles from Amesbury, in Wiltshire, southern England. When entire it consisted of two concentric circles of monoliths, the outer 100 feet in diameter, inclosing two smaller rows in form of a horseshoe, the opening to the northeast. Within there is a block of blue marble 15 feet long which is called the "Altar Stone." On a northeast line from the altar is a flat stone on the edge of the trench surrounding the whole ruin, and the line prolonged cuts another large stone some distance away called the "Friar's Heel." This arrangement points to a means of determining the time of the summer solstice, and it is thought that Stonehenge was connected with sun worship. In any case the monument, whether temple, court of justice, or battle ring, was designed with reference to the northeast. Modern research proves that the structure dates from as early as the Bronze age. Tumuli in the vicinity yield Bronze age remains. Stonehenge is in private possession. It was bought at auction in 1915 for $35,000. Consult W. M. Flinders Petrie, *Stonehenge: Plans, Descriptions, Theories* (London, 1881); J. N. Lockyer, *Stonehenge and Other British Monuments Astronomically Considered* (ib., 1906). See Megalithic Monuments.

STONE′HOUSE, East. See East Stonehouse.

STONE LILY. See Crinoidea and Plate.

STONE LUGGER. See Stone Roller.

STONE′MAN, George (1822–94). An American soldier and Governor of California. He was born at Busti, Chautauqua Co., N. Y., and graduated at West Point in 1846. Just before the Civil War he was in command of Fort Brown in Texas, and was ordered by his superior officer, General Twiggs, to surrender to the Confederates, but refused, and escaped with his troops on a steamer to New York. After service in West Virginia he was appointed chief of cavalry in the Army of the Potomac. By overtaking the Confederate troops after the evacuation of Yorktown in May, 1862, he brought on the battle of Williamsburg. During Hooker's Chancellorsville campaign he led a cavalry raid towards Richmond. In April, 1864, he was put in command of a cavalry corps in the Army of the Ohio, and in the Atlanta campaign undertook raids against Macon and Andersonville. He was captured with a part of his force at Clinton, Ga., and was a prisoner three months. In December, 1864, he led a raid from East Tennessee into southwestern Virginia. In the following March he again entered southwestern Virginia. In April he moved into North Carolina, took Charlotte and other towns, and at Salisbury captured about 1400 prisoners. In recognition of his service he was brevetted major general. In 1871 Stoneman retired from the army and settled in California. There he served as a railroad commissioner, and in 1883 was elected Governor.

STONE MARTEN. See Marten.

STONE MOUNTAIN. A massive dome of muscovite granite, said to be the largest in the world, in DeKalb Co., Georgia, about 16 miles east of Atlanta. It rises about 700 feet above the comparatively level surrounding country, and its bulk has been estimated as over 7,000,000,000 cubic feet. It does not seem to have been known to civilized man until about 1820, when that part of the State was first settled, the wooded condition of its surroundings previous to that time having kept it from being sighted at a distance. See paragraph *Topography and Scenery*, under Georgia, and *Bulletin 9A of the Geological Survey of Georgia*, pp. 113–119, 1902.

STONE OF DESTINY. See Coronation Chair.

STONE RIVER, Battle of (otherwise known as the Battle of Murfreesboro). A battle of the Civil War, fought Dec. 31, 1862, to Jan. 2, 1863, between the Army of the Cumberland, 47,000 men, under Rosecrans, and that of Tennessee, 38,000, under Braxton Bragg. After his retreat from Kentucky, Bragg moved his army through Knoxville and Chattanooga to Murfreesboro. Rosecrans, who had relieved Buell in the command of the Army of the Cumberland, had sent McCook's corps to the relief of Nashville, and late in November had his whole force there. He refused, in spite of most urgent letters from the War Department, to move against Bragg until he had sufficient rations to make him independent of the railroad from Nashville to Louisville, feeling sure he could not keep the Confederate cavalry from cutting this line.

Rosecrans put his army in march on December 26 in three columns, commanded by McCook, Thomas, and Crittenden. The Confederate cavalry under Wheeler at once opposed Rosecrans' advance, and so successfully that it was not until the 29th that the heads of the columns got within three miles of Murfreesboro, though the distance was only 30 miles. The field of battle lies 2 miles west of Murfreesboro, intersected by the sharp turns of Stone River, bridged at various points, fordable at others; the highroad from Nashville and the Nashville-Chattanooga Railway cross it from northwest to southeast.

On December 29 Bragg took a position guarding the western approaches, with Hardee's corps forming the right wing on the east bank, and Polk's the left, on the west bank of the river. McCown's division was held in reserve in the centre. Late in the afternoon Crittenden, advancing, found the Confederates in position; he formed line about a mile from the enemy. On the 30th the Union army stood as follows: Crittenden, Thomas, and McCook in the order named, from left to right, reaching from Stone River to the Franklin Road, and facing southeast. The Confederate position was as just given, save that McCown had been moved to Polk's left. Disappointed in not being attacked in this position on the 30th, Bragg resolved to take the offensive himself on the 31st, and to make his main effort against the Federal right. He accordingly moved Cleburne from his right to his left. The general plan was to swing to the right, with the pivot on the river. The Federal plan was similar: to attack the Confederate right. But as Bragg got the start, the contest took the development imposed by this condition. The Confederate attack was in so far successful, that the Union right wing and centre and the right of the left wing were driven out of their positions, and at noon had taken another parallel to the Nashville and Chattanooga Railroad, with the river behind them. The left of this position under Hazen held its ground and repulsed all Confederate attempts to crush it. Meanwhile the attack on the Confederate right had opened, as originally planned; but when it was found that the Union right was suffering, the attacking troops were recalled to reënforce it. As early as 10 A.M. Bragg had ordered Breckinridge to cross the river and come to Hardee's assistance, but that subordinate reported that the Union troops were advancing upon him and that he could not obey. When the order was repeated he moved forward only to find that the Federals had returned across the river. It was now too late to go to Hardee's help; Breckenridge, however, could cross the river, and this he did, though slowly; twice were his troops sent by Polk against Hazen, but repulsed. These belated attacks ended the battle proper. The armies remained on the field; the 1st of January passed without result, save that Crittenden crossed the river and formed line before Breckinridge, who had resumed his former position.

On the 2d Bragg, finding the enemy showed no disposition to move, ordered Breckinridge to carry a hill they held and then to entrench. The hill was captured, but the men rushed after the returning Federals only to be met by heavy artillery fire from batteries masked on the opposite bank. The Federals then crossed the river and recaptured the position. Late on the 3d Thomas broke the centre of the Confederate line, whereupon that night Bragg retired on Tullahoma. Rosecrans entered Murfreesboro on the morning of the 4th, but made no attempt to pursue. The losses were serious, over 13,000 for the Union and about 11,500 for the Confederate forces; in point of results the advantage lay with the Federals. Consult: Bickham, *Rosecrans's Campaign with the Fourteenth Corps* (Cincinnati, 1863); T. B. Van Horne, *History of the Army of the Cumberland* (2 vols., ib., 1875); Johnson and Buel, editors, *Battles and Leaders of the Civil War* (New York, 1887); J. C. Ropes, *Story of the Civil War*, vol. ii (ib., 1898); M. F. Steele, *American Campaigns* (Washington, 1909).

STONE ROLLER, or Stone Lugger. One of two fresh-water fishes of the Mississippi valley: (1) A small and worthless sucker (*Catostomus nigricans*), which inhabits clear streams throughout the West. It usually rests quietly on the bottom, but darts swiftly away when alarmed, scattering the pebbles. It is olive green with brassy sides, and has a flattened, concave head and thick lips. (2) A small brown cyprinoid (*Campostoma anomalum*), remarkable for the fact that in the nuptial season the males become covered about the head and often over the whole body with large rounded tubercles. They frequent the deep pools of small streams.

STONES, Precious and Semiprecious. A trade distinction is made among gem experts, jewelers, and lapidaries between the more valuable gem stones, diamond, ruby, sapphire, pearl, and emerald (qq.v.), which are classed as distinctly precious stones, and such gems as amethyst, peridot, garnet, tourmaline (qq.v.), which are ordinarily of less value than the former group and are known as semiprecious stones. Turquois and opal (qq.v.) are sometimes included under the precious stones, but are more often classed as semiprecious. See Agate; Amber; Aquamarine; Azurite; Benitoite; Beryl; Cairngorm; Carbuncle; Cat's-Eye; Chalcedony; Chalcedonyx; Chrysoberyl; Chrysolite; Chrysoprase; Coral; Feldspar; Heliotrope; Hyacinth; Jade; Jasper; Jet; Lapis Lazuli; Malachite; Microcline; Obsidian; Onyx; Quartz; Rhodonite; Sphene; Spinel; Spodumene; Sunstone; Titanite; Topaz; Zircon. See also Gems; Gems, Imitation and Artificial; Jewelry; Lapidary Work. For birthstones, see Ring.

STONES, Standing. See Megalithic Monuments.

STONES OF VENICE, The. A treatise on the art and architecture of Venice by John Ruskin (1851–53). It had great influence on the appreciation of Venetian art and on the Gothic revival of that day, and especially on William Morris.

STONEWARE. An opaque, highly fired, vitrified pottery, composed of plastic clay and sand, varying in color, and so hard that it cannot be scratched with steel. Stoneware is of three varieties—glazed, unglazed, and salt glazed.

Glazed stoneware has been made by the Chinese from a very early period, native writers claiming for it an antiquity reaching back almost two thousand years. Much of the so-called porcelain (q.v.) of the Chinese was in reality a vitrified, opaque stoneware which in later periods was frequently covered with a porcelaneous glaze. The celadons of the Sung and Yuan dynasties were brown stoneware, quite different from true porcelain. To the same category belong the large vases with pierced designs and low reliefs and touched with purple and blue enamels, of the Ming dynasty, and the still more recent wares with transmutation, or splash, glazes of red, blue, and variegated coloring. Much of the early Japanese pottery, with heavy, slow-flowing glazes, and the more modern Satsuma and Kyoto wares possess a stoneware body.

Unglazed stoneware, of dense, fine texture and dark red or chocolate color, called by the Portuguese *Boccaro* ware, was produced by Chinese potters during the Ming dynasty. It is usually embellished with relief designs, or painted with colored enamels. Frequently the ground of panels is composed of impressed diaperwork. The Dutch potters of the latter half of the seventeenth century, of whom Ary de Milde was one of the most prominent, attempted to imitate the Chinese ware. The shapes and decorations were closely copied, but the body of the ware was more of the nature of hard pottery than true stoneware. The Elers brothers, John Philip and David, who are believed to have come from Holland, began the manufacture of a similar ware in England some time between 1690 and 1710. Their red ware was characterized by great hardness, delicacy of form, careful potting, and a smooth, velvety surface, the fine relief ornaments being formed in separate molds and applied. Johann Friedrich Böttger first began his experiments at Meissen in 1707 in search of a substitute for the Chinese ware, and in the following year succeeded in obtaining a body which closely resembled in all particulars the Oriental Boccaro ware, which he incorrectly named red porcelain.

To the group of unglazed stonewares belong the jasper and basaltes, originated by Josiah Wedgwood (q.v.) in the latter half of the eighteenth century, and copied by his numerous imitators, of whom William Adams and John Turner were among his most prominent contemporaries. Wedgwood himself divided his productions into two groups: Wedgwood, which name he applied to his ornamental wares, including the jasper and basaltes, and Wedgwood ware, a term which covered his useful pottery and creamware (see POTTERY). Jasper is a vitrified stoneware of exceedingly fine grain, which is either tinted throughout the substance, or covered with a colored dip and decorated with molded ornaments, either white or colored, applied to the surface. Basaltes is similar in composition but jet black throughout. Both of these are of great hardness and devoid of glaze, except occasionally in the interiors of vessels. Among Wedgwood's most important achievements were the reproductions in jasper of the famous Barberini or Portland vase (q.v.).

To the group of unglazed stoneware may be assigned the white stoneware of Adams, Turner, Spode, and Hollins, and the apostle stoneware of Charles J. Meigh, all of which were produced in Staffordshire in the first half of the nineteenth century.

Salt-glazed stoneware, known as *grès* by the French, differs from all other ceramic wares in that it is glazed by vaporization instead of by dipping, by the use of a brush, or by insufflation. After the pieces have been placed in the kiln, and when the heat has reached its highest point, common salt is thrown in from above, which vaporizes and settles upon the surface of the ware in minute drops, forming an exceedingly thin coating which is so hard that it cannot be scratched by the usual tests and so transparent that it does not obscure the finest markings. This glaze is impervious to water and resists the action of acids. It resembles in texture the granular surface of an orange skin or the pitted shell of an ostrich egg. The body of the ware may be gray, buff, brown, or white, or it may be covered with a brown or almost black ferruginous wash.

There were several important centres of manufacture in Germany and Flanders where distinctive styles of art stoneware were produced. As early as the fourteenth century Frankish pottery was being made in the vicinity of Cologne, which, although true stoneware, was unglazed. At Siegburg, opposite Bonn, a coarse brownish-gray stoneware of similar character was later developed, and in the following century glazing with salt was introduced. The Siegburg stoneware of the second half of the sixteenth century is of light-colored, almost white, clay embellished with applied reliefs, the most common forms being tall, cylindrical canettes or tankards, and small baluster jugs with crimped feet.

Raeren, in the old province of Limburg, near Aix-la-Chapelle, was the earliest seat of the stoneware industry in Flanders. Dated pieces of the sixteenth century are known. The ware is of a reddish-brown color running into gray. This was one of the most important centres of stoneware manufacture and noted modelers were employed to give an artistic touch to a homely art. Among the more celebrated artists and master potters were Baldem Mennicken, Jan Emens, and Jan Baldems. Eminent patrons of the pottery were accustomed to order pieces with their coats of arms upon them. Among the best-known designs are jugs, with reliefs representing "Peasants' Dances," "Works of Mercy," arms of towns and ancient families, inscriptions, and frequently dates. Some of the larger pieces were most elaborately decorated in relief.

At Kreussen, Bavaria, a dark-brown stoneware, embellished with reliefs—figures of the Apostles, cherubs, heraldic shields, etc.—was largely produced in the seventeenth and eighteenth centuries. Tankards and hexagonal drug jars were among the most characteristic shapes. One variety of the Kreussen ware was painted in colored enamels. A contemporary stoneware, closely resembling that of Kreussen, but of a darker color, was produced in Saxony.

The Westerwald district of the Rhine, which includes Grenzhausen, Grenzau, and Höhr, near Coblenz, has been one of the largest centres of the industry since the end of the seventeenth century. The earlier wares reveal the influence of the Raeren potters, but at a later period a more original style was developed and cobalt blue and manganese purple, or brown, enamels (see ENAMEL) were used to some extent on the gray color of the clay. This ware was exported to England and other countries, and is frequently found in association with the remains of native production. The most common forms were bartmans or jugs with bearded heads in front, also pilgrim bottles, saltcellars, inkstands, and tankards. A great profusion of molded, stamped, incised, and champlevé ornaments, in all varieties of combination, often cover the entire surface.

Salt-glazed stoneware of distinctive character was manufactured at other places in Germany: at Frechen; at Bunzlau, where white pipe-clay reliefs were applied to a smooth, reddish-brown glaze of somewhat metallic lustre; at Dreyhausen, where vessels with numerous small movable rings were made; at Bouffioux, Belgium, where jugs and other articles of brown, mottled glaze were embellished with bearded masks and embossed medallions, and frequently smeared with blue enamel.

In England salt-glazed stoneware was produced at Fulham, near the end of the seventeenth century, by John Dwight, who took out a patent in 1671 for his discovery of the mysteries of the Cologne ware. Some of his figures, notably those of Meleager, Saturn, Mars, and Jupiter, colored in imitation of bronze, and busts of Prince Rupert, James II, and an effigy of his deceased daughter, are among the best works of their kind ever produced, and rank, in point of modeling, with some of the finest sculptures of the porcelain factories. Near the close of the same century Thomas Miles, of Shelton, improved the body of salt-glazed ware by adding feldspar to the composition, which resulted in the development of a white ware which in its thinnest parts was translucent, and during the eighteenth century many other Staffordshire potters engaged in the manufacture of this purely English product. At first molded and applied ornaments were used to decorate thrown and turned pieces, but later they were formed in molds which had previously been used by the silversmiths, the thinner examples being formed by the casting process in engraved molds. Teapots, dishes, and other objects were made in an infinite variety of shapes, in imitation of animals, such as camels, squirrels, and cats, and representations of houses. Finally color was added to the decorations by scratching patterns in the unbaked clay, into which blue was rubbed, a popular style known as scratched blue. Enamel colors were used in painting flowers and Chinese figure scenes, or in touching up reliefs, and transfer printing was also employed to some extent.

Bibliography. Meteyard, *Life of Josiah Wedgwood* (2 vols., London, 1865–66); J. B. Dornbusch, *Die Kunstgilde der Töpfer in der abteilichen Stadt Siegburg* (Cologne, 1873); Eliza Meteyard, *The Wedgwood Handbook* (London, 1875); L. M. Solon, *Art of the Old English Potter* (ib., 1885); id., *The Ancient Art Stoneware of the Low Countries and Germany* (2 vols., ib., 1892); Otto von Falke, *Das rheinische Steinzeug* (Berlin, 1908); Ernst Zimmermann, *Die Erfindung und Frühzeit des Meissner Porzellans* (ib., 1908); L. M. Solon, *Ceramic Literature: An Analytic Index to the Works Published in All Languages* (London, 1910).

STONEWORK. Structural and decorative work in stone, whether for buildings of an architectural or of an engineering character; including, therefore, all kinds of masonry (q.v.) for foundations, piers, walls, vaults, etc., and all kinds of stonecutting, both constructive and decorative. All such stonework is first roughed out, either at the quarry or at the stone-cutting yard, into blocks rudely approximating the intended form. If the stone is soft and friable, and the decorative detail complex or delicate, it is usually built into the structure in this rough form and finished afterward. The harder kinds of stone, bluestone, granite, and hard marble, and all moldings and blocks of simple form, are cut at the yard, or even at the quarry, carefully crated or packed and delivered finished at the building.

STONEWORTS. See Charales.

STONINGTON, stŏn′ĭng-ton. A town, including the borough of Stonington and the villages of Pawcatuck, Mystic, and Old Mystic, in New London Co., Conn., 49 miles southwest of Providence, R. I., on Long Island Sound, and on the New York, New Haven, and Hartford Railroad (Map: Connecticut, H 4). A good harbor, protected by three government breakwaters, makes it of considerable commercial importance. It is the headquarters of a large fishing industry. There are machine shops, printing-press works, thread mills, and manufactories of silk machinery, cotton, woolen, and silk goods, velvets, and fertilizers. Pop., 1900, 8540; 1910, 9154; 1915 (U. S. est.), 9477.

In 1649 William Chesebrough of Plymouth Colony made the first permanent settlement in Stonington at what is now Wequetequock. At first within the bounds of Massachusetts, whose General Court chartered it as Southertown in 1658, it passed to Connecticut in 1662, was named Mystic in 1665, and Stonington in 1666. In 1775 it was attacked by the British frigate *Rose,* under Commodore Sir James Wallace, and in 1814 it was bombarded for four days by Admiral Hardy, Nelson's favorite officer. For many years Stonington was prominent for its participation in the seal-catching and whale-fishing industries, and was also a shipbuilding centre. Consult Wheeler, *History of the Town of Stonington from 1649–1900* (New London, 1900), and Palmer, *Stonington by the Sea* (Stonington, 1913).

STONO FERRY, Battle of. An engagement near a ferry over the Stono River, a short distance from Charleston, S. C., on June 20, 1779, during the Revolutionary War, between a small force of British, strongly intrenched, under Lieutenant Colonel Maitland, and a superior American force under General Lincoln. General Prevost, on withdrawing from his invasion of South Carolina, left temporarily a small force of about 800 men at Stono Ferry and another small force on John's Island. In the early morning of June 20 General Lincoln attacked the British at Stono Ferry, but, owing to General Moultrie's neglect of Lincoln's orders to have everything in readiness, the garrison was reënforced from John's Island, and the American attack was repulsed. Lincoln then withdrew, beating off the attacks of the British, who followed for a short distance. The loss of the British in killed, wounded, and missing was about 130; that of the Americans was about 150.

STO′NYHURST COLLEGE. A leading Catholic college, at Stonyhurst, Lancs., England. It had its inception in the English college at St. Omer, in the Province of Artois, France, founded by Robert Person, S.J., in 1592, under the patronage of Philip II of Spain, to which that province then belonged. The school prospered, and when Artois was ceded to France in 1659 a clause in the capitulation insured its safety. In 1760 it obtained from Louis XV the much-desired title of "Collège Royal." At the expulsion of the Jesuits from France the college was removed to Bruges in the Austrian Netherlands. When the Society of Jesus was suppressed by Pope Clement XIV in 1773 the Austrian government attempted to conduct the school with the aid of English Dominicans, but such was the attachment of the pupils to former teachers that the college had to be closed owing to their attitude. Some of the masters and pupils took refuge in Liége, where the authorities were kindly disposed towards the Jesuits. In 1794, when the Revolutionary armies marched upon Liége, the college was offered a resting place by Thomas Weld—his estate at Stonyhurst, England. In 1808 the attendance had increased, and the construction of the first of five buildings was begun. In 1832–36 a church was erected and in 1837 the college library received the famous Arundel collection. The well-known observatory was erected in 1838. Since 1840 preparation has been given for the examinations of the University of London leading to degrees. The sciences were then introduced, and the curriculum, which was based on the Ratio Studiorum (q.v.), was generally enlarged. The courses cover a period of seven years. Consult Gruggen and Keating, *Stonyhurst* (London, 1901).

STONY POINT. A town in Rockland Co., N. Y., 35 miles north of New York City, on the Hudson River, and on the New York, Ontario, and Western, and West Shore railroads. Bricks are manufactured here. Pop., 1910, 3651; 1915 (State census), 3721. Stony Point was fortified by the Americans early in the Revolutionary War and was captured May 31, 1779, by Sir Henry Clinton. On July 16 it was recaptured by General Anthony Wayne, who, with 1200 men, stormed the works and took 543 prisoners, the American loss being 15 killed and 83 wounded, and the British 63 killed besides prisoners and wounded. Two days later the fortifications were dismantled and the place abandoned, the British soon reoccupying it. The site of the Revolutionary fort and battlefield has been converted into a reservation. Consult Johnston, *The Storming of Stony Point* (New York, 1900). See United States, *Revolutionary War.*

STOPING. See Mining.

STOPPAGE IN TRANSITU. The stoppage by an unpaid seller of goods while on their way from him to the buyer, after title has passed to the latter. The right so to stop goods is not founded on any contract between the parties, nor upon any principle of equity, but upon mercantile usage. Its first recognition in the judicial reports of England appears in an equity case decided in 1690. Prior to this it was a well-established rule of the law merchant (q.v.). From courts of equity it was adopted by the courts of common law, and for three centuries has been a recognized rule of English jurisprudence. The term "unpaid seller" is here employed in a broad sense. It includes not only the ordinary seller, but the factor of the buyer, who has paid for goods placed to his credit for the price—any one, indeed, whose position can be shown to be analogous to that of an ordinary seller, who is unpaid, wholly or partly.

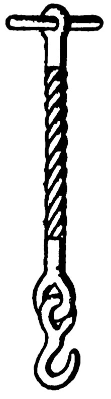
A requisite is that the buyer shall have become insolvent, and that the knowledge of this insolvency shall have come to the seller after dispatching the goods. Insolvency, in this connection, is used in its popular sense, meaning the financial condition of one who cannot pay debts falling due in the ordinary course of business; and if he lets commercial paper go to protest, or by other conduct affords the ordinary opponent evidence of insolvency, the unpaid seller is safe in treating him as insolvent.

Another requisite is that the goods shall have left the possession of the seller, but shall not have reached the possession of the buyer—they shall be in transit. Transit begins as soon as they have left the seller's possession for transportation to the buyer. It continues as long as they are in possession of a carrier, or other middleman, on their way to the buyer. "Such middleman may be the buyer's agent for certain purposes; and yet if, by the agreement of the parties or by the usage of trade, he is not a mere servant of the buyer, but is a person interposed between the seller and the buyer, having a possession of his own and liable, in his capacity as bailee, to an action by the buyer, in case the goods are carelessly lost or misdelivered, the goods are still in transit." Such transit may be intercepted by a new and distinct agreement between the carrier and the buyer, under which the carrier is thereafter to hold the goods subject to new orders from the buyer. It is not intercepted, however, by the levy of an execution or an attachment on the goods on behalf of a creditor of the buyer. Such a levy gives the creditor only the right of the buyer; and that right is subject to the unpaid vendor's right to stop the goods. If a bill of lading (q.v.) has been given to the buyer by the seller, its transfer to a bona fide purchaser cuts off the seller's right. This comes from the quasi negotiable character of the bill of lading under the law merchant. Hence where the bill of lading is marked "nonnegotiable" the seller's right is not cut off by a transfer to an innocent purchaser.

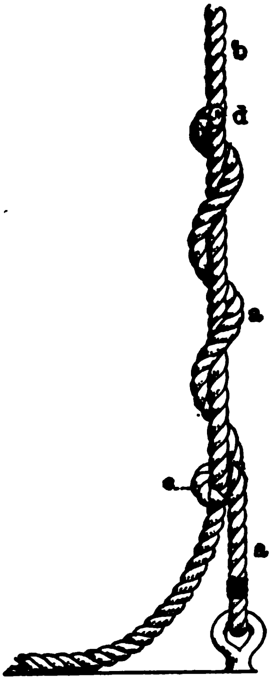
Although no particular form of notice is required, a valid stoppage in transitu cannot be made without a notice of some kind to the carrier. If the goods are in the hands of an agent of the carrier, notice that the seller stops the goods may be given to either the agent or the principal. If given to the latter it must be given at such time and under such circumstances that the principal, by the exercise of reasonable diligence, may communicate it to the agent in time to prevent a delivery to the buyer.

The exercise of this right restores to the seller the possession of the goods, but does not revest title in him. The buyer or his transferee is entitled to the goods upon paying cash for them, but not otherwise. See Sale, and consult authorities there referred to.

STOPPER. A short length of rope or chain or an iron contrivance used on board ship for checking the running of a rope or chain, or for holding it firmly. A stopper for ropes is a short length of soft manila secured at one end to the structure of the ship; the other end is passed around the rope to be stoppered with a jamming hitch. It is used to keep the rope from slipping while it is being belayed or secured. A stopper for a chain cable is usually of wire rope and four to six feet long. At one end it is spliced into the eye of a hook, and at the other has an eye formed around a short bar of iron. The hook is placed in a ringbolt in the deck, and the body of the stopper lashed to the chain by two tails of soft manila rope. When ships are at anchor the chain is held by such stoppers.



STOPPER FOR CHAIN CABLE.



STOPPER FOR ROPE.

a, rope stopper; *b*, rope held by the stopper; *c*, point where *a* grips *b*; *d*, loose end of *a*. This is usually held in place by a man until the stopper *a* is removed from *b*.

STOP SOUNDS. See Mutes.

STORAGE (from *store*, OF. *estorer*, *estaurer*, from Lat. *instaurare*, to renew, make, provide, from *in*, in + **staurare*, to set up; connected with Gk. *σταυρός*, *stauros*, stake). Since most plants absorb or produce food in excess of immediate needs, they provide for temporary or long-continued storage. These foods are transformed for permanent storage and mobilized for subsequent translocation by specific activities of the cell, self-regulated through irritability (q.v.). Means of storage are spores, seeds, fleshy fruits, roots, tubers, bulbs, leaves, and stems. As a rule the regions of the higher plants specially adapted for storage are thick, fleshy, and abundantly supplied with thin-walled parenchyma cells. (See Histology.) Storage occurs only in living cells. Occasionally the cell walls in storage regions are thick and woody, and in some cases, e.g., in the endosperm of seeds, the walls themselves are made up mainly of the stored material, reserve cellulose. The chief forms in which reserve food is stored are as follows:

Carbohydrates. Reserve carbohydrates are either soluble, such as sugars (saccharose, glucose, fructose, mannose, and galactose) and inulin, or insoluble, as starch and cellulose (qq.v.). Starch is organized into granules by the leucoplasts (q.v.). Reserve cellulose is deposited upon the cell walls as a complex carbohydrate, whose composition is unknown, though it seems to have somewhat the same relations to ordinary cellulose as the most complex of the dextrins, amylodextrin, holds to starch. It is found especially in the endosperm, or in various parts of the embryo, in bud scales, etc.

Fats. Fats occur in the form of minute droplets (oil) in the protoplasm, not infrequently accumulated by special organs of the cell, the leucoplasts. They are found in the endosperm or embryos of seeds (probably in the seeds of nine-tenths of all seed plants), in spores, tubers, and the wood of trees.

Proteins. Proteins are found either as amorphous grains, the so-called aleurone, or as crystals, which are not infrequently associated with or embedded in aleurone grains. These are sometimes formed by leucoplasts, but at other times appear to be deposited in the sap cavity (vacuoles) of cells, where the protein appears to accumulate in increasing concentration until it solidifies in the form of the vacuole, or in one or several crystals. (See Aleurone.) Crystals of protein are also found in chromatophores, nuclei, and even in the cytoplasm itself. They are often distinguished as crystalloids, because they have the capacity of swelling (see Imbibition), a rare quality among inorganic crystals.

Amino Acids. Amino acids are nitrogenous compounds and are often called building stones of the proteins. They are the final products of hydrolysis of proteins. Most nitrogenous materials are ordinarily translocated as amino acids. They are rare in seeds, but, along with other plant bases, are especially abundant in the sappy reservoirs, such as bulbs, tubers, rhizomes, etc., where they constitute 40 to 70 per cent of the total food.

The different kinds of storage materials are more or less definitely associated. Thus the reserve food may consist of proteins and sugar (e.g., the pea and onion); proteins and starch (e.g., the potato, the embryo of beans, pea, etc.); proteins and oil (e.g., the endosperm of the castor bean and the cotyledons of the soja bean); or proteins, oil, and reverse cellulose (e.g., the endosperm of the date and coffee); or proteins with oils in the cotyledons and mucilage in the endosperm walls (e.g., clover). The reason for the special association of reserve foods is not known. Insoluble reserve foods are only transportable after digestion (q.v.).

STORAGE BATTERY. A so-called storage battery or accumulator when acted upon by an electric current undergoes certain chemical changes. The chemicals which are thus separated recombine again when the circuit is closed, and in uniting give off a current about equal to that by which they were decomposed. Lead for many years was the metal most commonly used in accumulators, the positive plate having a coating of lead peroxide, PbO_2, and the negative plate a surface of spongy lead, but now the alkaline type of storage cell is extensively used where an iron-nickel element is immersed in a caustic potash solution.

In 1801 Gautherot showed that platinum wires used in the electrolysis of saline solutions developed secondary currents, and in 1803 Ritter constructed a secondary pile of copper disks separated by cloths moistened with a solution of sal ammoniac. By charging this a few moments with a powerful galvanic battery the pile gave a strong shock. Volta, Becquerel, and others discovered that platinum and other metals—gold, silver—gave secondary electric currents when subjected to electrolytic action in certain solutions. In 1842 Grove produced his celebrated gas battery, which gave a current by means of the difference in polarity of oxygen and hydrogen, the constituents of water. In Faraday's *Researches* he mentions the high conductivity of peroxide of lead at the negative pole. Gaston Planté was the first to apply this principle, and constructed in 1860 his cell with coiled plates, the first practical storage battery, which was afterward developed and modified by Faure, Metzger, Brush, Edison, and others.

Lead storage batteries may be divided into two general classes: Those in which the active material is formed on the surface of the plates by chemical or electrochemical action, and those in which some easily reducible salt of lead is applied mechanically. The former are known as the Planté type, and the latter as the pasted or Faure type. In either case the electrolyte is a diluted solution of sulphuric acid. While there may be various secondary chemical reactions the final result is shown by the following equation:

$$\underset{+\text{ Plate}}{PbO_2} + H_2SO_4 + \underset{-\text{ Plate}}{Pb} = \underset{+\text{ Plate}}{PbSO_4} + 2H_2O + \underset{-\text{ Plate}}{PbSO_4}$$

Reading from left to right the process of discharge is indicated and from right to left that of charging.

Planté Cell. The Planté cell is the simplest form of storage battery, and in an improved form is still much used where weight and space are of little importance. The earliest cells were formed of two lead plates immersed in dilute sulphuric acid in water. The plates were formed by repeated charging and discharging, resulting in the conversion of the surfaces of the two plates into lead peroxide and spongy lead respectively. The voltage of a lead-sulphuric acid cell is about two volts. The Planté accumulator is a very efficient cell when once formed, but the time it requires for forming is its chief drawback. Numerous methods have been devised for hastening this process, one of the most successful being the cutting of fine, deep grooves on the surface of the plate, thus increasing the active surface exposed to the electrolyte. The leading types of Planté plates are the central web; the cast lead, which has a number of vertical and transverse ribs cast in the plate; and the composite or pellet type where pellets of rolled lead are forced into holes in a grid of a hard lead antimony alloy. The Planté type renders good service in a central station or where it can have expert attention and where it is regularly charged and discharged.

Pasted Cells. To avoid the great loss of time consumed in forming the Planté cells, Camille A. Faure in 1880 devised the method of pasting a layer of chemically prepared oxide of lead to the surface of the plates. After charging, the salt on the positive plate is reduced to peroxide of lead, while that on the negative plate is converted into porous lead. The chief fault of the early Faure cells was the disintegration of the active material, which would drop away from the plate. Many methods have been devised for holding the active material on the plates, the most common of which is to cast a grid, or plate with cells or perforations, into which the active material is pressed. Most modern cells are made with perforated negative plates of this description; the positive plates are usually made by some modification of the Planté process. The pasted type is lighter and is preferred for stand-by service, and where high capacity and minimum weight are desired, as in electric vehicles, for lighting and starting motor vehicles and similar purposes.

In one of the most improved forms of batteries of the pasted type, the Exide, the positive plate is formed by a grid composed of a number of parallel vertical metal rods united to top and bottom frames, the former provided with the usual connecting devices. Each vertical rod forms a core which is surrounded by a cylindrical pencil of peroxide of lead, this being inclosed by a hard rubber tube with horizontal slits through which the electrolyte has access to the active material, but which are so fine as to prevent the latter washing out. The negative plates are of the usual lead incased in rubber and separated from the positive by a wood veneer and rubber.

Edison Battery. Numerous attempts have been made to devise a storage battery of lighter materials, and of more robust construction, but, with the exception of Edison's iron-nickel battery, such batteries give little promise of commercial success. The plates of the Edison battery consist of shallow perforated pockets or tubes of nickel-plated steel held in a sheet-steel frame or grid. The perforated steel tubes forming the positive plate contain alternate layers of pure nickel flake and nickel hydrate. The boxes forming the negative plate contain finely divided oxide of iron. The tubes and pockets are fastened firmly in the grids, and the plates thus formed are placed on connecting rods and held firmly by nuts, the positive and negative plates being separated by strips of hard rubber. All are inclosed by a steel container. The electrolyte is a 21 per cent solution of potassium hydrate with a small amount of lithium hydrate added. The operation of the battery depends upon the oxidation and reduction of metals in an electrolyte which does not dissolve and does not combine with the metals or their oxide. In charging, the current decomposes the solution, releasing oxygen, and oxidizes the nickel compound to the peroxide state, and reduces the iron compound in the negative plates to a spongy mass. In discharge the action is reversed. The average voltage during discharge is about 1.25. For equal capacity the Edison battery occupies about the same volume but weighs much less than a lead battery. Among the advantages claimed for it are that it may be charged and discharged without expert attention, for it is not injured by occasional improper charging nor is it permanently injured by short circuits. It is stronger mechanically, for the steel container will withstand hard usage and it is not affected by severe vibration and concussion. It does not give off obnoxious gases, though the hydrogen and oxygen produced must be taken care of, as they may form an explosive mixture. The Edison battery can be left idle either charged or uncharged for months, and does not require frequent examinations of the density of the electrolyte.

Storage batteries have found application for propulsion of electric vehicles and boats, for industrial trucks and tractors, for mining locomotives, for house lighting, for railway block-signal systems, for car lighting on railways, for miners' lamps, for regular or emergency use with wireless-telegraph installations, and for ignition purposes with gas or gasoline engines. Their use in submarine torpedo boats to supply energy for the motors when running submerged is now an important application. The cells must be charged by generators driven by internal combustion engines.

Storage batteries are employed also in many central stations to aid the dynamos in case of an emergency—stand-by service—or at the time of the maximum output, and to act as equalizers or reservoirs of electrical energy, taking the peak of the load, or in the case of a small system carrying the day load. In large central stations storage batteries are also used for reserve current for exciters. The efficiency varies considerably in laboratory tests, but in commercial practice runs from 70 per cent down.

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STO'RAX (Lat. *storax*, *styrax*, from Gk. *στύραξ*, a fragrant resin). A fragrant resinous substance, the styrax of the ancients, obtained from the storax tree (*Styrax officinale*) of the family Styracaceæ, native of the Mediterranean region. Storax, which exudes from wounds in the bark and hardens in the air, appears in the form of reddish-yellow, opaque, soft, adhesive tears about the size of a pea, or in dry, brittle masses, wrapped in the leaves of a kind of reed. It has a pleasant odor and an aromatic taste, and was formerly much used in medicine. Benzoin gum (q.v.) is the product of a species of *Styrax*. Several species of *Styrax* shrubs, and small trees, with showy white flowers, occur in the southern United States.

STO'RER, BELLAMY (1847-). An American lawyer, born in Cincinnati, Ohio. He graduated at Harvard in 1867, practiced law in Cincinnati, and was a member of Congress in 1891-95. He served as Minister to Belgium in 1897-99, and to Spain in 1899-1902, and in the latter year was appointed Ambassador to Austria-Hungary. The reported activity of Storer, and particularly of Mrs. Storer, in Roman Catholic efforts on behalf of Mgr. Ireland, whose friends wished to see him Cardinal, led to Storer's dismissal by President Roosevelt early in 1906. Consult *Letter of Bellamy Storer to the President and the Members of his Cabinet, November, 1906* (1906) for the correspondence of President Roosevelt and the Storers relative to their controversy.

STO'RER, David Humphreys (1804–91). An American physician and naturalist. He was born in Portland, Me., and graduated at Bowdoin in 1822. After studying medicine he settled in the practice of his profession in Boston. In 1854 he was called to the chair of obstetrics and medical jurisprudence in the Harvard Medical School. Storer was president of the American Medical Association in 1866. He published: *Report on the Ichthyology and Herpetology of Massachusetts* (1839); *Synopsis of the Fishes of North America* (1846); *History of the Fishes of Massachusetts* (1867). For D. H. Storer's son see Storer, Francis Humphreys.

STORER, Francis Humphreys (1832–1914). An American agricultural chemist, son of David H. Storer. He was born in Boston and studied at Harvard (S.B., 1855), and abroad at Heidelberg, Freiberg, Tharand, and Paris. In 1851–53 he was assistant to Prof. J. P. Cooke in Harvard, in 1853–54 chemist to the United States North Pacific Exploring Expedition, and in 1857–65 analytical and consulting chemist in Boston. In 1865 he accepted the chair of general and industrial chemistry in the Massachusetts Institute of Technology, and in 1870 that of agricultural chemistry in Harvard, becoming dean of the Bussey Institution in 1871. He retired in 1907. Storer was a fellow of the American Academy of Arts and Sciences and a member of many other scientific societies. The researches on the hydrocarbons which he carried on with C. M. Warren have become classic, but he is especially well known for his work on the methods of teaching chemistry, which he developed in conjunction with Charles W. Eliot (q.v.) while at the Massachusetts Institute of Technology. Their book, *A Manual of Inorganic Chemistry* (1869), representing a great advance in the methods of treating the subject, became very popular. Of notable importance also was Storer's *Agriculture in Some of its Relations with Chemistry* (1887; 7th ed., 3 vols., 1897). He also published *A Dictionary of Solubilities of Chemical Substances* (1864); *Manual of Qualitative Chemical Analysis* (1868; 16th ed., 1892), with Eliot; *Elementary Manual of Chemistry* (1894) and *Manual of Qualitative Analysis* (1899), both with W. B. Lindsay.

STO'REY, Moorfield (1845–). An American lawyer and publicist, born at Roxbury, Mass. He graduated at Harvard in 1866, studied at the Harvard Law School, and in 1869 was admitted to the bar. In 1867–69 he was private secretary to Senator Charles Sumner, and in the latter year began the practice of his profession in Boston. He was prominent in the "Mugwump" movement of 1884. In 1900 he was defeated for Congress. Storey served as president of the American Bar Association in 1896, of the Anti-Imperialist League after 1905, and of the National Association for the Advancement of the Colored People in 1910–13. He published *Charles Sumner* (1900) in "American Statesmen Series"; *The Reform of Legal Procedure* (1911); *Ebenezer Rockwood Hoar, a Memoir* (1911), with E. W. Emerson.

STORK (AS. *storc*, OHG. *storah*, Ger. *Storch*, stork). The popular name for a family of birds, the Ciconiidæ, allied to the herons and ibises. They are large birds, with long legs, half-webbed toes; the bill longer than the head, straight, strong, pointed, and without any groove; the nostrils pierced longitudinally in the horny substance. The species are about 25 in number. The common white stork (*Ciconia alba*, or *ciconia*), a migratory native of the greater part of the Old World, is about three and a half feet in length. The head, neck, and whole body are pure white; the wings partly black; the bill and legs red. The neck is long, and generally carried in an arched form; the feathers of the breast are long and pendulous, and the bird often has its bill half hidden among them. The stork frequents marshy places, feeding on eels and other fishes, batrachians, reptiles, young birds, and small mammals. It makes a rude nest of sticks, reeds, etc., on the tops of tall trees, or of ruins or disused chimneys. The stork has no voice. Its flight is powerful and very high in the air. Another species, the black stork (*Ciconia nigra*), rather smaller, the plumage of the upper parts glossy black, the under parts white, is also common in many parts of Europe, Asia, and Africa. The South American stork (*Dissoura* or *Euxenura maguari*) is very similar to the common stork. It is found on the pampas of Argentina; and where mice and frogs are abundant, hundreds of these birds will congregate.

The only birds of this family occurring in North America are the wood ibises of the Southern States and the jabiru (q.v.). They are large birds, three and a half feet long, with the head and neck bare, wings and tail black, and rest of plumage white. They are found in large flocks and nest in colonies. See Adjutant; Marabou; Shoebill; etc.; and Colored Plate of Waders.

STORM (AS. *storm*, Ger. *Sturm*, storm; probably connected with Gk. *ὁρμή, hormē*, attack). Any unusual, severe, or destructive atmospheric phenomenon—a windstorm, sandstorm, tornado, typhoon, or hurricane, in which wind is the destructive agent; rain, hail, or snow, monsoon, cloudburst, or flood, in which the precipitation is the prominent feature; a thunderstorm in which the thunder is impressive and the lightning is destructive; a blizzard, in which combined cold wind and snow is the prominent feature. All these storms attend the flow of air from areas of high to those of low barometric pressure—so-called storm centres or "lows." In general the winds blow around and in towards these low areas, thereby generating still lower barometric pressures near the centre. The air below, being forced to rise above the earth's surface, expands, cools, and precipitates its excess of moisture, thereby producing rain, snow, or hail.

Storms are often classified as attending areas of low pressure (cyclonic storms); or as attending areas of high pressure (anti-cyclonic). In all cases the flow of the air is primarily due to differences of density; the denser air is drawn by gravity to the earth's surface. The centrifugal tendency due to the diurnal rotation of the earth also pushes the denser air towards the equator harder than it does the lighter moist air. For both reasons, therefore, the lighter is raised by the denser air, and overflows towards the pole. Now a body on the earth's surface and in motion relative to it, while at the same time rotating with it, will appear to an observer on the earth to be deflected towards the right hand as it moves forward in the Northern Hemisphere, but to the left hand in the Southern Hemisphere. By virtue of this deflection the winds that are blowing towards a region of low pressure acquire, each for itself, a deflection towards the right or the left respectively, so that instead of flowing radially inward towards the centre they whirl around it in an inflowing spiral curve. The direction of the whirling inflow in extensive storms is invariably the same in each hemisphere because of the constant action of the earth's deflective influence upon each individual particle of air in motion. By reason of this circulation an outward centrifugal pressure is produced, and the pressure gradient over the region of the storm is much greater than it would be if the winds flowed directly to the centre, without any spiral circulation. In extensive storm areas this general tendency of the lower winds to circulate around a centre may exist over a region a thousand miles or even more in diameter.

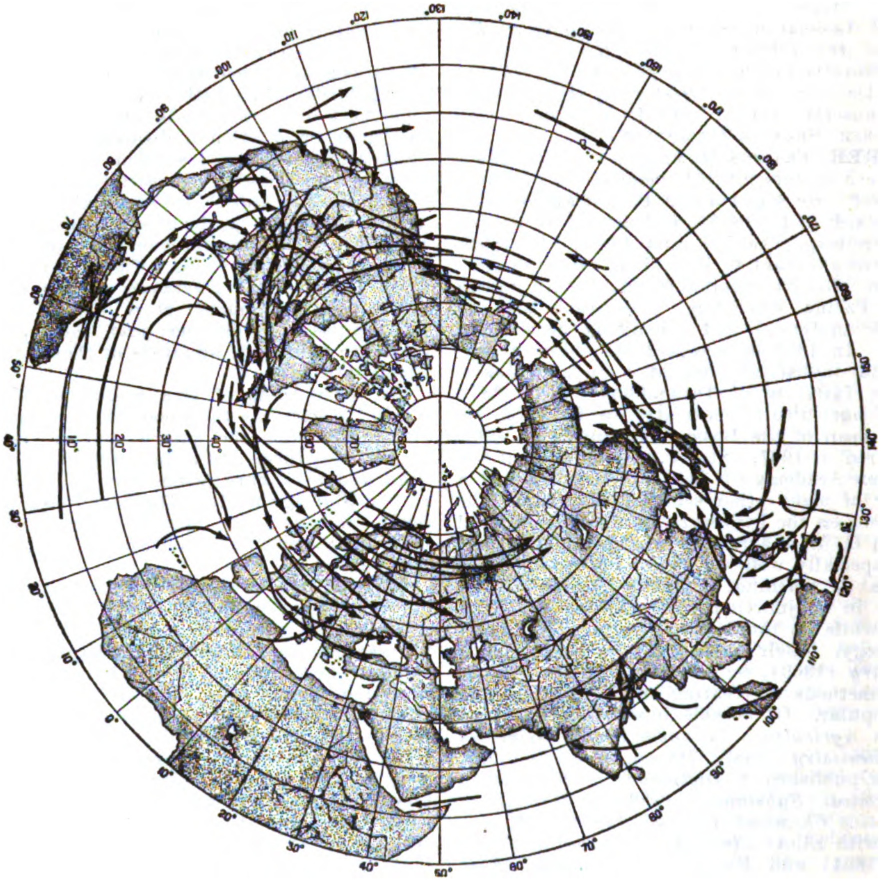


Fig. 1. CHART SHOWING STORM PATHS.

As far as possible the paths pursued by storm centres during past years are plotted upon charts, then classified according to their general characteristics and studied with reference to their relations to the topography of the continents and the general distribution of the barometric pressure, temperature, and moisture, and especially to the so-called general circulation of the atmosphere. The frequency of storms and the general types of storm paths are, of course, best known for the continental portions of the Northern Hemisphere, but there are also sufficient data for the oceanic regions to justify an attempt at presenting the accompanying sketch chart of the Northern Hemisphere showing the general character and track of the storm paths. (See Fig. 1.) This chart shows by its numerous lines and arrow heads the occurrence and the direction of motion of storm centres along the lines of greatest frequency, so far as now known. The Arctic region, northern Africa, and Central Asia must be considered as blanks; we have no daily maps for these regions, and only know that general cyclonic storms are infrequent in Africa and Asia. The chart shows that storm centres move slowly westward when within the tropics and also slowly towards the pole, but move more rapidly eastward between the tropics and the Arctic circle, as well as more rapidly northward. The zone of greatest storm frequency lies between lat. 45° and 55°. In general the path of any observed storm may be predicted on the basis of a simple study of this chart of storm tracks. But individual temporary departures from average conditions are so great that in actual weather forecasts it is necessary to allow these general maps of types and averages to have only a very slight influence upon the work. It is, in fact, always necessary to consider what a special storm has been doing during the preceding few days, and to what extent it is normal, and to what extent abnormal, as to the direction and velocity of its motion, and the rate of its increase or decrease in intensity. This can only be done by a careful comparison of several successive weather maps. As these maps are made up at least twice a day (sometimes oftener), the forecaster is in a position to say how fast the storm is moving and whether it is intensifying or dying away.

The great irregularities in individual storm paths may be appreciated by studying the accompanying chart (Fig. 2) showing the tracks of centres of low pressure over the United States. The most severe storms are the hurricanes that begin in the tropical portion of the Atlantic, move westward and northward into the South Atlantic or Gulf States, then turn towards the northeast and disappear while still moving towards Europe. The paths pursued by general cyclonic storms are apparently determined by the so-called general circulation of the atmosphere, but are modified considerably by the formation of cloud and rain or snow attending the storm. For the annual and geographical distribution of cyclones of high velocity in the United States, consult a paper by Hanzlik in *Monthly Weather Review* for August, 1904.

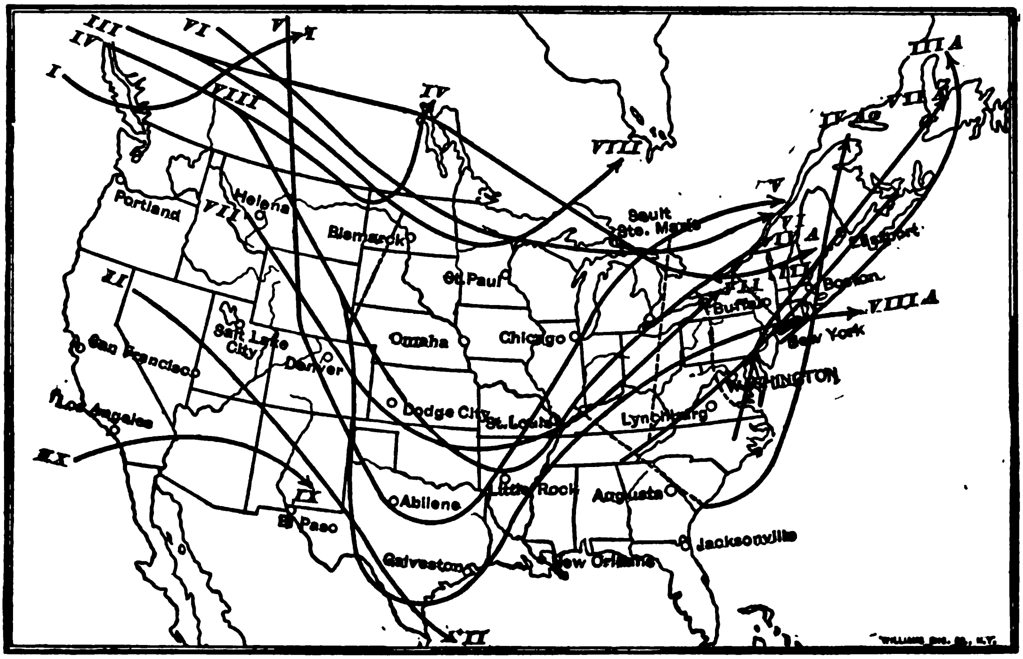


FIG. 2. TRACKS OF CENTRES OF LOW AREAS.

Bibliography. The mechanical and thermal problems connected with the generation and maintenance of storms are set forth without technical mathematics by Prof. William Ferrel in his *Popular Treatise on the Winds* (2d ed., New York, 1898). They are discussed most elaborately in a technical manner by Prof. F. H. Bigelow in his *Report on International Cloud Work* (published as vol. ii of the *Report of the Chief of the Weather Bureau for 1898*). See also his *Storms, Storm Tracks and Weather Forecasting,* U. S. Weather Bureau Bulletin 20 (1907). A full presentation of work upon this subject by students during the past century will be found in *Lehrbuch der Meteorologie*, by Prof. Dr. Julius Hann (3d ed., Leipzig, 1914–15). In his recent work *A Meteorological Treatise on the Circulation and Radiation in the Atmospheres of the Earth and the Sun* (New York, 1915) Professor Bigelow brings together in their most revised form all his mathematical conclusions. Consult, also: "Contributions to Meteorology," by Professor Loomis, as revised and published in the *Memoirs of the National Academy of Sciences*, vols. iii, iv, and v (Washington, 1885, 1887, and 1889). The details of current storm phenomena are published regularly by the Weather Bureau in the *Monthly Weather Review*. The physical-mathematical theories have been further developed in numerous memoirs. The current literature is contained in the successive volumes of the *Meteorologische Zeitschrift* (Berlin); Bowie and Weightman, *Types of Storms of the United States and Their Average Movements* (Washington, 1914).

STORM, stôrm, GUSTAV (1845–1903). A Norwegian historian, born in Lom. He studied at Christiania, becoming professor of history in 1877. His publications include many historical articles in German and Scandinavian journals. They include *Sagnkredsene om Karl den Store og Didrik af Bern* (1874), *Kritiske bidrag til vikingetidens historie* (1878), and a translation of Snorre Sturluson's *Kongesagaer* (1897), on which he had previously written his *Snorre Sturlasons historieskrivning* (1873). He edited *Monumenta historica norvegica* (1880). In 1900 the Norwegian Storthing appropriated 20,000 kroner for a popular edition of Storm's Dano-Norwegian rendering of the *Heimskringla* (1886–89).

STORM, shtôrm, THEODOR (1817–88). A German poet and novelist, one of the great masters of that peculiarly German creation, the short story of character and sentiment. He was born at Husum, Schleswig, on Sept. 14, 1817, studied jurisprudence at Kiel and Berlin, and, returning to Kiel in 1839, became intimate with the brothers Theodor and Tycho Mommsen, poetry being the bond of union, especially their mutual admiration for the Swabian poet Mörike. The result was the publication of the *Liederbuch dreier Freunde* (1843), now very rare, which contained Storm's first essays in poetry. For ten years he practiced law in his native town and returned to it as Landvogt in 1864, having entered the Prussian civil service in 1853, and occupied judicial offices at Potsdam and Heiligenstadt, near Göttingen. In 1880 he retired and settled at Hademarschen, in Holstein, where he died on July 4, 1888.

Storm began his literary work at Husum by collecting popular sagas and stories of Schleswig-Holstein, then assisted Biernatzki in editing his *Volksbuch*, in which, besides some exquisite lyrics, his first three important stories, *Martha und ihre Uhr* (1848), *Im Saale* (1849), and *Immensee* (1850; 66th ed., 1907), appeared. The last-named novelette, the author's most popular and perhaps his most characteristic work, was the crowning achievement of his first period. Through various translations it has become familiar to English readers. Of about a dozen stories written during the 11 years of absence from his native soil, *Im Sonnenschein* (1854) and *Angelica* (1855) are sketches of by-gone days, tinged with the elegiac melancholy which pervades most of the author's stories; *Im Schloss* (1861) and *Von jenseits des Meeres* (1864) boast of happy endings, and *Auf der Universität* (1862) is the most ambitious story of this period—scenes from his own student life being charmingly interwoven. *Die Regentrude* (1864) is the best of several delicious fairy tales. With Storm's return to Husum in 1864 his work enters an essentially new phase, in which the passive retrospective novel gives place to a more active and dramatic form of romance. On the one hand is here to be considered a series of chronicle tales, written in a quaint style, comprising *Der Spiegel des Cyprianus* (1865), a romantic tale of the Thirty Years' War, *Aquis Submersus* (1876), *Renata* (1878), *Zur Chronik von Grieshuus* (1884), and *Ein Fest auf Haderslevhuus* (1885); on the other hand some artist tales, such as *Ein stiller Musikant* (1874) and *Psyche* (1875). On psychological lines are *Viola Tricolor* (1873), *Carsten Curator* (1878), *John Riew* (1885), *Ein Bekenntnis* and *Der Schimmelreiter* (1888). Nor should the delightful children's story *Pole Poppenspäler* (1874) be forgotten. Consult Schütze, *Theodor Storm, sein Leben und seine Dichtung* (Berlin, 1887); Wehl, *Theodor Storm, ein Bild seines Lebens und Schaffens* (Altona, 1888); Stern, *Studien zur Litteratur der Gegenwart* (Dresden, 1895); Robertson, in *The Gentleman's Magazine* (London, 1895); Remer, *Theodor Storm als norddeutscher Dichter* (Berlin, 1897); and Gertrud Storm, *T. Storm* (2 vols., Berlin, 1911-12).

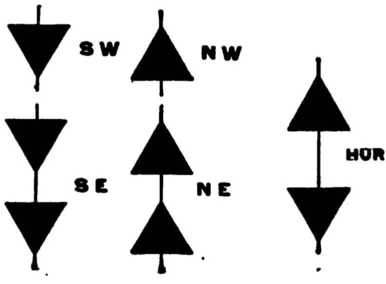
STORM AND STRESS (Ger. *Sturm und Drang*). The name of an emanciatory movement in German literature, usually considered as reaching its height in the decade 1770-80. It received the title from that of a typical drama by Klinger (1776), who wrote under the influence of Rousseau, with "nature," "originality," and "genius" as his watchwords. To this movement belong Goethe's *Götz von Berlichingen*, Schiller's *Die Räuber*, and countless works of similar striving but inferior worth. Consult A. Sauer, *Stürmer und Dränger*, in Joseph Küschrer, *Deutsche National-Litteratur*, vols. 79-81 (Stuttgart, 1883). See GERMAN LITERATURE.

STORM AND WEATHER SIGNALS. Flags, semaphores, lanterns, steam whistles, and other devices exhibited or sounded to inform mariners and others of approaching storms or unusual weather conditions. The use of such warnings resulted from personal studies in more or less coöperation about 1850-60. Storm and weather signals, properly so called, began to be displayed about 1863 in England by Captain Fitzroy; in France by Leverrier; and in Belgium by Buys-Ballot. The American system of observations began in 1870 and storm signals were first displayed in the autumn of 1871. At the present time every civilized nation and every port of any importance has some method of signaling or otherwise informing navigators of approaching storms. Among the systems that are now in use are the following:

The semaphore is a simple vertical post having two or more arms attached that can be set at different angles with the vertical. The semaphore was introduced as a telegraphic apparatus about 1790, and numerous semaphore stations are still maintained in Europe and in various colonies. See SIGNALING AND TELEGRAPHING, MILITARY.

The Dutch and Belgian aëroclinoscope (q.v.) was a modified semaphore, in which the position of the arm indicated the direction of the barometric gradient and consequently of the wind that is nearly perpendicular to that.

In 1910 the International Meteorological Committee, meeting at Berlin, adopted a system of international local day signals which they recommended to the weather services throughout the world. The signals are shown below and indicate that a gale is to be expected beginning with the wind stated:



Cones to be hoisted in vertical line separated by a distance equal to the length of the slant line of the cone.

In 1913 the same committee, meeting at Rome, adopted two codes of international storm signals, one for stations using three lanterns and one for countries using two lanterns. As with the day signals these indicate a gale beginning with the wind stated.

The lanterns to be not less than two meters apart. No night signal for a hurricane selected for recommendation.

These international storm-warning signals are not obligatory on the nations represented at the Meteorological Congresses, and have not been widely adopted (*in toto*) as yet. Great Britain announced her intention of adopting the above code, using three lanterns, beginning in 1914. Germany uses the international day signals (omitting the hurricane signal) and supplements them with a cautionary sphere or red flags; 1 red flag means the wind will veer, 2 red flags mean the wind will back. The night signal is one red light. Holland follows the German system, but uses black flags instead of red. France uses the international day signals but has no night signals. Spain has tried the international signals for day and night (two-lantern). Canada proposed to adopt the international day signals, but used the United States night signals in 1913. The symbols and signals used at the ports of the Orient depend upon the nationality of the port.

(For countries using three lanterns)

NW.	SW.	NE.	SE.
White Red Red	Red Red White	White White Red	Red White White

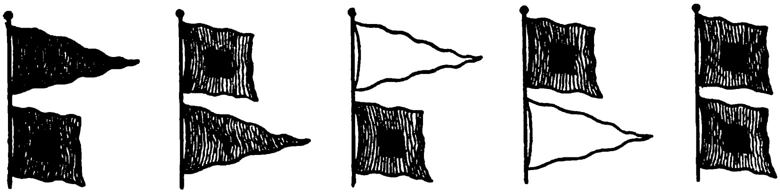
(For countries using two lanterns)

NW.	SW.	NE.	SE.
Red Red	White White	Red White	White Red

The arrangement of flags used in the United States by the United States Weather Bureau for storm warnings differs from that for weather forecasts and is shown in the accompanying illustrations.

Storm warnings

Hurricane warning



NE. Winds SE. Winds NW. Winds SW. Winds

EXPLANATION OF UNITED STATES WEATHER BUREAU STORM AND HURRICANE WARNINGS.

Small craft warning.—A red pennant indicates that moderately strong winds are expected.

Storm warning.—A red flag with a black centre indicates that a storm of marked violence is expected.

The pennants displayed with the flags indicate the direction of the wind; red, easterly (from northeast to south); white, westerly (from southwest to north). The pennant above the flag indicates that the wind is expected to blow from the northerly quadrants; below, from the southerly quadrants.

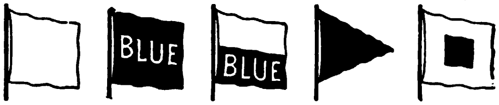
By night a red light has indicated easterly winds, and a white light below a red light, westerly winds.

Hurricane warning.—Two red flags with black centres, displayed one above the other, indicate the expected approach of a tropical hurricane, or one of those extremely severe and dangerous storms which occasionally move across the lakes and northern Atlantic coast. Neither small craft nor hurricane warnings are displayed at night.

A new system of night signals was formulated by the United States, to go into operation on the Great Lakes during 1916. This system is the two-lantern type but employs a three-lantern signal for severe storms or hurricanes.

Signals for the weather forecasts are as follows:

No. 1. No. 2. No. 3. No. 4. No. 5.



Fair Weather — Rain or Snow — Local Rain or Snow — Temperature — Cold Wave.

INTERPRETATION OF DISPLAYS.

No. 1, alone, indicates fair weather, stationary temperature. No. 2, alone, rain or snow, stationary temperature. No. 3, alone, local rain or snow, stationary temperature.

No. 1, with No. 4 above it, fair weather, warmer. No. 1, with No. 4 below it, fair weather, colder. No. 2, with No. 4 above it, rain or snow, warmer. No. 2, with No. 4 below it, rain or snow, colder. No. 3, with No. 4 above it, local rain or snow, warmer. No. 3, with No. 4 below it, local rain or snow, colder.

When a steam whistle is used for weather signals a warning blast of from 15 to 20 seconds' duration is first sounded and then the longer blasts (4 to 6 seconds), which refer to weather, and the shorter blasts (1 to 3 seconds), which refer to temperature, the former being sounded first. The signals are as follows: One long blast, fair weather; two long, rain or snow; three long, local rain or snow. One short blast, lower temperature; two short, higher temperature; three short, cold wave. The signals may be repeated to avoid error. For an account of storm and weather signals which have been used in the United States consult *Monthly Weather Review* (Washington, September, 1914).

The international code of maritime weather signals together with a list of the weather signals in use by various countries is given in a publication of the Meteorological Office, London (M. O. 206), entitled *Codes of signals adopted and recommended . . . together with a list of the maritime weather signals at present in use in the various countries of the globe* (London, 1914).

STORMCOCK. See MISTLE THRUSH.

STORM KING. A rocky peak of the Highlands of the Hudson, 1530 feet in height, 4 miles north of West Point. Its Dutch name was Boterberg, Butter Mountain.

STORM VAN 'SGRAVESANDE, vän sgrä′ve-zän′de. See GRAVESANDE.

STOR′NOWAY. The chief town of Lewis-with-Harris (q.v.), an island of the Outer Hebrides, Scotland (Map: Scotland, B 1). Its chief feature is the palatial Stornoway Castle, completed in 1870. It is an important fishing station, shipping large quantities of fish to home and Baltic ports, and has a fine harbor, covering a square mile. Urban pop., 1901, 3711; 1911, 3806; of parish, 1901, 12,983; 1911, 13,438.

STORRS, RICHARD SALTER (1821–1900). An American Congregational minister, born at Braintree, Mass. He graduated at Amherst College (1839) and at Andover Theological Seminary (1845); and was minister of the Harvard Congregational Church, Brookline, Mass., and, from 1846 till his death, of the Church of the Pilgrims, Brooklyn. He was much sought after as an orator and lecturer, and his best-known writings represent the substance of what had earlier been spoken. They show learning as well as oratorical power. Collections were made as follows: *Bernard of Clairvaux, the Times, the Man, and his Work* (1892), eight lectures; *Addresses on Foreign Missions* (1900); *Orations and Addresses* (1901). In 1848 Dr. Storrs helped to found the *Independent,* and in 1896 he was president of the American Historical Association. Consult Charles Storrs, *The Storrs Family* (New York, 1886), and the *Memorial Address* by E. A. Park (ib., 1900).

STORRS, William Lucius (1795–1861). An American jurist, born at Middletown, Conn. He graduated at Yale College, 1814; studied law at Whitestown, N. Y.; was admitted to the bar in 1817; resided and practiced law in Middletown; and was a member of Congress 1829–33 and 1839–40. He was a Whig in politics. In the latter year he was appointed associate judge of the State Supreme Court of Errors; Chief Justice, 1856; and was professor of law in Yale College, 1846–47. His decisions are printed in the Connecticut *Reports.*

STORTHING, stŏr′tĭng. The legislative assembly of Norway (q.v.).

STO′RY, George Henry (1835–). An American portrait and genre painter and museum official. He was born in New Haven, Conn., where he studied wood engraving under Charles Hine; later he studied painting for a year in Europe. Upon his return to America he settled in 1863 in New York, and became an associate of the National Academy in 1875. His portrait of Alexander S. Murray and one of himself are in the Metropolitan Museum, where he was curator of paintings from 1889 to 1906 and acting director in 1904–05.

STORY, Joseph (1779–1845). An eminent American jurist and judge, born at Marblehead, Mass. He graduated from Harvard College in 1798, studied law, and was admitted to the bar in 1801. For a time he gave considerable attention to general literature and poetry. In 1804 he published *The Power of Solitude,* and other poems, which were not favorably received. Thereafter he devoted himself to law and politics. He was elected to the State Legislature in 1805 and became a leader of the Republican (afterward called the Democratic) party, and defended the measures of Jefferson. In 1808 he was elected to Congress, and although not in sympathy with Madison's administration, the President, in 1811, appointed him associate justice of the Supreme Court of the United States. He was then only 32 years of age. In 1820, as a member of the Massachusetts Constitutional Convention, he advocated a property basis for the Senate. In 1829 he was appointed professor of law at Harvard, and taught law for 16 years, at the same time serving on the Supreme Court bench. He was opposed to slavery, and was unpopular in certain sections of the country. He presided as acting Chief Justice of the Supreme Court for some time after the death of Marshall, and probably only his attitude towards Madison's administration prevented his selection as permanent Chief Justice. During his long service on the bench he decided many admiralty and patent law cases which are authority at the present time, and he shared with Chancellor Kent the distinction of molding American equity jurisprudence. He wrote the opinion in the celebrated Dartmouth College case, which has been the subject of much criticism, although recognized as an able effort. He received the degree of LL.D. from Brown in 1815, from Harvard in 1821, and from Dartmouth in 1824. Story continued his labors on the bench and in the law school until his death at Cambridge in 1845. His legal writings and decisions are still frequently quoted in the highest courts of the United States and England. He published the following legal works: *Commentaries on the Law of Bailments* (Boston, 1832); *Commentaries on the Constitution of the United States* (1833); *Conflict of Laws* (1834); *Commentaries on Equity Jurisprudence* (1835–36); and works on *Bills and Notes, Partnership, Agency, and Equity Pleadings,* at later dates. His works have gone through many editions, and are still used. Consult W. W. Story, *Life and Letters of Joseph Story* (Boston, 1851).

STORY, Julian. See Story, William Wetmore.

STORY, Mrs. Julian. See Eames, Emma.

STORY, T. Waldo. See Story, William Wetmore.

STORY, Mrs. William Cumming (?–). An American women's club leader, born in New York City. Her maiden name was Daisy Allen. She was active in women's clubs and in patriotic societies for many years, and served as president of the New York City Federation of Women's Clubs, as first vice president of the New York State Federation of Women's Clubs, and as vice president of the National Society of Patriotic Women of America. She was principally known, however, in connection with the Daughters of the American Revolution, of which she was elected president general in 1913 and reelected in 1915.

STORY, William Edward (1850–). An American mathematician, born in Boston. He graduated at Harvard in 1871, and studied at the universities of Berlin and Leipzig (Ph.D., 1875). He taught at Harvard and at Johns Hopkins until 1889 and thereafter was professor of mathematics at Clark University. In 1878–82 he was editor in charge of the *American Journal of Mathematics,* and later edited the *Mathematical Review.* Story was elected a member of the National Academy of Sciences in 1908. His contributions deal with the theory of errors, algebraic invariants, finite differences, etc.

STORY, William Wetmore (1819–95). An American sculptor, legal scholar, and author. He was born at Salem, Mass., the son of Joseph Story (q.v.). After graduating from Harvard College in 1844 he studied law under his father's direction, but although he was admitted to the bar and wrote several learned works, he never practiced. In 1851 he took up sculpture as a profession and removed to Italy, where he spent the remainder of his life. Residing principally at Rome, he maintained a studio famous for its brilliant hospitality. Among the many monuments, statues, ideal figures, and portrait busts by him are the statues of Cleopatra (1864) and Semiramis (1874) in the Metropolitan Museum of Art, New York; a statue of his father (Mount Auburn Cemetery); Edward Everett (Boston Public Gardens); a bronze statue of George Peabody, erected in London (replica, Baltimore, 1888); William Prescott (Bunker Hill); Professor Henry (Washington); and Francis Scott Key, Golden Gate Park, San Francisco. Story's work, as a whole, while possessing some dignity of conception, lacks in technique and real inspiration. A man of varied talents and accomplishments, he published a number of books and pamphlets, including poems, essays, etc. His *Works* are to be had in eight volumes.

One of his sons, Julian Story (1857–), a portrait painter, was a student of Duveneck in Munich, and of Boulanger and Lefebvre in Paris. He received a gold medal in Berlin in 1891 and a silver medal at the Paris Exposition of 1900, and was elected an associate of the National Academy. Among his sitters were King Edward VII and Emma Eames, whom he married but from whom he was later divorced. Another son, T. Waldo Story (died 1915), a sculptor, designed the bronze doors for the library of the late J. P. Morgan in New York. His statue of Sir William Harcourt was the first ever placed in the House of Commons. Consult: M. E. Phillips, *Reminiscences of William Wetmore Story* (New York, 1898); Henry James, *William Wetmore Story and his Friends* (Boston, 1903); Lorado Taft, *History of American Sculpture* (New York, 1903).

STOSCH, shtŏsh, Albrecht von (1818–96). A German general and naval administrator, born at Coblenz. He received a military education and was commissioned lieutenant in 1835. He entered the general staff in 1855, and became chief of staff of the Fourth Army Corps in 1861 and major general in 1866. In the Seven Weeks' War he was quartermaster-general of the Second Army. In the same year he was appointed director of the commissary department with the rank of lieutenant general, which position he held during the Franco-Prussian War in 1870–71, and was chief of staff with the army left in France after the conclusion of peace. In 1872 he was appointed chief of the admiralty and in 1876 received the title of admiral. While holding these offices he greatly increased the power and efficiency of the German navy. He retired in 1883.

STOSS, shtŏs, Veit (c.1440–1533). A celebrated German sculptor and engraver, chief master of wood carving in Germany. His birthplace, whether at Cracow or Nuremberg, is disputed, but it was more probably Nuremberg, where he certainly received his artistic education. In 1477 he renounced his Nuremberg citizenship and removed to Cracow to execute commissions of great importance. An honored citizen, he was repeatedly chosen master of the artists' guild, and in 1485 was granted freedom from taxation by the city. He again practiced his art in Nuremberg in 1487–89, then at Cracow until 1496, in which year he resumed his Nuremberg citizenship. With the wealth acquired at Cracow he purchased in 1499 a house with spacious grounds and made divers investments. In one of these he was defrauded of 1200 gulden, and in order to recoup his losses he forged an obligatory note in the name of the burgher who had advised and profited by the investment. This crime, punishable by death, was commuted by the council of Nuremberg in 1503 to having both cheeks branded. From then on he was in constant quarrel with the council, which twice imprisoned him and refused to pay what he considered his just dues for work done. He finally secured a letter of pardon with restoration of civic rights from Emperor Maximilian, which the council in 1508 had to recognize. Stoss's activity as an artist continued unabated, not only in works for Nuremberg churches and elsewhere but for the Emperor himself, at whose court he appeared. He left a large estate at his death.

His earliest work on record is the "High Altar," in St. Mary's at Cracow, executed in 1477–89, with the "Death of the Virgin" and the "Assumption" in the middle shrine, a work praised as a wonder of art by the master's contemporaries and still reckoned among the best creations of its kind, exhibiting the artist's chief characteristics: vivid description, varied and animated figures, and rich drapery. Next followed, in 1492, the red marble "Monument of King Casimir IV," in the cathedral, a work of solemn splendor and simplicity. The earliest of his sculptures executed at Nuremberg are the three stone reliefs of the "Last Supper," "Christ on the Mount of Olives," and "Taking of Christ" (1499), in the ambulatory of St. Sebaldus. Over the high altar in the same church rise the "Crucifix" (1520) and the large and imposing Renaissance "Figures of Mary and Saint John" (c.1532), largely destroyed by restoration. In the Germanic Museum may be seen the noble high relief of the "Crowning of the Virgin by God and Christ," clear in composition and executed with masterly perfection; and the wooden paneling known as the "Rose Garland," in the Germanic Museum, Nuremberg, which contains numerous examples of his work. Seven more reliefs, which formed part of this work, are now in the Berlin Museum. Noteworthy is the large "Pietà" in the Jacobskirche, which also contains several smaller but very able works of the master, but his best-known work in carved wood is "The Angel's Salutation" (1518), in the church of St. Lawrence, the central group of heroic size surrounded by a chaplet of roses in which are set seven medallions with the "Joys of the Virgin" in bas-relief, a work unique in beauty and conception. He designed also the superbly carved altarpieces in the parish church at Schwabach (1506) and in the upper parish church at Bamberg (1523). His engravings, scenes from the Passion, severe in style and dating from his early period, are now very rare.

Bibliography. The best-known monographs on Veit Stoss are by Berthold Daun (Bielefeld, 1906), F. Kopéra (Cracow, 1907), and Max Lossnitzer (Leipzig, 1912).

STOTHARD, stŏth′ẽrd, Charles Alfred (1786–1821). An English antiquarian draftsman, the second son of the painter Thomas Stothard. He was born in London, studied at the Royal Academy schools, and exhibited his best painting, "The Death of Richard II," in 1811. Afterward he worked on the *Magna Britannia* (1815), and became historical draftsman to the Society of Antiquaries. In that capacity he made drawings of the Bayeux tapestry, which were published in the society's *Vetusta Monumenta* (1821–23). His most important work was the *Monumental Effigies of Great Britain* (10 parts, 1811–21), which was completed by other artists, and republished in 1876. His drawings are all of remarkable accuracy. He married Anna Eliza Kempe in 1818. See Bray, Mrs. Anna Eliza Kempe.

STOTHARD, Thomas (1755–1834). An English illustrator and painter. He was born in London and studied at the Royal Academy schools. In 1779 he entered upon his career as an illustrator. More than 3000 of his designs, the greater number of which are in the British Museum, were engraved. Although somewhat superficial, his illustrations are characterized by grace and charm and by a sympathetic touch, especially when he depicted the loveliness of childhood. Stothard illustrated the works of Fielding, Richardson, Sterne, Goldsmith, Shakespeare, and Milton, as well as *Pilgrim's Progress, Don Quixote, Robinson Crusoe,* and other standard works. As a painter he is less important. He executed decorations at Burghley House (1799–1802), and in the Signet Library (1822) at Edinburgh. Sixteen of his easel pictures are in the National Gallery. Consult his *Life* by Mrs. Bray (London, 1851) and the monograph by A. C. Coxhead (ib., 1906).

STOTT, Henry Gordon (1866–). An American electrical engineer, born in the Orkney Islands, Scotland. He was educated at the College of Science and Arts, Glasgow, and at the Glasgow and West of Scotland Technical College. Between 1885 and 1891 he was engineer for various corporations in Britain and Spain. From 1891 to 1901 he was an engineer with the Buffalo General Electric Company, and in that connection did much notable construction work. After 1901 he was superintendent of motive power of the Interborough Rapid Transit Company of New York, and after 1912 held also the same position with the New York Railways Company. Stott served as president of the American Institute of Electrical Engineers in 1907–08.

STOUGHTON, stŏ'ton. A town, including several villages, in Norfolk Co., Mass., 16 miles south of Boston, on the New York, New Haven, and Hartford Railroad (Map: Massachusetts, E 4). It has a public library and a handsome town hall. Boot and shoe making, and the manufacture of woolens, rubber goods, boxes, knitted goods, and fountains are the chief industries. Pop., 1900, 5442; 1910, 6316. Stoughton, named in honor of Gov. William Stoughton, was set off from Dorchester and incorporated in 1726. Consult Hurd, *History of Norfolk County* (Philadelphia, 1884).

STOUGHTON. A city in Dane Co., Wis., 16 miles by rail southeast of Madison, on the Chicago, Milwaukee, and St. Paul Railroad (Map: Wisconsin, D 6). It has a Carnegie library. Carriages and wagons, agricultural implements, sleds, shoes, flour, etc., are manufactured. Pop., 1900, 3431; 1910, 4761.

STOUGHTON, Israel (?–1645). An American colonist, born in England. He was one of the founders of Dorchester, Mass., and in 1633 he became a freeman of the Colony. Though a member of the General Court in 1634–35, he wrote a pamphlet denying the right of the assistants to act as magistrates. As a punishment the government debarred him from holding public office for three years, but upon his making a humble submission revoked the sentence. From 1637 to 1643 he himself was an assistant, and in 1637 he was appointed commander of the Colony's troops in the Pequot War. In 1639 he was a commissioner in the boundary controversy with Plymouth. Five years later he went to England, where he entered the Parliamentary forces with the rank of lieutenant colonel, and probably fought at the battle of Naseby. At his death he left 300 acres of land in Dorchester to Harvard University. Consult Josiah Quincy, *The History of Harvard University* (2 vols., Boston, 1860).

STOUGHTON, John (1807–97). An English dissenting preacher and ecclesiastical historian. He was born in Norwich, and after an elementary education entered a law office. He abandoned law for the ministry, and after preparation in Highbury College he was ordained (1833). In 1872 he was elected professor of historical theology in New College, Saint John's Wood. In 1862 he published *Church and State, Two Hundred Years Ago . . . 1660–63.* Other works are: *Ecclesiastical History of England from the Opening of the Long Parliament to the Death of Oliver Cromwell* (1867); *Religion in England under Queen Anne and the Georges* (1878); *Religion in England from 1800 to 1850* (1884). Consult his *Recollections of a Long Life* (London, 1894), and G. K. S. Lewis, *John Stoughton, a Short Record of a Long Life* (ib., 1898).

STOUGHTON, William (c.1632–1701). A Colonial Governor of Massachusetts. He graduated at Harvard in 1650, and as a fellow at New College, Oxford, from 1652 until ejected at the time of the Restoration (1660). Returning to Massachusetts, he was an assistant from 1671 to 1686—though in 1684 he refused to serve—and a commissioner of the United Colonies from 1674 to 1676, and again from 1680 to 1686. In 1677 he went to England as the agent of his colony in a boundary dispute with New Hampshire. He was a member of Governor Andros's Council, and from 1692 until his death was Lieutenant Governor of Massachusetts, being acting Governor from the recall (1694) of Sir William Phipps until the arrival (1699) of Lord Bellomont. In 1692 he was Chief Justice of the Special Court of Oyer and Terminer by which the Salem "witches" were tried, and, as such, treated the accused with relentless severity. He was a liberal benefactor of Harvard, and it was for him that Stoughton Hall was named. Consult J. L. Sibley, *Biographical Sketches of Graduates of Harvard University,* vol. i (Cambridge, 1873).

STOUGHTON MUSICAL SOCIETY. See Choral Societies.

STOUP, stōōp. See Holy Water Vase.

STOURBRIDGE, stẽr'brĭj. A town in Worcestershire, England, 20 miles north-northeast of Worcester, on the Stour (Map: England, D 4). It contains iron, glass, earthenware, and fire-brick factories. Stourbridge clay, upon which the action of fire has less effect than upon most varieties of clay, is an article of export. In the grammar school founded in 1552, and rebuilt in 1864, Samuel Johnson received part of his education. Pop., 1901, 16,302; 1911, 17,312.

STOURM, stōōrm, René (1837–). A French economist, born and educated in Paris. He was employed in a department of the Ministry of Finance, became professor of finance in the Ecole Libre des Sciences Politiques in 1885, and in 1896 became a member of the Academy of Political and Moral Sciences. In 1913 he succeeded A. de Foville as permanent secretary of the academy. On the history of finance, and more especially of taxation, he wrote *Les finances de l'ancien régime et de la révolution* (1885); *Cours de finance, le budget* (1889; 6th ed., 1909); *Systèmes généraux d'impôts* (1893); *Bibliographie historique des finances de la France du XVIIIème siècle* (1895); and *Les finances du consulat* (1902).

STOUT. See Beer.

STOUT, George Frederick (1859–). An English psychologist, born at South Shields, and educated at the Charlotte Terrace School in his native town and at St. John's College, Cambridge. He was made a fellow of St. John's College in 1884, and succeeded Croom Robertson as editor of *Mind* in 1891. After holding various academic positions in the field of philosophy and psychology, he was appointed in 1903 professor of logic and metaphysics in the University of St. Andrews. He became a fellow of the British Academy in 1903. His chief published works are: *Analytic Psychology* (1896, 1902); *Manual of Psychology* (1901; 3d ed., 1913); "Truth and Error," in *Personal Idealism* (1902); *Groundwork of Psychology* (1903). As a pupil of James Ward (q.v.), Stout infused into the traditional English psychology something of his teacher's critical spirit. His *Analytic Psychology* is planned, however, as a preliminary to a larger work on genetic psychology, in which especial attention is to be devoted to ethnographical evidence.

STOVAINE, stō′vȧ-ĭn. An anæsthetic drug, a substitute for cocaine (q.v.) but having an advantage over the latter in being more stable, less toxic, and a vasoconstrictor, while equally powerful as an anæsthetic. Its composition is indicated by its chemical name, benzoylethyldimethylaminopropanol hydrochloride. Stovaine is safer than cocaine for spinal anæsthesia. Locally it may be applied to the mucous membrane or injected hypodermically.

STOVE. See Heating and Ventilation.

STOW, stō, John (c.1525–1605). An important English historian and antiquary. As a boy he learned the tailor's trade, probably the occupation of his father, but he seems to have abandoned it for antiquarian pursuits. His principal works are his *Summary of English Chronicles,* first published in 1565, and frequently reprinted until his death, with a continuation to the date of each new publication; *Chronicles* or *Annals of England,* 1580, and reprinted in 1592, to which year the annals are brought down; and *A Survey of London,* the most important of his writings, published in 1598 (ed. by W. J. Thoms, London, 1876, and by C. L. Kingsford, Oxford, 1908). Besides these original works Stow assisted in the continuation of Holinshed's *Chronicle* (1585–87), Speght's edition of Chaucer (1561), etc.

STOWE, Calvin Ellis (1802–86). An American clergyman, born at Natick, Mass. He was educated at Bowdoin College and at Andover Theological Seminary. In 1830–32 he was professor of Greek at Dartmouth, and in the latter year became professor of sacred literature at Lane Theological Seminary, Cincinnati, where in 1836 he married Harriet, the daughter of Lyman Beecher, then president of the seminary; his wife became famous as Harriet Beecher Stowe (q.v.). In 1850–52 he was professor of divinity at Bowdoin and from 1852 until his retirement in 1864 professor of sacred literature in Andover Seminary. Among his works are: *Lectures on the Sacred Poetry of the Hebrews* (1829), from the Latin of Lowth; *Introduction to the Criticism and Interpretation of the Bible* (1835); *Elementary Education in Europe* (1837); *The Religious Element in Education* (1844); *Origin and History of the Books of the Bible* (1867).

STOWE, Emily Howard (*née* Jennings) (1831–1903). A Canadian woman suffragist and pioneer woman physician. She was born in South Norwich, Ontario. Educated at the Provincial Normal School, Toronto, she became a school teacher at an early age. In 1856 she married John Stowe, of Norwichville, Ontario. She studied medicine, graduated at the New York Medical College for Women in 1867, but, owing to strong and persistent opposition, was not registered as a member of the Ontario College of Physicians and Surgeons until July 16, 1880. She was then the first woman in Canada to be officially recognized as a physician. In 1877 she organized the Toronto Woman's Literary and Science Club, which some years later became a woman's suffrage club. By vigorous effort municipal suffrage for widows and spinsters in Ontario was won in 1883. Ten years later, mainly through her efforts, the Dominion Woman's Suffrage Association was incorporated and she became its president. She was likewise instrumental in securing the admission of women to the University of Toronto. She was highly successful as a public lecturer.

STOWE, Harriet (Elizabeth) Beecher (1811–96). An American novelist and Abolitionist, born in Litchfield, Conn., the daughter of the Rev. Lyman Beecher and sister of Henry Ward Beecher. She attended school at Litchfield Academy and later at Hartford. In 1832 her father became president of Lane Theological Seminary at Cincinnati, Ohio. While living there she gained some acquaintance with the ways of slavery, especially as to fugitive slaves and the attitude of the South towards the Abolitionists. The impression was strengthened by journeys into the slave States with her husband, the Rev. Calvin E. Stowe (q.v.), a strong antislavery man, whom she married in 1836. In 1843 Mrs. Stowe published her first book, entitled *The Mayflower, or Sketches of Scenes and Characters among the Descendants of the Pilgrims.* In 1850 her husband was called to Bowdoin College, Brunswick, Me., and in the interval before his transfer to the chair of sacred literature at Andover (Mass.) Theological Seminary, two years later, Mrs. Stowe wrote the book by which she is most widely known, *Uncle Tom's Cabin, or Life among the Lowly.* It appeared in the *National Era* of Washington, D. C. (June, 1851, to April, 1852), in the latter year being issued in book form in Boston. As a serial it attracted no unusual notice, but as a book its success, after a few weeks, was unprecedented. Five hundred thousand copies were sold in the United States in five years, and many more in England, and it has been translated into a score of foreign languages. In 1853 Mrs. Stowe, in reply to various inquiries, criticisms, and censures, published *A Key to Uncle Tom's Cabin.* She also wrote, in the same year, *A Peep into Uncle Tom's Cabin, for Children.*

Her health was somewhat impaired, and in 1853 she went to Europe. On her return she published (1854) *Sunny Memories of Foreign Lands,* two volumes of travel. She then returned to the attack against slavery in *Dred: A Tale of the Great Dismal Swamp* (1856; at one time entitled *Nina Gordon*), but without the vigor and success of her former work. In 1864 Professor Stowe resigned his professorship at Andover, and with his wife took up his residence at Hartford, which was Mrs. Stowe's home for the rest of her life. In 1868 she became associated with D. G. Mitchell (q.v.) in the editing of *Hearth and Home.* Her later writing consisted chiefly of novels of quiet New England life, with which she was familiar, and except for her polemic, *Lady Byron Vindicated: A History of the Byron Controversy* (1869), and her article in *Macmillan's Magazine* which had occasioned that discussion, her works were comparatively free from the didactic spirit. Among her books should be mentioned: *The Minister's Wooing* (1859); *The Pearl of Orr's Island* (1862); *Agnes of Sorrento* (1862); *Religious Poems* (1865); *Oldtown Folks* (1869); *Pink and White Tyranny* (1871); *My Wife and I* (1871); *We and our Neighbors* (1875); and *Poganuc People* (1878). Of these, the best are *The Minister's Wooing* and *Oldtown Folks.* Her collected works in nine volumes were published in New York in 1913.

Mrs. Stowe is remembered chiefly as the author of one of the most influential and widely read novels in literature. Though, like almost all her novels, rambling in structure, *Uncle Tom's Cabin* has abundant vitality, and is the work of a genuine story-teller. It also has the unusual fortune of being at once a cause and an outcome of a heated national struggle; no novel was ever better timed for an occasion, and few have aroused so much admiration and dislike. Soon after its publication the book was dramatized, and it still keeps the stage. The character Uncle Tom was drawn from the life of Josiah Henson (q.v.).

Consult: C. L. Stowe, *Life* (Boston, 1889); Mrs. Annie Fields, *Life and Letters* (ib., 1899); C. E. and L. B. Stowe, *Harriet Beecher Stowe: The Story of her Life* (ib., 1911).

STOWELL, stō'el, Ellery Cory (1875–). An American international law scholar. He was born at Lynn, Mass., and graduated at Harvard in 1898. He afterward traveled in the Orient and in Europe and studied in Berlin and Paris. Between 1908 and 1913 he taught at George Washington University and at the University of Pennsylvania, and subsequently at Columbia, where he was appointed assistant professor of international law in 1914. In 1910–12 he was assistant editor of the *Annals of the American Academy of Political and Social Science.* He attended the Second Peace Conference at The Hague (1907), and was secretary of the American delegation to the Naval Conference at London (1908–09). He published *Le Consul* (1909); *Consular Cases and Opinions* (1909); *The Diplomacy of the War of 1914* (vol. i, 1915).

STOWELL, William Scott, Baron (1745–1836). A British admiralty and ecclesiastical judge and jurist. He was the eldest brother of Lord Eldon (q.v.). He was born at Heworth, Durham, was educated at Newcastle, went to Oxford in 1761, and became a college tutor. In 1779 he removed to London, was called to the bar (1780), and admitted to the faculty of advocates at Doctors' Commons. In 1788 he was appointed judge in the Consistory Court, knighted, and nominated Privy Councilor. In 1798 he became judge of the Court of Admiralty. As an ecclesiastical and admiralty judge he won high distinction. He practically created much of the admiralty law of England. He drew on the Roman law, and the maritime law of all nations, ancient and modern, and his opinions were very scholarly. He wrote no systematic treatise or textbook, but his judgments were admirably reported. He is the highest English authority on the law of nations, and his judgments—those especially relating to the rights of belligerents and neutrals—have been described as the most valuable contributions made by an English judge to general jurisprudence since the time of Lord Mansfield. He represented Oxford in the House of Commons for 20 years, but he took no part in the business of Parliament, although he was a zealous supporter of the Conservative party and the Established church. At the coronation of George IV he was raised to the peerage as Baron Stowell of Stowell Park.

STRABIS'MUS (Neo-Lat., from Gk. *στραβισμός*, a squinting, from *στραβός*, *strabos*, crooked, from *στρέφειν*, *strephein*, to twist, turn about), or Squint. A well-known and common deformity which may be defined as a want of parallelism in the visual axes when the patient endeavors to direct both eyes to an object at the same time. The eye which is directed towards the object looked at is called the fixing eye, the other the squinting eye. The squint is said to be convergent, or internal, when the eye or eyes are directed towards the nose, divergent, or external, when they are directed towards the temple, and vertical when directed upward or downward. The last is often associated with convergent squint. The divergent form is rare, but occurs with myopia.

Squint is of two kinds: (1) paralytic and (2) concomitant. Paralytic squint is caused by paralysis of one or more of the ocular muscles. There is inability to move the affected eyeball away from the side towards which it is directed. The paralysis may be due to a lesion at any point between the cerebral cortex and the muscle. There is diplopia (double vision) unless the squinting eye is the one fixed on the object. Syphilis is the most common cause; others are acute infectious diseases from tumors, abscesses, and meningitis. The treatment is that of the cause. In concomitant squint there is the same deviation of the eyes in every position, and both eyes possess a normal range of movement. Squint may be alternating (to fix with either eye), fixed, or unilateral (squint confined to one eye); in regard to permanency it may be constant or periodic. In concomitant squint there is rarely double vision, one image being disregarded. Uncorrected errors of refraction, congenital feebleness of vision, opacities of the cornea or media, or other disease of the eye, combined with weakness of a muscle, leads to concomitant squint, for, as the sight in one eye is imperfect, there is little inducement to make the muscular effort to keep the two parallel. The treatment includes correction of errors of refraction by glasses, exercise of the muscles by prisms, and operative methods. The last may be division of the short tendon or advancement of that of the opposing muscle, or a combination of these procedures. Latent squint or *heterophoria* is a muscular anomaly differing from strabismus in degree, but not in character. The squint does not become manifest (except by appropriate tests) as in strabismus, but the nervous effort required to keep the eyes in focus results in asthenopia of a very severe type. The varieties of heterophoria are *hyperphoria*, a tendency of one eye to deviate upward; *esophoria*, a tendency of the eye to deviate inward; *exophoria*, a tendency to deviate outward; *hyperesophoria*, a tendency of one eye to deviate upward and inward, or of its fellow to deviate downward and inward; *hyperexophoria*, a tendency of one eye to deviate upward and outward, while the other deviates downward and outward. Perfect muscular equilibrium of both eyes is called *orthophoria*.

STRA'BO (Lat., from Gk. *Στράβων*, *Strabōn*) (c.64 B.C.–19 A.D.). A famous Greek geographer and historian, born at Amasia, in Pontus. He received his education first at Nysa, on the Meander, from the grammarian Aristodemus, and appears to have come to Rome, about 29 B.C., with the Peripatetic Xenarchus and the grammarian Tyrannion, whose pupil he had also been. In 24 B.C. he left Rome in the train of Aëlius Gallus, and traveled in Arabia. Returning to Rome in 20 B.C., he made it his home until his death. Yet during this latter period he must have undertaken great journeys, for he informs us that he had traveled from Armenia in the east to Sardinia in the west, and from the Pontus Euxinus on the north to the borders of Ethiopia. While we lack certain information with regard to these journeys, Strabo's scanty knowledge of events in Rome in the latter half of Augustus' rule gives basis to the conjecture that he was absent during this period, very probably at the court of Pythodoris, Queen of Pontus, of whom he makes frequent mention. Strabo is famous for his valuable *Geography*, extant in 17 books, of which books 1 and 2 deal with physical geography, 3 to 10 with the geography of Europe, 11 to 16 with that of Asia, and 17 with that of Africa. It is quite clear from internal evidence that the author did not complete his original plan. The sources of his knowledge were his own observations made during his journeys, and the earlier geographers, of whom the most famous were Eratosthenes, Artemidorus, and Apollodorus of Athens. For Spain and Gaul his chief sources were Polybius and Posidonius.

His other work, of which we have but scanty fragments, was his *History*, in 43 books, intended as a supplement to the work of Polybius. The first part sketched the history down to the period at which Polybius began; the latter treated in greater detail the history from Polybius to 27 B.C. The fragments of this work are published by Müller, *Fragmenta Historicorum Græcorum*, vol. iii. Consult also Otto, "Strabonis ʽΙστορικῶν ʽΥπομνημάτων Fragmenta," in *Leipziger Studien*, vol. xi (1889). The *Geography* is edited by Kramer (Berlin, 1844–52); Meineke (Leipzig, 1866–77). It was translated into French for Napoleon I by Coraës, Lebronne, and others (Paris, 1805–19); very valuable is the translation into German by Grosskurd (Berlin, 1831–34). There is an English translation by Hamilton in Bohn's Classical Library (London, 1887) and a translation of selections, with introduction, maps, and plans, by Tozer (Oxford, 1893). Another translation into English is under way in the Loeb Classical Library. Consult Christ-Schmid, *Geschichte der griechischen Litteratur*, vol. ii, part i (5th ed., Munich, 1911), and the article "Strabon" in Fr. Lübker, *Reallexikon des klassischen Altertums*, vol. ii (8th ed., Leipzig, 1914).

STRABO, WALAFRID. See WALAFRID STRABO.

STRACHAN, strạwn, JOHN (1778–1867). A Canadian Anglican bishop. He was born at Aberdeen, Scotland, and was educated at the city grammar school and at King's College, where he graduated in 1796. He emigrated to Canada in 1799 and opened a school at Kingston. Having decided to enter the ministry of the Church of England in Canada, he was ordained deacon in 1803, priest in 1804, and was made curate at Cornwall, where a school was established by him. In 1812 he removed to York (Toronto), of which he became rector, and, in 1827, archdeacon. Once a Presbyterian, he had become the outspoken champion of an Anglican state church in a province essentially democratic. Having rendered valuable government service in the War of 1812, he was appointed a member of the Executive Council in 1815 and of the Legislative Council in 1820. The special task he set for himself was the establishment of ecclesiastical control of higher education. With this intention he obtained in 1826–27 an English charter for the University of King's College, under full Anglican direction. This was a signal for other religious denominations to protest against their exclusion from government endowments. The dispute was for some years in abeyance, but the attempt in 1836 to proceed against the Clergy Reserves lands (see CANADA) in behalf of Episcopal rectories provoked an outburst of popular resentment against the whole fabric of oligarchical rule. The rebellion of 1837–38, in part the result of this educational policy, won responsible government for the province, with an implied equality of religious denominations before the law. Strachan, who was appointed the first Bishop of Toronto in 1839, did not accept the political consequences of that uprising, nor would he consent to a division of the Clergy Reserves, although the Anglican church was offered the largest share. In 1843 he established the University of King's College on a privileged basis. The question of religious and educational monopoly was then transferred to the politics of the new province of United Canada, and in 1849 King's College was reorganized as the University of Toronto, a provincial institution free of religious tests. Nothing daunted, the Bishop founded Trinity University, opened in 1852 under Anglican control; but legalized preference of any church was irrevocably lost. Strachan's public labors, which had been predominantly those of an ecclesiastical politician, were afterward restricted to episcopal duties, performed with energy and acceptability. Consult A. N. Bethune, *Memoir of Bishop Strachan* (Toronto, 1870); J. C. Dent, *Canadian Portrait Gallery* (ib., 1880); C. H. Mockridge, *The Bishops of the Church of England in Canada and Newfoundland* (ib., 1896).

STRACHAN, JOHN (1862–1907). A British Celtic scholar, born near Keith, Banffshire. He was educated at Aberdeen (1877–81) and Cambridge (1881–85), also spending a summer at Göttingen (1880) and a year at Jena (1883). In 1885 he was elected professor of Greek at Owens College, Manchester, and after 1889 he was also professor of comparative philology. In 1903, in coöperation with Kuno Meyer (q.v.), he founded the Summer School of Irish Learning at Dublin, in which he taught Old Irish during several vacations. Though at first Strachan devoted his attention to the classics—his edition of Herodotus (1891) is said to contain an account of the Ionic dialect superior to anything preceding it—his reputation rests distinctly upon his work in Celtic. His interests centred mainly on grammar and syntax, in which he was probably the leading authority. From 1893 to 1900 he published a long series of articles on the Irish verb and similar grammatical subjects in the Transactions of the Philological Society. His most important works include the *Thesaurus Palæohibernicus*, in collaboration with Whitley Stokes (q.v.) (2 vols., 1901–03); *Selections from the Old Irish Glosses* (1904; 2d ed., 1909); *Old Irish Paradigms* (1905; 2d ed., 1909); *Stories from the Táin*, a posthumous work edited by Kuno Meyer (1908); and *An Introduction to Early Welsh*, also posthumous (1909).

STRACHAN-DAVIDSON, James Leigh (1843–1916). An English classical scholar, born at Penrith. He was educated at Leamington College and at Balliol College, Oxford, and from 1907 was master of Balliol. He received the honorary degree of Doctor of Laws from the universities of St. Andrews and Glasgow. His publications include an edition of *Selections from Polybius* (1888); of Appian, *Civil Wars*, book i (1902); *Life of Cicero* (1901); *Problems of the Roman Criminal Law* (2 vols., 1914).

STRACHEY, strā'chĭ, John St. Loe (1860–). English editor and author, educated at Balliol College, Oxford. After 1884 he was actively engaged in journalistic work in London. The *Cornhill Magazine* was under his editorship in 1896–97, and subsequently he gained control of and edited the London *Spectator*. His publications include: *The Manufacture of Paupers* (1907); *Problems and Perils of Socialism* (1908); *The Practical Wisdom of the Bible* (1908); *A New Way of Life* (1909); *The Citizen and the State* (1913). Consult A. G. Gardiner, *Pillars of Society* (London, 1913).

STRACHEY, Sir Richard (1817–1908). A British soldier and administrator, born at Sutton Court, Somersetshire. He served in India from 1836 to 1850, lived in England for five years, and then returned to India, where he was connected with the public works department (1856–65) and was director general of irrigation (1867–71). In 1877–79 he was again in India to arrange for the purchase of the East Indian Railway. Between 1875 and 1889 he served as a member of the council of the Secretary of State for India. For his important investigations in the geology, botany, and physical geography of the Himalaya, he was made a fellow of the Royal Society in 1854, and in 1888–90 he was president of the Royal Geographical Society. He wrote *The Finances and Public Works of India* (1882), with his brother, Sir John Strachey, also an Indian administrator.

STRACHEY, William. Colonist and historian of early Virginia—a member of Gray's Inn, London. In May, 1609, he sailed for Virginia with Sir George Somers, and was wrecked on the Bermudas on July 28. Strachey wrote an account of the Colonists' adventures, widely circulated in manuscript before being printed in 1625, in Purchas's *Pilgrims*. In May, 1610, he reached Virginia, becoming secretary and recorder of the Colony. He edited the code of laws drawn up by Gates and Dale, commonly known by the latter's name. Returning to England in 1612, he began his *Historie of Travaile into Virginia Britannia*. It was first printed in 1849, by the Hakluyt Society of London. It is the most reliable single narrative of events during the Virginian period with which he deals. Besides the 1849 edition of the *Historie*, consult Alexander Brown, *Genesis of the United States* (Boston, 1891).

STRACHWITZ, shträG'vĭts, Moritz, Count (1822–47). A German poet, born in Peterwitz, Silesia, and educated for the law in Breslau and Berlin. His early death occurred in Vienna, while he was returning from Italy. His first volume, *Lieder eines Erwachenden* (1842), was mostly written while he was still in the Gymnasium. More typical is the collection posthumously published, *Neue Gedichte* (1847), with its sharp attack on Heine and the other revolutionists, its protests against the "Everlasting No," and its famous and popular lyrics, "Der Himmel ist blau" and "Germania." He wrote also some very good ballads. A complete edition of his poems appeared in 1850, and in Reclam's *Bibliothek* in 1878, Nos. 1009 and 1010. Consult Tielo, *Dichtung des Grafen M. von Strachwitz* (Berlin, 1902).

STRACK, shtrăk, Hermann Lebrecht (1848–). A German theologian and Oriental scholar. He was born in Berlin and was educated there and at Leipzig. In 1877 he became professor in the theological faculty at Berlin. Among his more notable publications are: *Prophetarum Posteriorum Codex Babylonicus Petropolitanus* (1875); *Einleitung in das Alte Testament* (6th ed., 1906); *Lehrbuch der neuhebräischen Sprache und Litteratur* (1884), with Siegfried; *Einleitung in den Talmud* (1887; 5th ed., 1911); *Hebräisches Vokabularium* (1889; 10th ed., 1914); *Das Blut im Glauben und Aberglauben der Menschen* (8th ed., 1900); *Grammatik des biblisch-Aramäischen* (5th ed., 1911); *Das Buch Jesus Sirach im hebräischen Texte* (1903); *Das Wesen des Judentums* (1906); *Jesus, die Häretiker und die Christen nach den ältesten jüdischen Angaben* (1910); *Berakhoth* (1914). He also published editions of several Mishna tracts; became editor of the *Porta Linguarum Orientalium* (Berlin), for which he wrote the Hebrew grammar (10th ed., 1911; Eng. trans., 1886); and, with O. Zöckler, editor of *Kurzgefasster Kommentar zu den Schriften Alten und Neuen Testaments* (Munich, 1886 et seq.). He prepared lexicons to the *Anabasis* (10th ed., 1908) and *Cyropædia* (2d ed., 1892) of Xenophon. From 1885 he edited *Nathanael*, a periodical devoted to Christian missionary work among the Jews; and from 1906 the *Jahrbuch der evangelischen Judenmission*.

STRADELLA, strä-dĕl'lä, Alessandro (c.1645–1681). An Italian composer, born in Naples. Of his life nothing is known beyond the story of his love affair, which, related by Bonnet-Bourdelot in his *Histoire de la musique et de ses effets* (1715), served as the basis of Flotow's opera *Stradella*. He was murdered in Genoa. His compositions include six operas, six oratorios, numerous cantatas and sonatas. The manuscripts of these works are in possession of various libraries in Italy, France, and England. Consult P. Richard, *Alessandro Stradella* (Paris, 1866); F. M. Crawford, *Stradella* (London, 1911).

STRADIVARI, strä'dē-vä'rē, or **STRADI-VA'RIUS**, Antonio (1644–1737). The most famous violin maker of the Cremonese school. He was born in Cremona, and was probably apprenticed at a very early age to Nicola Amati, at that time regarded as the greatest of Cremonese masters. His first instruments were made between 1670 and 1685 and were of the Amati model, in consequence of which they are usually described as Amatese Strads. They are distinguished by their lack of symmetry compared with his later work, their plain wood, and generally squatty design. About 1685 his originality began to assert itself, and by the following year he had acquired his own peculiar style, since largely used as a model. The period known as the long Strad period was from 1690 to 1700, and it may be pointed out that the instruments made then were not longer in design than those of the following years, from which they differed only in their treatment. The middle bouts, edges, and corners were longer and more graceful, and were possessed of a contour which has been described as a mingling of the feminine character of Nicola Amati's work and the masculine massive style of Stradivari from 1700 to 1737. In 1684 Nicola Amati died and bequeathed all his wood, models, and tools to Stradivari, thus providing the latter with a large and choice stock of tempered and seasoned wood, which was responsible for the improved quality of his later instruments. All the work of Stradivari was marked by minuteness of detail, high quality of material, and beauty of tone, which has a distinctly sympathetic quality. His violins must have numbered fully two thousand, although comparatively few specimens are now in existence. He died at Cremona. Consult A. Riechers, *The Violin and the Art of its Construction: A Treatise on Stradivari* (London, 1895; W. H. Hill and others, *Antonio Stradivari: His Life and Work* (2d ed., New York, 1909). See Plate of VIOLINS.

STRADIVARI, FRANCESCO (1671–1743). An Italian violin maker, the second son of Antonio. He was born at Cremona. He carried on his father's business, adopting Antonio's model of the period of 1700–1712, and produced instruments of a commanding style and an invariably good tone. Like his father, he was exceedingly careful in the artistic finish of his work, using wood of the finest quality and a rich red-brown varnish.—OMOBONO STRADIVARI (1679–1742), the fourth child of Antonio, was chiefly remarkable for his skill in repairing valuable instruments.

STRADONITZ, KEKULE VON. See KEKULE VON STRADONITZ.

STRAFFORD, THOMAS WENTWORTH, first EARL OF (1593–1641). An English statesman, born April 13, 1593, in London, of an old Yorkshire family. He was educated at St. John's College, Cambridge, and later (1607) became a student of the Inner Temple. He was married in 1611 and knighted in the same year, after which he traveled on the Continent. In 1614 his father died and he succeeded to the title of Baronet and to a large estate. He was a member of the last three Parliaments of James I. In the Parliaments of 1621 and 1624 he supported the crown against those who were trying to force England into a war with Spain. In the first Parliament of Charles I he opposed Buckingham, who had now adopted the same policy of war with Spain, yet he was not in sympathy with Eliot and the Puritans. In the Parliament of 1628 he became the real leader of the House of Commons, though no formal leadership was recognized then. He introduced a bill similar in tenor to the Petition of Right (q.v.), but containing no declaration that the law had been violated in the past. Charles, however, refused to accept it, and Wentworth, unwilling to resist the King further, allowed the opposition to pass into other and more hostile hands. He supported the Petition of Right and was then apparently satisfied that the ancient government of the Kingdom had been restored. In June, 1628, he was made Baron, on December 10 Viscount, and on December 25 President of the Council of the North. On Nov. 10, 1629, he was made member of the Privy Council. As President of the Council of the North he was the royal executive in that region and he exercised his authority vigorously in checking insubordination. His anti-Puritan sympathies had drawn him into intimate relations with Laud, which became life-long friendship. On Jan. 12, 1632, Wentworth was made Lord Deputy of Ireland and went to Dublin in July, 1633. His administration lasted six years. His task was difficult and his actions were often harsh, but on the whole beneficial. Trade and industry were encouraged, disorders suppressed, and Ireland enjoyed unprecedented prosperity. In 1639 Wentworth visited England. On Jan. 12, 1640, he was created Earl of Strafford, and thenceforth was the King's most influential adviser. Already the Scottish troubles had reached an acute stage. On account of long absence, Strafford failed to appreciate the changed temper of the English people. He advocated the strongest measures and hurried back to Ireland to raise money and troops for Charles. This was made the basis of his impeachment on the meeting of the Long Parliament. Charles promised him that if he would come to London to meet the charges he "should not suffer in his person, honor, or fortune." Inasmuch as the charges against him, even if proved, did not constitute treason as defined by the statute of Edward III, Parliament changed the impeachment into a bill of attainder, though Strafford was still heard in his own defense. His doom was sealed when Parliament discovered that Charles was plotting to rescue him by force. On May 8, 1641, the attainder bill was passed and on the 10th Charles, daring to resist no longer, signed it with Strafford's consent. Strafford was beheaded two days later.

Our estimate of Strafford's high personal qualities will always rest principally upon his own recorded words. They will be found in *The Earl of Strafford's Letters and Despatches, with an Essay towards his Life*, edited by Radcliffe (2 vols., London, 1739). Consult also S. R. Gardiner, *History of England, 1603–42* (10 vols., New York, 1883–84); H. D. Traill, *Lord Strafford* (London, 1889); *Papers Relating to Thomas Wentworth, First Earl of Strafford*, edited for the Camden Society by C. H. Firth (ib., 1890); Robert Browning, *Prose Life of Strafford* (Boston, 1892).

STRAIGHT, WILLARD DICKERMAN (1880–). An American financier. He was born at Oswego, N. Y., and graduated as B.Arch. from Cornell in 1901. From 1902 to 1914 he was resident principally in China and Korea, being connected with the Chinese Customs Service; correspondent of Reuter's Agency and the Associated Press; American Vice Consul General at Seoul; Consul General at Mukden, and representative in China for a group of notable American financiers. In 1908–09 he had been at Washington, as acting chief of the Division of Far Eastern Affairs in the Department of State. After his return from China (1914) he was for a time connected with J. P. Morgan and Company of New York, but in 1915 withdrew from that firm to study international law at Columbia University. In 1909 he was elected a fellow of the Royal Geographical Society of London, and in 1914 he became president of the American Asiatic Association. In 1915 he became vice president of the American International Corporation, formed to develop the foreign trade of the United States. He married a daughter of William C. Whitney (q.v.).

STRAIGHT COLLEGE. A coeducational college for negroes, founded at New Orleans in 1869 by Seymour Straight. It has an endowment of about $20,000, and is supported by voluntary contribution through the American Mission Association. The buildings and the grounds are valued at $10,000, and the library contains about 3000 volumes. The faculty in 1914–15 numbered 25, and the students in all departments about 570.

STRAIN, Isaac G. (1821–57). An American naval officer and explorer, born in Roxbury, Pa. He entered the navy as a midshipman in 1837, in 1845 was in command of an exploring expedition that penetrated into the interior of Brazil, and in 1848 explored Lower California. In 1849 he made the overland journey from Valparaiso to Buenos Aires, publishing an account of the trip entitled *The Cordillera and Pampa: Sketches of a Journey in Chile and the Argentine Provinces in 1849* (1853). He became a lieutenant in 1850, served with the commission to locate the boundary line between Mexico and the United States, and in 1854 was in charge of a party to survey and explore the Isthmus of Panama and report upon the best route for an interoceanic canal. In 1856 in the *Arctic* he made soundings in the North Atlantic Ocean to ascertain the feasibility of a submarine cable. Returning to Panama, he died there the following year. Consult Headley, *The Darien Exploring Expedition under Command of Lieutenant Strain* (New York, 1885).

STRAIT OF MESSINA. See Messina, Strait of.

STRAIT OF SURIGAO. See Surigao, Strait of.

STRAITS SETTLEMENTS. A British colony, consisting of the settlements of Singapore, Penang, and Malacca (Map: Siam, D 6). The settlement of Singapore includes, besides the island of that name, the Cocos or Keeling Islands (since 1903) and Christmas Island (1900). The area of the colony is about 1600 square miles. Aside from its strategic value, the colony is important chiefly for its large transit trade, which passes almost entirely through Singapore and Georgetown. The principal exports include tin, spices, gambier, rubber, gum, tapioca, copra, rattan, coffee, pineapples, and sago. The tin comes from the Federated Malay States. Large imports are rice, cotton piece goods, coal, opium, petroleum, tobacco, flour, and fish. The ports are free. Imports and exports in 1905 were valued at 332,234,000 and 282,961,000 Straits Settlements dollars respectively (the Straits Settlements dollar is worth 56.776 cents); in 1913, 484,163,000 and 388,930,000. Exclusive of native craft, shipping entered and cleared in 1913 was 27,125,000 tons, of which 15,251,000 tons British. Revenue in 1913, 12,398,000 dollars; expenditure, 10,469,000. The Governor is assisted by an executive council, and by a legislative council composed of ten official and eight unofficial members, nominated by the crown. The Governor is also High Commissioner for the Federated Malay States, High Commissioner of Brunei, and British agent for British North Borneo and Sarawak. The population of the colony, as constituted in 1911, was 1891, 518,758; 1901, 582,009; 1911, 722,075 (474,874 males, 247,201 females). The estimate in 1914 was 761,521, of whom 7945 were whites, 8679 Eurasians, and the remainder Asiatics; of the latter Chinese form a very large part. There is an extensive migration to and from China and India, chiefly coolies. The Straits Settlements were transferred from the government of India to the colonial office April 1, 1867. The capital is Singapore. See Malacca; Penang; Singapore.

STRAKOSCH, shträ'kōsh, Moritz (1825–87). An Austrian composer and pianist, born in Lemberg, Galicia. He was the brother-in-law and teacher of Adelina Patti. He was educated in music at Vienna, and came to America in 1845, where he won considerable success as a teacher and concert pianist. In 1856 he became an impresario and introduced many great musicians to the American public. He was the composer of several salon pieces for the pianoforte and one opera, *Giovanni di Napoli*, which had its first presentation in New York. He died in Paris.—Max Strakosch, brother of Moritz, succeeded him in the management of the various concerts and opera undertakings. He died in New York in 1892.

STRALSUND, shträl'zụnt. A seaport in the Province of Pomerania, Prussia, situated on the Strelasund, which separates the mainland from the island of Rügen, 149 miles by rail north-northeast of Berlin (Map: Germany, E 1). It is entirely surrounded by water. The natural strength of the place was greatly increased by formidable fortifications, which, however, were converted into promenades in 1873. Stralsund has narrow but regular streets, and many of the houses are finely gabled, giving the town a quaint and ancient appearance. There are three splendid Gothic churches erected in the fourteenth and fifteenth centuries. The handsome town hall contains a picture gallery, a collection of antiquities, and a public library of 73,000 volumes. There is a school of navigation. Stralsund is noted for its manufactures of playing cards. Oil, soap, machinery, arc lights, furniture, and bricks are also produced. There is considerable shipping and a large export trade, chiefly in grain, sugar, fish, and malt. The city, founded in 1209, was in the fourteenth century an important member of the Hanseatic League. The most notable event in its history was its eleven weeks' siege by Wallenstein during the Thirty Years' War (May–August, 1628). It was a possession of Sweden from the Peace of Westphalia (1648) to 1815, when it passed to Prussia. Pop., 1900, 31,083; 1910, 33,988.

STRAMO'NIUM (Neo-Lat., of uncertain etymology), Stinkweed, Jamestown Weed, Jimson Weed, Thorn Apple (*Datura stramonium*). A common weed of the family Solanaceæ. De Candolle refers it to countries bordering on the Caspian Sea; others regard it as coming from Northern India. It is a coarse, strong, vigorous, branching weed, from two to six feet high, with ovate-toothed or angled leaves, large funnel-shaped flowers followed by prickly globular four-celled pods containing numerous angular black seeds which are narcotic. All parts of the plant have a disagreeable smell. The leaves and seeds are used in medicine to some extent. A second species, *Datura tatula*, is taller and the stems are purple instead of green. Both species are extensively distributed in the United States. See Colored Plate of Poisonous Plants.

STRANAHAN, străn'â-*a*n, James Samuel Thomas (1808–98). An American contractor and philanthropist, born at Peterboro, N. Y. He was successively school teacher, surveyor, and trader, and then became a railroad contractor in Newark, N. J., gradually acquiring large interests in the companies by accepting stock as payment for construction. He removed to Brooklyn in 1844 and until his death was closely identified with the city's commercial expansion and public improvement. From 1860 until 1882 he served as president of the Brooklyn Park Commission, during which time he devised a system of parks and boulevards for the city. His greatest achievement was the planning and laying out in Brooklyn of Prospect Park, at the main entrance of which is a statue of Stranahan by MacMonnies.

STRAND. See KNOTTING AND SPLICING; ROPE.

STRAND, THE. An important business thoroughfare of London, so named because it led through the marshy land bordering the former banks of the Thames. It extends from Charing Cross to Fleet Street.

STRANDBERG, strănd'bărj', KARL WILHELM AUGUST (1818–77). A Swedish poet, born in Södermanland, and educated at Upsala and Lund. The greater part of his earlier writing was of a patriotic nature. His works show great purity of form and depth of patriotism. Under the pseudonym Talis Qualis he published *Sånger i pansar* (1845);. *Vilda Rosor* (1848); and his *Samlade vitterhetsarbeten*, edited by G. Ljunggren (5 vols., 1878). He translated Byron's *Don Juan* and selections from Molière.

STRAND PLANTS. See BEACH PLANTS.

STRANG, WILLIAM (1859–). An English etcher, engraver, and painter. He was born at Dumbarton, and was the pupil and assistant of Alphonse Legros at the Slade Art School, London. He first gained fame as a master of engraving in many mediums: etching, line and wood engraving, mezzotint, and silver and gold point. He also revived drawing on tinted paper in chalk and pencil (erroneously called the Holbein portrait) and later turned to painting. Although early influenced by Legros and also by Rembrandt, Strang's work is almost aggressively original. It shows him a skillful draftsman, with a fine sense of composition. Among varied subjects are the grotesque "Misery" and "War." His excellent portraits include etchings of Rudyard Kipling, Robert Bridges, and R. L. Stevenson, and oil portraits of Lord Fisher and John Masefield. Among his finest paintings are the "Love Song," "The Bath," and "A Bay in Brittany." His illustrations include those for Kipling's *Short Stories* (1901), and for *Don Quixote* (1903). He became a Royal Academician in 1906, and was one of the original members of the Royal Society of Painter-Etchers. Strang worked and exhibited not only in England, but in the United States and in Germany (gold medal, Dresden, 1897). Consult Frank Newbolt, *Etchings of William Strang* (London, 1907), and H. W. Singer, *William Strang: Zeichnungen* (Leipzig, 1912).

STRANGE, SIR ROBERT (1721–92). A Scottish engraver. He was born in Kirkwall, Orkney Islands, and was apprenticed to Richard Cooper, at Edinburgh, for six years. To gain the hand of Isabella Luminsden, he joined the Jacobite army, and after its defeat went, in 1747, to Rouen and studied under Descamps, and later to Paris, where he learned dry point under Le Bas. He moved to London in 1751, devoting himself to historical engravings, and in 1760 visited Italy, where he was made a member of the academies of Rome, Florence, and Bologna. During a subsequent stay in Paris he was elected to the French Academy, but on his return to London was refused membership in the Royal Academy. He was, however, knighted in 1787 for his engraving of West's "Apotheosis of the Royal Children." Strange's engravings are chiefly after the Italian masters, including Raphael, Correggio, Titian, and unfortunately many of the Eclectics. His masterpieces are "Charles I with his Horse," and "Charles I in his Robes," after Van Dyck. Though often defective in draftsmanship, his work is characterized by purity, breadth and vigor. Consult Dennistoun, *Memoirs of Sir Robert Strange* (London, 1855), and Charles Blanc, *L'Œuvre de Robert Strange* (Leipzig, 1848).

STRANGE, ROBERT (1796–1854). An American lawyer. He was born in Virginia; was educated at Hampden-Sidney College; studied law, and after his admission to practice, settled at Fayetteville, N. C. He served as a member of the North Carolina House of Delegates in 1822–23 and 1826, was judge of the Superior Court 1826–36, United States Senator 1836–40, and some time later Solicitor of the Fifth Judicial District. The Indian legends of the region about Fayetteville were attractively related in his novel, entitled *Eoneguski; or, the Cherokee Chief.*

STRANGE CASE OF DOCTOR JEKYLL AND MR. HYDE, THE. A story by R. L. Stevenson (1886). It illustrates the struggle between good and evil in a human soul. Dr. Jekyll, a physician, has learned to transform himself at will, by means of a certain drug, into "Mr. Hyde," a misshapen dwarf of debased propensities, who commits hideous crimes. An antidote, which restored Dr. Jekyll to his former character, finally fails him, and the baser nature rules.

STRANGLES (from *strangle*, Fr. *étrangler*, from Lat. *strangulare;* connected with Gk. *στραγγός, strangos*, twisted, Lat. *stringere*, to draw tight), DISTEMPER, or COLT ILL. An acute infectious disease of the horse, ass, and mule, most frequently observed in young animals, especially pure-bred, supposed to be due to *Streptococcus equi.* The animal seems dejected, has a capricious appetite, dry, staring coat, reddish eyes, and accelerated pulse and breathing. After about two days a cough and a nasal discharge are noted. A large puffy abscess is developed under the lower jaw, which opens later to the outside. Abscesses sometimes develop in other parts of the body. Light cases require little treatment except proper care and dieting, the opening of the abscesses, and the alleviating of fever when excessive. Consult: Leonard Pearson and others, *Special Report on Diseases of the Horse* (Washington, rev. ed., 1911); Hutyra and Marek, *Special Pathology and Therapeutics of the Disease of Domestic Animals*, vol. i (Chicago, 1912).

STRAN'GULA'TION. The mechanical constriction of the neck so as to prevent the passage of air and to suspend respiration, and consequently life. Strangulation may be produced by throttling or hanging. Death is sudden when the obstruction to respiration is complete but otherwise it is gradual in its onset. In hanging, especially in judicial executions where a long drop is used, death is probably due to fracture of the cervical vertebræ, with compression of the medulla oblongata, the seat of the nerve centre controlling respiration. When breathing has been interrupted for only a short time, and there is no mechanical obstacle to respiration, nor injury to the medulla, life may sometimes be restored by proper measures, such as artificial respiration, stimulant applications, and a plentiful supply of fresh air.

When death has taken place by hanging, proofs of this, concerning which medicolegal questions may arise, depend upon the position of the body when found, the presence of marks upon the neck, and of the signs of asphyxia in the internal organs, and the absence of any other possible cause of death. The mark on the neck is generally a hard, dry, yellowish, horny furrow running obliquely. The face is turgid, with bloodstained froth about the nostrils and lips; the tongue is swollen and protruding. The right side of the heart and the right lung are engorged with venous blood, while the left side is empty. See ASPHYXIA.

STRAN'GURY (Lat. *stranguria*, from Gk. *στραγγουρία*, *strangouria*, retention of urine). Painful, scanty urination, due to spasm of the urethra. It occurs after the use of cantharides or oil of turpentine internally (both of which are eliminated by the kidneys) or even after blistering with these agents. Acute posterior urethritis is a common cause, but inflammatory conditions of the bladder or prostate gland may bring on attack. Hot applications to the perineum, a hot sitz bath, hot enemata, or an injection of morphine will give relief. See RETENTION OF URINE.

STRANSKY, străn'skĭ, JOSEF (1872–). An American orchestral conductor, born at Humpoletz (Bohemia). He early studied medicine at the University of Prague. When he decided upon a musical career he went to Leipzig to study composition under Jadassohn. Subsequently he continued his studies in Prague and Vienna under Dvořák and Bruckner, and also had the good fortune of coming into closer relations with Brahms. He began his career in 1898 as first conductor at the Opera in Prague. From 1903 to 1910 he was conductor of the Opera at Hamburg, with frequent leave of absence to fill engagements as guest conductor (both in opera and in concert) in Germany, Austria, Holland, and England. In 1911 he was chosen to succeed Mahler as conductor of the Philharmonic Society of New York. So ably did he carry out the intentions and policy of his great predecessor, that after three seasons the Philharmonic Orchestra was regarded as the equal of the famous Boston Symphony Orchestra. He wrote an opera, *Beatrice and Benedict*, an operetta, *Der General;* symphonies; symphonic songs, and some chamber music.

STRAPAROLA, stră'pȧ-rō'lȧ, GIOVANNI FRANCESCO (?–c.1557). An Italian author, who was born at Caravaggio. Little is known of his life, and his name is only a sobriquet signifying loquacity. He published *Sonetti, strambotti, epistole, e capitoli* in 1508. He is remembered, however, for the 73 tales in his *Tredici piacevoli notti* (Facetious Nights) (Venice, 1550, 1554). This, one of the most amusing works of the *Decameron* type, is distinctive in the stress laid upon fantastic subjects and in inspiration from folk tales, such as the *Re Porco* and *Augellin bel verde*. Consult edition of his works by Gius. Rua (Bologna, 1898); *The Nights* (Eng. trans. by W. C. Waters (2 vols., London, 1894); Gius. Rua, *Tra antiche fiabe e novelle* (Rome, 1898); also J. C. Dunlop, *History of Prose Fiction* (2 vols., London, 1896).

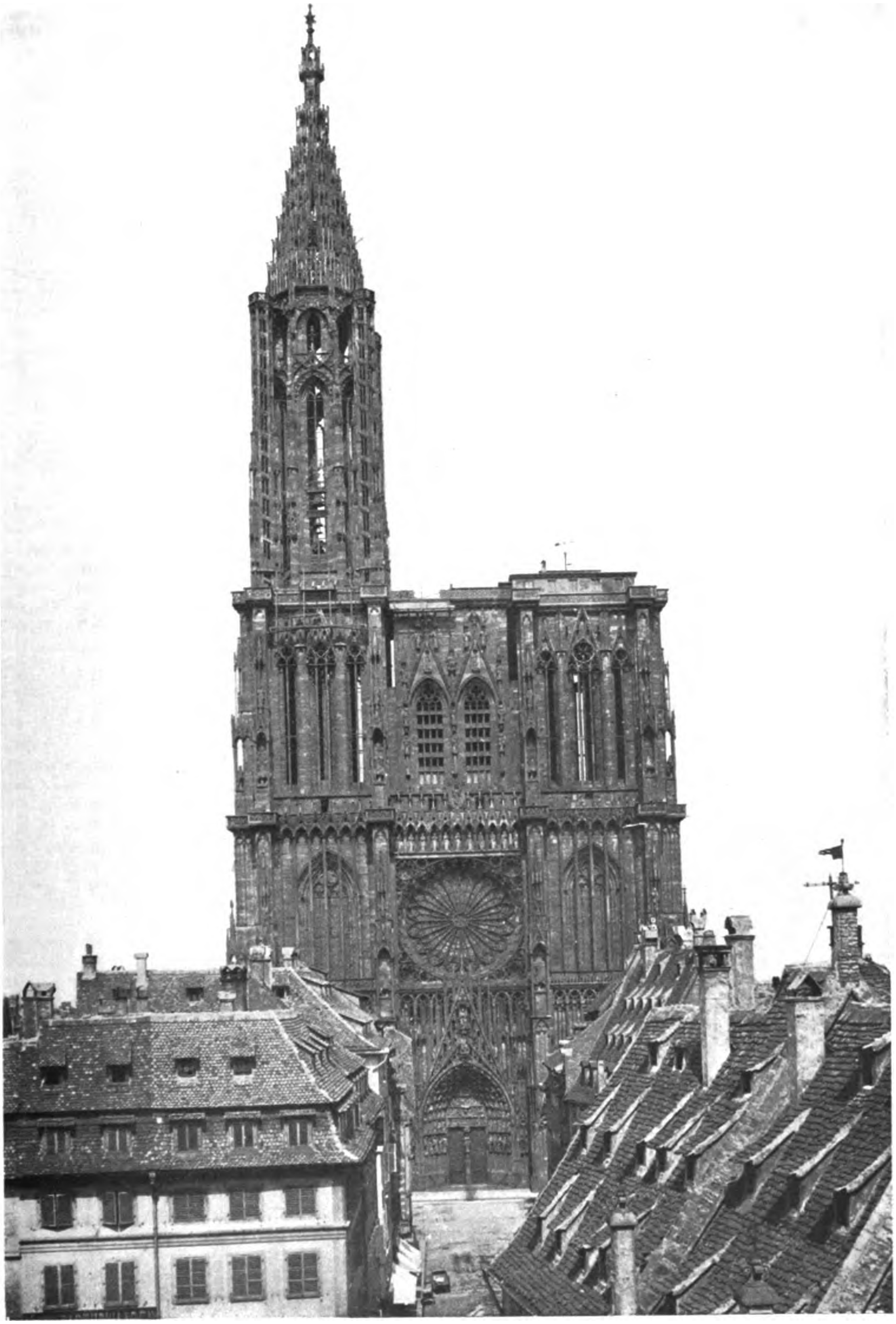
STRAP OYSTER. See COON OYSTER.

STRASBURGER, shtrȧs'bụr-gẽr, EDUARD (1844–1912). A German botanist, born at Warsaw and educated at Bonn and at Jena, where he became professor in 1869 and director of the botanical garden in 1873. With Haeckel he visited the East, and in 1881 he accepted a call to the University of Bonn. In his special field of histology of plants he wrote: *Die Befruchtung bei den Koniferen* (1869); *Ueber Zellbildung und Zellteilung* (1875; 3d ed., 1880); *Ueber den Bau und das Wachstum der Zellhäute* (1882); besides *Das botanische Praktikum* (1884; 3d ed., 1897); *Histologische Beiträge* (1888–1900); and, with Noll, Schenck, and Schimper, *Lehrbuch der Botanik für Hochschulen* (8th ed., 1906). Conjointly with Pfeffer he edited the *Jahrbücher für wissenschaftliche Botanik* (Berlin, 1894 et seq.).

STRASCHIRIPKA, stră'shē-rĭp'kȧ, JOHANN. See CANON, JOHANN.

STRASSBURG, shtrȧs'bụrk. A city of Germany, the capital of Alsace-Lorraine. It is situated at the junction of the Breusch and the Ill, 2 miles west of the Rhine, 28 miles east of the French frontier, and 88 miles by rail north of Basel (Map: Germany, B 4). The Ill divides into five arms in the city. Strassburg is a fortress of the first class. A circle of 14 forts and an inner rampart defend the city. The centre of the city forms an oval, and is surrounded by two arms of the Ill. Here, and especially in the quarter called "Alt' Frankreich," the streets are narrow and crooked, and the picturesque ancient houses and frequent specimens of pure mediæval architecture reflect a period when the city was both art-loving and wealthy. In this section, on the southeast, rises the structure for which Strassburg is best known —the cathedral, or minster. It is said to have been founded about 600. The Romanesque choir dates from 1176, the splendid Gothic nave from 1250 to 1266; the façade was completed in 1365, except the upper part and spire, which date from 1429 to 1439. The remarkable façade, the work of Erwin von Steinbach (q.v.), with its galleries and rose window, especially commands admiration. Noteworthy also are the late Romanesque south portal with its sculptures and the still more splendid west portals. The tower is 465 feet high. A scarcely less celebrated feature of the minster is its astronomical clock, the mechanism of which was constructed in 1839–42 to replace that of the famous clock of the sixteenth century. (See CLOCK.) Southwest of the cathedral is the Protestant church of St. Thomas, a Romanesque and Gothic edifice, begun about 1200. It contains a marble monument to Marshal Saxe by Pigalle. Near the cathedral is the old episcopal palace (1731–41), identified with the Rohans, and now containing the unimportant municipal art museum. In the Grosse Metzig (the market hall) dating from 1588 is the Museum of Industrial Art.

North of the Ill extend the handsome new quarters of the city, where, in the Kaiserplatz, may be seen the Imperial Palace (1889–93), in the modern German Renaissance style. It was designed by H. Eggert and has a cupola 115 feet high. The Hall of the Provincial Diet (1888–92) and the provincial and university library are near by. The library has some 1,020,000 volumes. Farther on in a northeasterly direction is the Contades Park. Some little distance east of the city, and reached by the Ruprechtsauer Allée, lie the beautiful municipal grounds of the Orangerie—a pleasure garden with Oriental features and beautiful promenades. Be-



STRASSBURG
THE CATHEDRAL

tween it and the city is the extensive arsenal. Strassburg has a statue of General Kléber, who was born there, and of Gutenberg; also a bust of Goethe, which marks the house where the poet lived as a student.

The university (see STRASSBURG, UNIVERSITY OF) is situated across the Ill in the southeastern part of the city, covering a large area with its various buildings. There are, in addition, the important Protestant Gymnasium (1538), the academy with its collections, a lyceum, a Roman Catholic seminary, a very fine municipal conservatorium of music, a mechanics' school of art, and an industrial art school. The municipal theatre is an admirable institution. The Frauenhaus contains an architectural and sculptural collection. The city archives are very valuable. The numerous excellent hospitals are mostly situated in the southern part of the city.

The city government is administered by the burgomaster, with six associates, and a council of 36 members. The city is divided into four cantons. Strassburg is commercially important, and a considerable part of the traffic between France, Germany, and Switzerland passes through the city. The Ill is canalized; the Rhine-Marne and other canals traverse the city; and Strassburg is a railway centre. The port covers upward of 300 acres, with wharves and quays on the Rhine. Strassburg has long been famous for its production and exportation of *pâtés de foie gras*, averaging $400,000 annually. Latterly manufactories have grown up to some extent and include foundries, locomotive works, tobacco factories, tanneries, piano factories, chemical works, etc. Much jewelry is manufactured. Pop., 1900, 151,041; 1910, 178,891, about one-half being Roman Catholics.

History. Strassburg is the Argentoratum of the Romans. A bishopric appears to have been established before the seventh century, when the name Stratisburgum began to be used. In 1262 its citizens threw off the yoke of the Bishop in a battle at Oberhausbergen. The city, free and independent, had reached a high degree of prosperity at the Reformation. The citizens embraced Protestantism at an early date (c.1523). In 1681 Louis XIV suddenly took possession of Strassburg, which was fortified by Vauban. It remained a French city until it became a part of the German Empire as a result of the Franco-Prussian War. It was an important military point under the French, and in 1870 held out against the Germans for over seven weeks under its gallant commander, Uhrich, who finally capitulated on September 28 with over 17,000 men. Great damage was wrought during the siege by the bombardment. Strassburg was bombarded by allied air craft during the Great War which began in 1914. See WAR IN EUROPE.

Consult: Gustav Schmoller, *Strassburgs Blüte* (Strassburg, 1875); Charles Staehling, *Histoire contemporaine de Strasbourg* (Paris, 1884); Eduard Förster, *Strassburg. die Hauptstadt des Reichslandes* (ib., 1894); Julius Enting, *Descriptive Guide to the City of Strassburg* (Strassburg, 1905; later editions in German and French).

STRASSBURG, GOTTFRIED VON. See GOTTFRIED VON STRASSBURG.

STRASSBURG, UNIVERSITY OF. A German university, the outgrowth of an earlier Gymnasium, formally founded by privilege of Ferdinand II in 1621. It flourished greatly in the seventeenth and eighteenth centuries, and, though Strassburg became French territory in 1681, the university retained much of its German character. Goethe and Herder studied here in 1770. It disappeared in the Revolution, rose again in 1802 as a Protestant academy, and in 1808 became part of the University of France by university reforms of Napoleon I. After the War of 1870 the institution once more became German and was reorganized as a university in 1872. It has since been greatly encouraged by the Imperial government as a centre of German influence and culture in reclaiming Alsace-Lorraine, and has been in a flourishing condition. Its budget amounted to 1,630,000 marks, and it had in 1913 about 2150 students. Its library contains more than 1,000,000 volumes. There are various institutes connected.

STRASSBURG PIE. See PÂTÉ DE FOIE GRAS.

STRASSER, shträs′ẽr, ARTHUR (1854–). An Austrian sculptor. He was born at Adelsberg, Carniola, and studied at the Vienna Academy and under Pilz, Tilgner, and Kundmann. He excels in small plastics, such as statuettes of Japanese jugglers and actresses and terra-cotta figures, often combined with animals, which, by skillful coloring, he succeeded in making impressively true to nature. These include the "Egyptian Snake-Charmer" and the "Hindu at Prayer." His figures in bronze, such as "Cleopatra" and "The Goose Girl," are equally lifelike. His chief monumental work is "Triumphal Chariot of Marcus Antoninus," before the Secession Building in Vienna, which won the Grand Prix at Paris in 1900. In this year Strasser became professor at the Industrial Art School, Vienna.

STRAT′EGY (Fr. *stratégie*, from Gk. *στρατηγία*, *stratēgia*, generalship, from *στρατηγός*, *stratēgos*, general). The word "strategy" has been variously defined. It is useful to recall some of the definitions, because their influence still subsists in some form. Thus, early in the nineteenth century strategy was held to be the science of the movements of an army at a distance from the enemy, while tactics was the same thing in the presence of the enemy, within gun range. Napoleon was apparently unacquainted with the word; he used the expression "hautes parties de la guerre" instead. Jomini defined the term as the art of all the operations in the theatre of war; for him tactics was the art of using troops in battle. Von Moltke, returning to the etymology of the word, called it the science of the commander in chief, indicating the best road to battle, while tactics tells us the best way of using troops in battle. As may be seen from these definitions, there seems to have existed in men's minds an appreciation of the difference between operations of war carried on over a wide theatre and more or less slowly and those condensed into a few hours of battle. Hence the instinctive classification of the whole subject of war into strategy and tactics. As a matter of fact, so complicated and varying are the elements, facts, and conditions of warfare that their exact division into, and inclusion within, the two great subdivisions in question are really impossible. War cannot be treated as an exact science, subject to rigorously formal definitions and rules. In the study of war to-day, two things are accepted almost generally: first, the *art of war;* and second, the business of giving this art concrete expression. The art of war breaks up into *strategy*, or the art of supreme command (in battle as elsewhere); and *tactics* (without any qualifier), or the method of employing troop units of all arms in subordinate situations (on the march, etc., as well as in battle). The "business of war" in its turn is concerned with the tactics of the various arms and departments of an army. See TACTICS.

The modern conception of what is meant by strategy leads to certain deductions. Thus it may be regarded as a constant force operative in peace as well as in war, for certainly the supreme command must take into account such factors as the habits, *morale*, and even temper, not only of a possible enemy, but of its own people. The financial condition of the country and of its possible adversaries must weigh very heavily in any plans under consideration, not only on the outbreak of war, but also as the war wears on. Many of these factors almost defy evaluation in advance; their evaluation may increase in difficulty once operations are undertaken. Moreover, in peace to a certain extent, and assuredly in war, the situation may vary, and so rapidly that no general solution offers or can offer itself. Lastly, now that wars are carried on, not by professional armies as formerly, but by the entire armed nation or people, the masses engaged from the outset are so vast that, once set in motion in accordance with a strategical plan formed in peace, it is almost impossible to shift the objective, should that plan be found on trial to be defective. This condition, more clearly than any other perhaps, proves, or tends to prove, that strategy, as defined above, is a force operative in peace as well as in war; that it is, in other words, a function of government at all times, as much so as the operations of the Treasury. War merely puts the plan or plans into execution; without terminating what may be called the peace business of strategy, it adds to it the concrete facts and realities of campaigns and battles, both on land and on the sea. These facts and realities are subject to principles so obvious and so simple as to be almost truisms; they cannot however be confined or controlled by set or fixed rules. But these principles of themselves lead nowhere; the entire difficulty resides in their correct application to circumstances and conditions as they develop. In war it will ever remain true "that everything is simple, but the simple is difficult."

The "peace business" of strategy, all important though it is, evidently cannot be made a subject of study or research in the same way as actual warfare; involving as it does national policy, perhaps secular in scope, it is, or should be, a matter of statesmanship affecting all the organic relations of the state. The case alters when we pass from peace to war; the strategic policy now finds expression in the facts and realities of campaigns, and these may very properly be investigated and analyzed. Only one method of investigation is recognized to-day as having any value, the historic, in which a profound study is made of complete campaigns, especially of those conducted by great captains in recent times. Complete campaigns must be taken, because only thus may effects be traced to their causes, in the determination of principles to serve as guides in like cases should they arise in the future. For modern purposes it is perhaps unnecessary to go back of the time of Frederick the Great; Napoleonic campaigns, it is needless to say, call for the profoundest study, for this reason, if for no other, that in them are to be found the germs of the modern strategy of national masses. We cannot here dwell on the methods either of Frederick or Napoleon. We may remark, however, as marking the evolution of the subject, that in the eighteenth century sieges played an important part in all campaigns. Thus, in the period 1701–35, 87 battles were fought and 366 sieges laid; i.e., it was not yet perfectly clear that the object of war is to beat the hostile army. From 1804 to 1815, if we leave Spain out of the account, we note 400 battles to 50 sieges. And although in the Great War that began in 1914 many fortified places fell to the Germans, it was nevertheless made absolutely evident that the great objective on all fronts was the destruction of the enemy's armies.

The actual business of destruction is a tactical matter, but the preparation and execution of plans, so as to make this destruction possible, is strategic; it is, to-day, the fundamental question of war strategy. Everything else is by comparison insignificant, for, if the enemy army is destroyed, his country is conquered, and with its fall go capital, provinces, and fortresses. Moreover, it is a condition of modern strategy that an army shall, if possible, deliver not only a crushing but a rapid blow as well, in contradistinction to the relatively slow and deliberate efforts of former days. Hence the existence of *general staffs* (see GENERAL STAFF), without which strategy, having in view the enormous masses engaged, would fail. Further, the characteristic rapidity of modern effort is determined wholly by transport facilities, such as rail and motor. To sum up, we have, as the elements with which modern strategy has to deal: plans laid in peace and involving national policy, finance, and commerce; a trained body of men to keep these plans up to date in peace, and to apply and execute them in war; armed masses coextensive, between certain limits, with the male population; and suitable transport to carry these masses to the theatre of operations and there to supply them. And since modern war is truly national in character, and the prize at stake is the very existence of nations, so is it the business of a state to-day to bring into play almost at once the sum total of the armed strength of the nation or nations concerned.

This implies the closest study of the questions of mobilization and formation of armies. If we imagine, as we may, the advanced guards of two opposing armies in contact immediately after the declaration of war, then this formation of armies, by the side assuming the offensive, takes on the character of a strategical deployment, adopted and prepared in advance with a view to the offensive. And since this plan once adopted is on the whole not susceptible of alteration should conditions change, or be found different from those assumed, it is easy to realize the gravity of the problem that strategy is called upon to solve even before a shot is fired, a gravity somewhat diminished perhaps to-day by the more or less exact knowledge each general staff possesses in respect of its possible adversaries. Thus the character of an enemy is known, the temper and quality of his troops, the nature of his armament, his resources in rail and other transport, the probable theatre of operations. If we place ourselves on the side compelled at first to remain on the defensive (e.g., France against Germany in 1914), then it becomes necessary to form some idea, in advance, of the manœuvres of the enemy. Here we touch on a fresh difference between modern strategy and that of a century ago. Whereas in olden days manœuvring could force an enemy either out of a position or to accept battle under unfavorable conditions, the vast masses of to-day have reduced its possibilities. Given an army whose numbers mount into the millions with their attendant supply and ammunition trains, operating on a relatively narrow front, itself broken by obstacles and the nature of the terrain, almost the only thing possible, it would seem, is to march straight ahead with the main body and leave to a wing the task of outflanking the adverse wing. But the general nature of this movement could at any past time almost certainly be anticipated, and to-day, thanks to the application of aëronautics, cannot hope to escape detection. If now we take into account the tremendous efficiency of modern weapons and the difficulties of the frontal attack, it follows (and this result was in a limited fashion predicted years ago) that the assailant must literally lay siege to his adversary. And in fact practice has bettered the precept. We had in France the spectacle of two enormous armies each virtually in a state of siege, and strategy silent. This result is very largely due to the intervention of aëronautics, which must therefore be counted in present and future wars, as an element tending to reduce the value of strategical manœuvring by generally lessening the possibility of deriving any practical results therefrom.

It is a characteristic of modern war conditions that a general in chief of a group of armies must of necessity leave to his subordinate generals a greater strategic initiative than was the case when he commanded practically only a single army and could deal directly with his corps commanders. He must give up the hope of seeing everything himself; his instructions have practically ceased to be orders and consist now chiefly in general directions. But whatever may be the changes wrought in strategy by present-day conditions, changes the full weight of which cannot as yet be accurately measured, it still remains true that the object of strategy is success in war, and that this success must be sought in delivering a decisive blow upon the main body of the enemy at its weakest point, by troops as superior to his as it is possible to have them at the moment.

As conditions of success, it should be recollected that the defensive gains no victories; that only the offensive promises positive results, and that every effort must be made to collect at the decisive moment all the available forces, because it is impossible to be too strong for a decisive battle. The principles of strategy apply, due allowance having been made for sea conditions, with equal force to naval warfare.

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STRATFORD. A town and suburb of London, in Essex, on the Lea, 4 miles east of St. Paul's (Map: London, D 8). It has a fine town hall and is the seat of various extensive manufactures. There are flour mills, distilleries, and chemical works. The prosperity of the town has increased through its connection with the Eastern Counties Railway and the extensive works the company established here. Pop., 1901, 44,825; 1911, 50,738.

STRATFORD. A city, port of entry, and the capital of Perth County, Ontario, Canada, on the Avon River, and a divisional point on the Grand Trunk Railway, 88 miles west-southwest of Toronto (Map: Ontario, D 7). The city contains five county buildings, a Provincial Normal School, a business college, a collegiate institute, and two parks. Grand Trunk Railway repair shops are located here. There is a variety of manufactures. Pop., 1901, 9959; 1911, 12,946.

STRATFORD. A town in Fairfield Co., Conn., 3 miles east-northeast of Bridgeport, which it once included within its limits, on the New York, New Haven, and Hartford Railroad (Map: Connecticut, C 5). There are manufactories of silverware, paint, brass goods, and wire-forming machinery. Pop., 1900, 3657; 1910, 5712.

STRATFORD DE RED'CLIFFE, Stratford Canning, Viscount (1786–1880). An English diplomat, born in London. George Canning's influence secured for Stratford in 1808 the secretaryship of the Embassy at Constantinople, under Adair, on whose resignation in 1810 Stratford Canning was made Minister Plenipotentiary. Here at a critical moment in the struggle against Napoleon, he negotiated the Treaty of Bucharest between Russia and Turkey in 1812. In 1814–18 he was Minister to Switzerland. In 1819 he was made Minister to the United States, where he was successful in the settlement of the questions arising out of the War of 1812. After various diplomatic services and a seat in the House of Commons, he went in 1841 as Ambassador to Constantinople. The most important event of his service at the Turkish capital was his diplomatic contest in 1853 with Prince Menshikoff, Russian Ambassador Extraordinary. The result of the struggle was a victory for Canning. He remained at Constantinople through the Crimean War and until 1858 and exerted great influence upon the Turkish government with regard to its foreign relations and inauguration of political reforms. He became peer in 1852, as Viscount Stratford de Redcliffe. He wrote some creditable verse. In 1881 extracts from his papers and correspondence were published, with a preface by A. P. Stanley, under the title *The Eastern*

Question. Consult also Stanley Lane-Poole, *Life of the Right Honourable Stratford Canning, Viscount Stratford de Redcliffe* (London, 1888).

STRATFORD-ON-AVON, -ā′von. A municipal borough and township in Warwickshire, England, 8 miles southwest of Warwick, on the Avon, famous as the birthplace of Shakespeare (Map: England, E 4). The town is neatly built, with wide, pleasant streets, containing numerous quaint half-timbered houses. The house in which Shakespeare was born is still preserved, and there is a Shakespeare memorial building, including a theatre and a gallery of Shakespearean paintings, and a library of rare Shakespeareana. The poet is buried in the parish church of the Holy Trinity, a fine cruciform structure partly early English and Perpendicular, dating from the twelfth century and built on the site of a Saxon monastery which existed before 691. Other interesting remains of Shakespeare's time are the grammar school endowed in 1482, in which he was educated, the guildhall, and the town hall. In the neighborhood at Wilmcote is the cottage of his mother, Mary Arden, and at Shottery, that of his wife, Anne Hathaway. Stratford is annually visited by 30,000 tourists, one-fourth of whom are from the United States, and to them is due the memorial clock tower erected in 1887. In 1916 a notable celebration of the tercentenary of Shakespeare's death took place at Stratford. This included a fortnight of performances by F. R. Benson's company in the memorial theatre. The town is an old free market borough with a governing charter since 1553. Pop., 1901, 10,600; 1911, 8531. Consult Sir Sidney Lee, *Stratford-on-Avon* (London, 1890), and Savage, *The Registers of Stratford-on-Avon* (ib., 1898).

STRATH′CLYDE′. A British kingdom which first appears prominently in the seventh century as one of the strongholds of the original Celtic inhabitants against the invading Anglo-Saxons. It lay in the western part of the island between the Clyde River and the Derwent in what is now Cumberland, though the name is sometimes applied to the entire territory between the Clyde and the Mersey. It was from an early time closely connected with the Scottish crown, to which it was united in the eleventh century. Consult Sir John Rhys, *Celtic Britain* (London, 1904).

STRATHCLYDE, ALEXANDER URE, BARON (1853–). A British statesman and jurist. He was born at Glasgow, Scotland, and was educated at Glasgow and Edinburgh universities. He was called to the Scottish bar in 1878. From 1895 to 1913, as a Liberal, he represented Linlithgowshire in the House of Commons. He was Solicitor-General for Scotland in 1905–09, Lord Advocate for Scotland in 1909–13, and in the latter year was appointed Lord President of the Court of Session and Lord Justice General for Scotland. Ure's intimate knowledge of the land question was of great assistance to David Lloyd-George and other members of Premier Asquith's administration in formulating their plans of land and social reform. Ure was made a member of the Imperial Privy Council in 1909, and became a life peer in 1914. Consult A. G. Gardiner, *Pillars of Society* (London, 1913).

STRATHCONA AND MOUNT ROYAL, DONALD ALEXANDER SMITH, first BARON (1820–1914). A Canadian capitalist, railway builder, and statesman. He was born at Forres, Morayshire, Scotland, was educated at the local schools, and went to Canada in 1838 as a cadet in the service of the Hudson's Bay Company. After 13 years in trading posts on the Labrador coast he was stationed in the Canadian Northwest, where he was promoted through various positions until he became successively Chief Factor, resident Governor, and Chief Commissioner. By his many journeys in summer and winter he acquired a familiarity with the geography and resources of the vast region throughout which the company's activity extended; while his intercourse with the various Indian tribes proved to be highly useful to the Canadian government. In 1869 he was appointed a special commissioner to inquire into the causes of the first rebellion led by Louis Riel (q.v.). The task was so wisely accomplished that Smith received the thanks of the Governor-General in Council. After the organization of the Province of Manitoba in 1870 he was elected in the same year a Conservative member of the Provincial Legislature, became also a member of the Council of the Northwest Territories, and afterward represented Selkirk in the Dominion House of Commons. He resigned his seat in the Manitoba Legislature in 1874 on account of the prohibition of dual representation, and retained his seat for Selkirk until 1880. At the time of the so-called Pacific Railway Scandal (see MACDONALD, SIR JOHN ALEXANDER) Smith (as he was then known) withdrew from the Conservative party, but gave it an independent support after its return to power in 1879. He sat again in the House of Commons for Montreal West in 1887–96, resigning in the latter year upon his appointment as High Commissioner for Canada in London, which position he held until his death. He was the chief promoter and builder of the Canadian Pacific Railway at a time when the linking of the provinces from the Atlantic to the Pacific coast was essential to the political life of the Dominion. He became a director of the Canadian Pacific in 1880 and in 1886 was knighted (K.C.M.G.) for his services, receiving in 1896 the G.C.M.G. His exceptional experience in Canada and the Northwest as banker and railway builder gave him a special authority in his office of High Commissioner, and his advice commanded respect on questions of imperial trade and communications. He was a delegate to several important British cable and commercial conferences in London, and enthusiastically supported Imperial Federation. He was elected president of the Bank of Montreal in 1887, chancellor of McGill University in 1889, chancellor of Aberdeen University in 1903, and later became lord rector of the last-named institution. He was either president of, or a director in, a large number of financial and industrial corporations; with Lord Mount Stephen he endowed the Royal Victoria Hospital at Montreal, to which he bequeathed $1,000,000. He also built and endowed at Montreal the Royal Victoria College for the higher education of women, gave to McGill University at various times over $1,000,000, and made other large benefactions. In 1897 he was raised to the peerage. He published *Western Canada Before and Since Confederation* (1897) and *The History of the Hudson's Bay Company* (1899). Consult Beckles Willson, *The Life of Lord Strathcona* (2 vols., Boston, 1915); W. T. R. Preston, *Strathcona and the Making of Canada* (New York, 1915).

STRATH′MORE′. In its most comprehensive sense, an extensive plain in Scotland (q.v.).

STRATH'NAIRN', Hugh Henry Rose, first Baron (1803–85). An English general born at Berlin, Germany. He served in 1840–41 under General Michell with the Turkish troops against Mehemet Ali; in 1841–51 was British agent in Syria; and became chargé d'affaires at Constantinople in 1852. During the Crimean War he distinguished himself at Inkerman, and was promoted to major general in 1854. In the Indian Mutiny he commanded the Central India field force, and gained a great victory on April 1, 1858, over Tantia Topi, with 20,000 men, and captured Jhansi, the strongest fortress in Central India, April 5; Kalpi, May 23; and Gwalior, June 19. For these services he received the thanks of Parliament, was gazetted a G.C.B., and in 1860 was promoted to be lieutenant general. He returned to England in 1865, and was soon after given command of the forces in Ireland, where he prevented the Fenian troubles from becoming formidable. In 1867 he was promoted to be general, and in 1877 became a field marshal. Consult Sir O. T. Burne, *Clyde and Strathnairn* (London, 1891).

STRATHROY, străth'roi'. A town in Middlesex Co., Ontario, Canada, situated on the Sydenham River and on the Grand Trunk Railway, about 75 miles west by south of London (Map: Ontario, D 8). It has a collegiate institute, armory, and park. Pop., 1901, 2933; 1911, 2823.

STRATHSPEY, străth'spā' (so called from *Strathspey* in Scotland). A rapid Scotch dance in $\frac{4}{4}$ time, somewhat resembling the reel (q.v.). Its music is composed of dotted eighths and sixteenths, and the dance itself is of a violent, abrupt character. It dates from the latter part of the eighteenth century.

STRAT'IFICA'TION (from *stratify*, from Lat. *stratum*, pavement, coverlet, neut. sing. of *stratus*, p.p. of *sternere*, to spread, extend, strew + *facere*, to make, do). The term used in geology to define the arrangement of certain rocks into more or less parallel layers. Stratification is a very general characteristic of sedimentary deposits, sandstone, shale, limestone, etc., which for the most part have accumulated on the shores of the sea and the beds of lakes and rivers. The rock materials in each layer are of homogeneous character, due to the uniformity of conditions during the time of deposition, but the passage from one layer to another may be marked by a change in the nature and size of the materials, indicating a variation in the process of deposition. The layers are separated by divisional planes which mark periods of interruption in the deposition. When the layers are very thin, as in shale, e.g., they are generally known as laminæ. A stratum is a group of one or more layers of the same mineral substance. See Geology.

STRAT'TON, Charles Sherwood (1838–83). An American dwarf, born in Bridgeport, Conn. Owing to his smallness of stature he was engaged by P. T. Barnum, and was exhibited under the name of Gen. Tom Thumb. He was about two feet high. In 1863 he was married to Lavinia Warren (q.v.), also a dwarf, and in company with Minnie Warren and "Commodore" Nutt, was widely exhibited.

STRA'TUM (Lat., pavement, coverlet, bed). The term applied in geology to the smallest subdivision of sedimentary rocks, practically synonymous with layer, seam, and bed. The distinctive characteristics of a stratum are homogeneity of composition and separation from adjacent beds or strata by well-marked divisional planes called bedding planes. A stratum represents a single uninterrupted period of accumulation, while the bedding planes are caused by longer or shorter pauses in the process. See Bed; Geology.

STRA'TUM VITEL'LIA'NUM. See Watling Street.

STRATUS. See Cloud.

STRAUBING, strou'bĭng. A town of Bavaria, Germany, 23 miles southeast of Regensburg, on the right bank of the Danube (Map: Germany, E 4). The late Gothic Church of St. James contains some notable paintings. The town has important manufactures of brick, lime, and cement. There are breweries and tanneries. Pop., 1900, 17,454; 1910, 22,021. Straubing stands on the site of the Roman colony *Sorbiodurum*. The present town dates from 1208, when Louis I erected the Stadt-Thurm, which is still standing.

STRAUS, strous, Isidor (1845–1912). An American merchant and publicist, brother of Nathan and Oscar S. Straus. He was born in Rhenish Bavaria, Germany, and came to the United States with his parents in 1854. In 1866 he joined his father in forming the firm of L. Straus & Sons, importers of pottery and glassware, in New York City. With his brother Nathan he became a member of the department-store firms of R. H. Macy & Co., New York, in 1888, and of Abraham & Straus, Brooklyn, in 1892. While a member of Congress (1893–95) he was active in drafting the Wilson Tariff Bill. He declined the portfolio of Postmaster-General offered him by President Cleveland. In 1908 he was president of the National Democratic Business Men's League. He was much interested in civil-service reform, in improving the condition of immigrants, in education (he was president of the Educational Alliance), and in various charities. With his wife, who refused to be saved without her husband, he was lost when the *Titanic* sank in 1912.

STRAUS, Nathan (1848–). An American merchant and philanthropist, brother of Isidor and Oscar S. Straus. He was born in Rhenish Bavaria, and in 1854 came to the United States with his parents. After graduating from Packard's Business College he was employed in his father's importing business, and later for many years was a member of R. H. Macy & Co. and Abraham & Straus department-store firms of New York and Brooklyn respectively. He served as park commissioner of New York in 1893, and as president of the New York Board of Health in 1898. He established and maintained in New York a system of distribution of sterilized milk for the children of the poor, and a system of coal depots, and in 1912 he established soup kitchens in Jerusalem, and also a health bureau to eliminate malaria in Palestine. He retired from the Macy firm in 1913, and devoted most of his time thereafter to his philanthropies in Palestine. He wrote *Disease in Milk, the Remedy, Pasteurization* (1913).

STRAUS, Oscar (1870–). An Austrian composer, born at Vienna. In his native city he studied composition with Herman Grädener, and then went to Berlin to Max Bruch. From 1895 to 1900 he filled various positions as theatre conductor (at Brünn, Teplitz, Mainz, Berlin). In 1901 he associated himself with

Ernst von Wolzogen (q.v.), Otto Bierbaum, and Franz Wedekind, furnishing the music for their sparkling comedies dealing with modern life and thought, which for some years enjoyed immense popularity. Among the best of his operettas are: *Die Lustigen Nibelungen* (1904); *Zur Indischen Witwe* (1905); *Hugdietrichs Brautfahrt* (1906); *Ein Walzertraum* (1907); *Der Tapfere Soldat* (1908), based on G. B. Shaw's *Arms and the Man* and presented with tremendous success in the United States as *The Chocolate Soldier; Das Tal der Liebe* (1909); *Rund um die Liebe* (1915). Works of another type include an overture, *Der Traum ein Leben;* a serenade for string orchestra; a violin sonata; an opera, *Columbine* (1909).

STRAUS, Oscar Solomon (1850–). An American diplomat and publicist, brother of Isidor and Nathan Straus. He was born at Otterberg, in Rhenish Bavaria, came to the United States in 1854, and lived in Georgia until the close of the Civil War. He graduated at Columbia in 1871 and at the Columbia Law School in 1873. Later he was associated with his brothers in the department-store firms of R. H. Macy & Co. and Abraham & Straus. In 1887–89 he was Minister to Turkey, and so distinguished himself that in 1897 he was reappointed to the same position by President McKinley, remaining in it till 1900. In 1902 he was named a member of the Permanent Court of Arbitration at The Hague to fill the place left vacant by the death of ex-President Harrison. Straus was Secretary of Commerce and Labor in President Roosevelt's cabinet (1906–09), Ambassador to Turkey (1909–10); Progressive candidate for Governor of New York; chairman of the arbitration commission that decided the wage dispute between the eastern railroads and their engineers (1914). In 1915 he was appointed chairman of the Public Service Commission (first district) of New York State. His published works include: *The Origin of the Republican Form of Government in the United States* (1885; 2d ed., rev., 1901); *Roger Williams, the Pioneer of Religious Liberty* (1894); *The Development of Religious Liberty in the United States* (1896); *Reform in the Consular Service* (1897); *United States Doctrine of Citizenship* (1901); *Our Diplomacy with Reference to our Foreign Service* (1902); *The American Spirit* (1913).

STRAUSS, shtrous, David Friedrich (1808–74). A distinguished German theological and philosophical writer, born at Ludwigsburg, near Stuttgart, Jan. 27, 1808. He was educated in the evangelical seminary of Blaubouren (where F. C. Baur was then teaching), whence he passed to the University of Tübingen. Here his religious convictions became disturbed. The theories of Schelling, of Jakob Böhme, and, finally, of Schleiermacher and Hegel successively claimed his allegiance. He left the university in 1830 to become assistant pastor of a small church and then taught in the seminary at Maulbronn. Here he remained but six months, and then went to Berlin in order to hear Schleiermacher and Hegel. The death of Hegel and Schleiermacher's apparent lack of sympathy determined him to quit Berlin after a very brief stay to take up the work of a "repetent" at Tübingen (1832). Here his lectures on Hegelianism attracted attention. His skepticism was now quite pronounced, since his view of Hegelianism, which he accepted as the final philosophy, made a miraculous Christianity impossible. His theory of the origins of Christianity was formulated in the work that made him famous, *Das Leben Jesu, kritisch bearbeitet* (1835–36; Eng. trans. by George Eliot, 1846), in which he sought to explain the gospel history on the mythical theory. The work aroused a storm of opposition, but nevertheless had a widespread influence. In consequence of his views he was removed from his position and given a subordinate place in the Lyceum of Ludwigsburg. From 1836 until his death Strauss lived a somewhat wandering life, holding no position, though he had accepted, in 1839, an appointment in the University of Zurich, which position, on account of popular opposition, he had not been permitted to fill.

After the publication of *Der Romantiker auf dem Thron der Cäsaren* (1847), a satirical criticism of Frederick William IV of Prussia, he was elected a member of the Württemberg Diet in 1848. But he was not sufficiently radical for his constituents and so resigned. His second chief work, *Die christliche Glaubenslehre in ihrer geschichtlichen Entwickelung und im Kampf mit der modernen Wissenschaft dargestellt*, was even more skeptical than his *Leben Jesu.* After the publication in 1848 of *Sechs theologisch-politische Volksreden* Strauss turned from theological to literary criticism and biography. He wrote critical biographies of Schubart (1849), Märklin (1851), Frischlin (1855), Ulrich von Hutten (1857; 6th ed., 1895), Reimarus (1862), and Voltaire (1870; 9th ed., 1907), the last a work of remarkable merit. Not until 1864 did he again turn to theology, when he published *Das Leben Jesu für das deutsche Volk*, following it in the next year by *Die Halben und die Ganzen* and *Der Christus des Glaubens und der Jesus der Geschichte.* His last work was *Der alte und der neue Glaube, ein Bekenntnis* (1872; 16th ed., 1904). In these last works Strauss gave up entirely the faith he once may have had in Christianity. Strauss's popularity was doubtless due as much to his clear and captivating style as to any logical force in his arguments. He died Feb. 8, 1874.

Consult: his *Gesammelte Schriften*, edited with an Introduction by Eduard Zeller (12 vols., Bonn, 1876–78); Zeller, *D. F. Strauss in seinem Leben und seinen Schriften* (ib., 1874); Hausrath, *D. F. Strauss und die Theologie seiner Zeit* (Heidelberg, 1876–78); Albert Schweitzer, in *Von Reimarus zu Wrede* (Tübingen, 1906; Eng. trans., *The Quest of the Historical Jesus*, New York, 1910); F. W. Nietzsche, in *Thoughts Out of Season*, part i (ib., 1910).

STRAUSS, Johann, the Elder (1804–49). An Austrian composer of dance music, born in Vienna. He received an imperfect musical education. In 1819 he was received into Pamer's orchestra, and four years later joined the celebrated Lanner Quartet as viola player. He subsequently became assistant conductor of Lanner's orchestra, but in 1824 started an independent organization, with which he played at various resorts, and through which he gave to the world the waltzes which made him famous. In 1845 he was appointed conductor of the court balls at Vienna. Conspicuous among the 152 waltzes which he published were the "Lorelei," "Gabrielen," "Taglioni," "Victoria," "Kettenbrücken," "Bajaderen," and the "Donau-Lieder." Both as conductor and as composer he succeeded in raising the dance form to an artistic plane before unknown. Consult F. Lange, *J. Lanner und Joh. Strauss* (Vienna, 1904).

STRAUSS, Johann, the Younger (1825–99). An Austrian composer, born in Vienna, son of the preceding. His father was averse to his adopting the profession of music, but, aided by his mother, he was enabled to secure instruction on the violin and in composition, and at nineteen years of age severed his home connections and secured an engagement as conductor of an orchestra at a popular restaurant in Hietzing. He used the opportunity to play his own waltz compositions and soon became widely popular. After his father's death he united both orchestras and began a concert tour through many European countries. From 1855 to 1865 he was the conductor of the Petropaulovski Park summer concerts in St. Petersburg, and from 1863 to 1870 was also conductor of the court balls. He composed nearly 500 dance pieces, which for the most part possess the highest merit, and became immensely popular, especially *The Beautiful Blue Danube* waltz. In their own field many of his operettas may be regarded as classic. They include: *Indigo* (1871); *Der Carneval in Rom* (1873); *Die Fledermaus* (1874); *Cagliostro* (1875); *Prinz Methusalem* (1877); *Das Spitzentuch der Königin* (1880); *Der lustige Krieg* (1881); *Eine Nacht in Venedig* (1883); *Der Zigeunerbaron* (1885); *Simplicius* (1887); *Ritter Pasman* (1892); *Fürstin Ninetta* (1893); *Jabuka, oder das Apfelfest* (1894); *Waldmeister* (1895); *Die Göttin der Vernunft* (1897); and a ballet *Aschenbrödel*. Consult L. Eisenberg, *Johann Strauss, Ein Lebensbild* (Leipzig, 1894); R. von Prochazka, *Johann Strauss* (Berlin, 1900); F. Lange, *Johann Strauss* (Leipzig, 1912).

His brothers, Joseph, who became leader of the Vienna orchestra in 1863, and Eduard, who assumed its direction in 1870, both did creditable work as musical conductors and composers of dance music.

STRAUSS, Richard (1864–?). A German composer, who became a dominating figure in his art. He was born in Munich, June 11, 1864. His musical talent showed itself at a very early age; indeed, when only four and a half years old he was receiving regular instruction on the piano. In his seventh year he wrote his first original composition, and before he had reached his eighth year he began the study of the violin with Benno Walter, the concertmaster of the Munich Court Opera. From 1875 to 1880 he studied composition and orchestration under court conductor F. W. Meyer. At the same time his father, the celebrated horn virtuoso Franz Strauss (1822–1905), influenced the boy's early development through systematic study of the classic masters. Together with this thorough musical training he enjoyed also the benefit of a liberal education at the Gymnasium, and subsequently attended courses in philosophy and æsthetics at the University of Munich. In 1885 he became assistant conductor to Bülow at Meiningen, and soon after the latter's resignation (in November of the same year) his successor. From 1886 to 1889 he was third conductor at the Court Opera in Munich. Becoming dissatisfied with the conditions prevailing at that time, he then accepted a call as court conductor at Weimar, where he remained till 1894. There he won such fame as composer and conductor that his native city once more secured him, this time as principal conductor ranking with Levi. Conditions, however, had not been improved materially, and he found it difficult to realize his intentions. Consequently he gladly signed a ten-year contract with the Royal Opera of Berlin in 1898. Liberal leave of absence allowed him to make extensive and very successful concert tours of Europe and also of the United States (1904). From 1901 to 1909 he was president of the Allgemeiner Deutscher Musikverein. In 1904 he was appointed Generalmusikdirektor. He married, in 1894, Pauline de Ahna, an excellent interpreter of his songs.

To the date of writing, the works of Strauss exhibit three distinct styles. The compositions of the first period (1880–87) show the influence of the classic and romantic masters. The more notable ones are: a string quartet op. 2; a sonata for cello, op. 6; a piano quartet, op. 13; a sonata for violin, op. 18; serenade for wind instruments, op. 7; a concerto for violin, op. 8; a concerto for horn, op. 11; a symphony in F minor, op. 12; a symphonic fantasy, *Aus Italien*, op. 16; *Wanderers Sturmlied*, op. 14, for chorus and orchestra.

Through the influence of Alexander Ritter (q.v.) the views of Strauss underwent a radical change, so that in his second period (1887–1904) he espoused the cause of programme music (q.v.). He took up and still further developed Liszt's idea of the Symphonic Poem, and became an innovator as regards harmony and orchestration. As yet he introduced no new instruments, but by employing a very large orchestral apparatus he succeeded in obtaining from existing instruments new effects and sound combinations of striking beauty. The themes are well defined, expressive and plastic, and their contrapuntal development and combinations attest the hand of the consummate master. The works exhibiting these splendid qualities are the great Tone Poems (Tondichtungen) *Don Juan* (1889), *Tod und Verklärung* (1890), *Macbeth* (1890), *Till Eulenspiegels Lustige Streiche* (1895). The second and fourth of these compositions mark to this day the zenith of Strauss's creative power. After *Eulenspiegel* begins a period of steady decline. Mere technical skill usurps the place of inspiration. The boundary lines between music and the other arts become more and more obliterated. The themes in the successive works lose beauty and power. Originality gradually degenerates into sensationalism. What characterizes these works as still belonging to the composer's second period is the fact that each work, despite all objectionable features, yet contains passages of transcendent beauty. But the effect of such moments is marred by the juxtaposition, without compelling necessity, of passages that sound unnatural, forced, grotesque, or repellent. The works in question are: *Also Sprach Zarathustra* (1896); *Don Quixote* (1898); *Ein Heldenleben* (1899); *Sinfonia Domestica* (1904). In spite of Wagnerian influences the two operas, *Guntram* (1894) and *Feuersnot* (1901), also belong to Strauss's second period. In both the excellent qualities of his style predominate.

The third period is represented by only two works, both dramatic, *Salome* (1905) and *Elektra* (1909). The style here exploited, one of hopeless decadence, is the natural evolution of all the objectionable features of the preceding period. The repulsive texts naturally determine the character of the music. Ugliness and cacophony reign supreme. Characterization becomes caricature; dissonance degenerates into discord; brutality usurps the place of force. Thematic invention is at its lowest ebb. Generally the instrumentation is so overloaded that it produces little effect, because of lack of sufficient contrast. Strauss's better nature seems to have realized how far he had strayed beyond the furthest boundaries of art, for his next work, *Der Rosenkavalier* (1911), marks a decided return to his own second style and to recognized standards. In *Ariadne auf Naxos* (1912) he yields once more to the temptation of being original at all costs. But, fortunately, he experiments here with the external dramatic form rather than with the music itself. With the *Joseflegende* (1914) Strauss successfully ventured upon the field of the ballet; while his return to purely instrumental music—the field of his greatest achievements—with his *Alpensymphonie* (1915) augured well for the future. Yet his latest works show all the characteristics of a transition period. There is a decided weakness of the inventive faculty as compared with his masterpieces *Tod und Verklärung* and *Till Eulenspiegel*, and he seems to rely on his stupendous technical skill to cover this defect as much as possible.

From the very beginning of his career, throughout all changes of style, Strauss cultivated the song; and with such success, that in his best productions of this kind he reaches the level of the greatest lyric masters. The texts are chosen with unerring taste, the declamation is faultless, the musical inspiration flows freely, naturally, without interruption. The composer is happiest in his settings of words demanding for their proper musical interpretation deep feeling or great emotional intensity. While it is, as yet, too early to attempt to fix Strauss's place in the history of music, certain facts may be stated without fear of contradiction: his place among the great masters of song is securely established; he has advanced the art of orchestration even beyond Wagner; the greatest of his Tone Poems mark the highest achievement in the field of programme music. The following list includes his more important works not already mentioned: *Festliches Præludium* for orchestra; the two melodramas *Enoch Arden* and *Das Schloss am Meer; Taillefer*, ballad for soli, chorus and orchestra; *Deutsche Motette*, for soli and 16 part a capella chorus; *Bardengesang*, for male chorus and orchestra. He also edited his father's compositions for Horn, Gluck's *Iphigenie auf Tauris*, and revised and enlarged Berlioz' *Treatise on Instrumentation*.

Bibliography. J. G. Huneker, in *Mezzotints in Modern Music* (1899); E. Urban, *Richard Strauss* (Berlin, 1901); id., *Strauss contra Wagner* (ib., 1902); W. J. Henderson, in *Modern Musical Drift* (New York, 1904); J. G. Huneker, *Overtones* (ib., 1904); O. Bie, *Die moderne Musik und Richard Strauss* (Berlin, 1906); Arthur Symons, in *Studies in Seven Arts* (New York, 1906); Felix Weingartner, in *Post-Beethoven Symphonists* (ib., 1906); E. Schmitz, *R. Strauss als Musikdramatiker* (Munich, 1907); E. Newman, *Richard Strauss* (London, 1908); M. Steinitzer, *Richard Strauss* (2d ed., Berlin, 1914).

STRAVINSKY, strȧ-vĭn′skĭ, IGOR FEDOROVITCH (1882–). A Russian composer, born at Oranienbaum. At an early age he began the study of the piano. In 1902 he met Rimsky-Korsakov, with whom he then took up the study of composition. He first attracted attention in 1908, when Siloti produced at St. Petersburg his *Scherzo Symphonique*, which at once proclaimed him a disciple of the extremists. New works followed in rapid succession, and in each he advanced beyond the preceding, so that he came to be regarded as the leader of Futurism—a cult which even the extreme impressionists hesitated to accept as legitimate art (see MUSIC, HISTORY OF, *Twentieth Century Tendencies*). His other works are: a symphonic fantasy, *Fireworks;* the ballets *L'Oiseau de Feu* (1910), *Petrouchka* (1911), *Le Sacre du Printemps* (1913); a string quartet, *Grotesques* (1915). An opera, *Le Rossignol*, after Andersen's fairy tale, was produced in Moscow in 1914.

STRAW, PAPER AND OTHER MANUFACTURES OF. Prior to the introduction of mechanically-ground wood pulp in the manufacture of newsprint paper, rags and straw were widely used. Objections to the use of straw fibres for paper were due to the brittle character of the paper. Straw pulp fibres are so short and narrow as to make the paper weak. To-day, however, straw is widely used in the manufacture of paper board, chiefly because of its low cost. The straw is stripped of undesirable elements when originally prepared, and therefore needs no extra process for the pulp-making machines, where it is boiled up with lime and made into half stuff, just as any other raw material in the pulp process. See PAPER.

Strawboard, the principal paper product of straw, is made by the Fourdrinier process of paper making, except that the pulp is taken from the vats by a revolving wire covered cylinder instead of by a traveling wire or screen. The cylinder presses the pulp against a heavy felt which absorbs the moisture and under pressure welds the fibres together.

Occasionally straw is used with other materials in the manufacture of higher grades of paper, but its presence can always be determined by a peculiar rattle to the sheet and also a predominating characteristic of translucency. When chemical tests are applied the straw fibres stain this paper a grayish blue. Microscopic examination shows the peculiar kinky nature of the fibres. In all essentials the straw process is the same as that of Esparto (q.v.) grass. Strawboard is the cheapest paper board available for binding and mounting purposes. The boards are cut usually in sizes of 30 × 25 inches and 32 × 22 inches, and are made up into bundles weighing fifty-six pounds, the number of boards to the bundle being determined by the weight of the individual boards. The production of strawboard in America amounts to about 175,000 to 200,000 tons annually. The United States census of manufactures for 1909 showed that the production in 1909 was 171,000 tons valued at $3,751,000. For Bibliography see PAPER.

STRAW BAIL. In old English law, the names of two or more fictitious persons entered on the records of a court as sureties for the appearance of a defendant in a civil action. In early times a defendant was first served with a summons, and if he did not appear he was considered to be guilty of contempt of court, for which the sheriff arrested him under a *capias*, and he was obliged to give bail for his appearance. Gradually, through the change of practice in serving only one process and the indulgence of the courts, this became a mere formality, and the fictitious names of John Doe and Richard Roe were entered as sureties. This was known as common or straw bail. This practice no longer prevails, but the name is retained to denote a financially irresponsible surety on a bail bond. See BAIL.

STRAWBERRY (AS. *strēawberie, strēawberige,* strawberry; perhaps so called either because the long stems resemble straws, or because of an old custom of stringing the berries on straws). Certain perennial herbs of the family Rosaceæ, widely distributed mostly in temperate regions throughout the world. The cultivated forms are all derived by the hybridization and crossings of three principal species, *Fragaria vesca, Fragaria virginiana,* and *Fragaria chiloënsis,* particularly the last named. The plants are low growing, have trifoliate leaves, white flowers either pistillate or polygamous, and numerous achenes on usually red, sometimes yellowish-white fleshy receptacles which constitute the edible part. The plants are hardy and may be grown in almost any region in America from Florida to Alaska. The varieties grown almost universally in America have a short season of fruitfulness, but several of the European varieties bear more or less continuously throughout the summer and early autumn. Nurserymen have been partially successful in developing strains of fall-fruiting strawberries. With the varieties thus far introduced the fruit is medium to small in size and the fall-bearing habit must be encouraged by removing all blossoms after the spring setting of fruit until after midsummer, when the fall crop is allowed to develop.

COMMON WILD STRAWBERRY (*Fragaria virginiana*).

Since young plants are most productive, the strawberry plantations are usually allowed to fruit only once, sometimes twice. The plants obtained from rooted runners are set in the field in spring or in late summer, and are allowed to form matted rows from their runners or are grown in so-called hills, in which case the runners are cut off, and the plants made to form stools. The former method is by far the most popular, but finer and larger individual fruits, though in smaller number, are obtained by the latter method. The land may be any rich soil suitable for corn or potatoes, and should have been in cultivation for at least one year, preferably two or three, previous to the planting of the strawberries, in order to be free from the larvæ of certain insects that feed on the roots especially of grasses. The plants are usually set at about 18 inches distance, in rows three feet apart, and given clean culture throughout the season. When the ground has frozen hard straw, marsh hay, or similar substance free from weeds is spread upon the plants as a winter mulch. This is raked between the rows when growth starts in the spring and allowed to remain to protect the berries from dirt during rains. Usually in the spring of the second year complete fertilizers are applied, but no cultivation is given. After the crop is gathered, the plants are usually plowed under in commercial practice, but may be fruited for several seasons in the home garden. Land cropped with strawberries should be planted to other crops for two or three years before strawberries are again planted.

The whole industry has been developed since the introduction, in 1834, of the Hovey strawberry, a variety which originated in Massachusetts. Since that date thousands of varieties have been introduced. Strawberries are cultivated to a small extent under glass to supply a demand for forced fruits in some cities.

The principal disease to which the strawberry plant is subject is the blight or rust (*Mycosphærella fragariæ*), which appears on the leaves as small purple spots which increase in size and become brown with purple margins. Serious losses may follow severe attacks. Since the disease is carried over winter in the old leaves, all such should be collected and burned and the young foliage protected by two or three sprayings of Bordeaux mixture or other fungicide (q.v.). A mildew (*Sphærotheca humuli*) sometimes appears on the leaves as a delicate cobweb which causes the crumpling of the leaves. It seldom causes much injury and is readily controlled as above indicated. A number of serious rots of strawberry fruits, which develop during shipment, were described by Stevens in 1915. Temperature control in shipment seems to be the only means for prevention of these rots. Consult: Fuller, *The Strawberry Culturist* (New York, 1897); Terry and Root, *A, B, C of Strawberry Culture* (Medina, Ohio, 1902); S. W. Fletcher, *The Strawberry in North America* (New York, 1915); as well as literature of the United States Department of Agriculture and the State experiment stations.

STRAWBERRY BLITE. See CHENOPODIUM.

STRAWBERRY BUSH. See SPINDLE TREE.

STRAWBERRY INSECTS. The principal insect enemy of the strawberry in the eastern United States is the strawberry weevil (*Anthonomus signatus*), which appears just before the blossoms expand, lays an egg in the bud usually of the staminate varieties or those pistillate varieties rich in pollen, and then punctures the stem so that in a few days the bud drops to the ground. The larva develops within the severed bud and after pupation emerges as a dull red or nearly black beetle, about one-tenth of an inch long. Both larvæ and adults feed upon the pollen. Covering the beds, cultivating pistillate varieties, and clean culture are the remedies recommended.

The larva of the strawberry leaf-roller, a small reddish brown tortricid moth (*Ancylis comptana*), rolls the leaves of the strawberry into cylindrical cases during June, becomes a chrysalis within the folded leaf, and appears as a moth in July. A second generation occurs during August. An arsenical spray is the remedy.

The strawberry sawfly (*Harpiphorus maculatus*), a small, black insect, lays its eggs in the substance of the leaf early in May. The pale green larvæ, which feed upon the leaves, and when full grown are nearly three-fourths of an inch long, burrow in the ground and form minute cocoons. A second generation appears in the late summer and hibernates under ground. Hellebore is recommended as a remedy. Consult: Saunders, *Insects Injurious to Fruits* (Philadelphia, 1889); Chittenden, *The Strawberry Weevil* (Washington, 1897); Slingerland and Crosby, *Manual of Fruit Insects* (New York, 1914).

STRAW CAT. See Pampas Cat.

STRAWWORM. See Wheat Insects.

STRAY. See Estray.

STREAM TIN. See Cassiterite.

STREATOR, strĕ′tor. A city in La Salle Co., Ill., 90 miles southwest of Chicago; on the Vermilion River, and on the Chicago, Burlington, and Quincy, the Chicago and Alton, the Wabash, the New York Central, the Chicago, Ottawa, and Peoria, and the Atchison, Topeka, and Santa Fe railroads (Map: Illinois, G 3). There is an attractive park in the heart of the city. Streator has important railroad interests, and is the centre of an agricultural region noted also for its deposits of coal and clay. Bottle and rough plate-glass works, foundries and machine shops, and manufactories of automobiles and accessories, sewer pipe, and brick and tile are the leading industrial establishments. Streator was settled in 1860, and was laid out in 1867. It was incorporated as a village in 1870, and organized as a city in 1882. Pop., 1900, 14,079; 1910, 14,253; 1915 (U. S. est.), 14,295.

STRECK, shtrĕk, Karl Maximilian (1873–). A German Semitic philologist, born at Pfarrkirchen, Bavaria. He studied at Munich, Leipzig, and Strassburg, taught successively at Munich, Berlin, and Strassburg, and in 1908 became professor of Semitic philology at Würzburg. His writings include: *Armenien, Kurdistan, und Westpersien nach Keilinschrift* (1898–1900); *Die alte Landschaft Babylonien nach den arabischen Geographen* (2 vols., 1900–01); *Keilinschrift Beiträge zur Geographen Vorder-Asiens* (1906); *Ueber der ältesten Geschichte des Aramäer* (1906); *Lexikalische Studien* (1908); *Die Inschrift Assurbanipals mit Nachfolgen* (1912).

STRECKER, Herman (1836–1901). An American entomologist, born in Philadelphia. He acquired considerable skill as a sculptor and designer, but his chief claim to distinction is due to his study of butterflies. His collection of these insects was the largest in America and one of the largest in the world. He published *Lepidoptera, Rhopalocera and Heterocera, Indigenous and Exotic* (1872–77) and *Butterflies and Moths of North America* (1878).

STRECKFUSS, shtrĕk′fōōs, Karl (1778–1844). A German poet and translator. He was born at Gera, studied law at Leipzig, and occupied high positions in the Prussian civil service. His original works, not important, include *Gedichte* (1823), *Neuere Dichtungen* (1834), and *Erzählungen* (1830), but he is best known as the translator of *Ariosto* (1818–20), *Tasso* (1822 and often), and *Dante* (1824–26; 9th ed., 1871; and Reclam, Nos. 796–800).

His son Adolf (1823–95), a novelist and historian, was the author of *Friedrich I und die Quitzows* (1859); *Vom Fischerdorf zur Weltstadt; 500 Jahre Berliner Geschichte* (last ed., 1899); *Weltgeschichte, dem deutschen Volk erzählt* (1865); and *Das einsame Haus* (1888).

STREET (AS. *stræt*, from Lat. *strata*, street, *highway*, fem. sing. of *stratus*, p.p. of *sternere*). The term as here used denotes a way for foot and vehicular traffic in cities and other more or less closely inhabited areas. Some points to be observed in planning a city's streets are as follows: The radiation from a principal centre, and sometimes subradiations from local centres. This will save time and distance, and afford opportunity for better artistic effects in the way of commanding central features, as public squares, monuments, buildings, vistas. Placing pipes and wires in underground galleries is a modern means for relieving overhead congestion. Much relief has been gained by placing wires in inclosed underground conduits accessible from manholes, or covered chambers placed sufficiently near together to render excavation unnecessary. See Subways.

In building sidewalks care must be taken to secure an unyielding, well-drained foundation, to prevent uneven settlement, cracks, or breaks. Boards or planks are generally laid crosswise of the walk, on longitudinal stringpieces, or timbers, designed to keep the boards off the ground and postpone decay. On account of this decay, wooden sidewalks are, in the long run, decidedly uneconomical, and flags, brick, concrete, artificial stone, or asphalt are to be preferred, their selection depending upon local conditions and economy. Curbstones are from four to six inches thick and deep enough to form the necessary rise above the gutter and to extend into the earth sufficiently to give a firm foundation. They are often set on broken stone, to insure good drainage, or on concrete, to give a solid foundation. They may be of stone or of concrete. Where concrete is used it sometimes extends so as to form the gutter as well, and has the upper and outer edge of the curb protected with an iron bar or rod, embedded in the concrete. Consult Robinson, *The Width and Arrangement of Streets: A Study of Town Planning* (New York, 1911). See Boulevard; City Planning; Electric Lighting; Electric Railways; Gas; Heating and Ventilation, *Central Heating Plants;* Pavement; Road; Road and Street Machinery; Sewerage and Drainage; Street Railway; Subways for Pipes and Wires; Water Works; etc., and references given in these articles.

STREET, Alfred Billings (1811–81). An American author, born at Poughkeepsie, N. Y. For many years he was New York State librarian. His poems deal with the sights and sounds of the woodland and the life of the more primitive days of the settlement of America. Among his books of verse are: *The Burning of Schenectady, and Other Poems* (1842); *Drawings and Tintings* (1844); and *Fugitive Poems* (1846). His chief prose works are: *Woods and Waters*

(1860); *The Indian Pass* (1869); *Lake and Mountain; or, Autumn in the Adirondacks* (1870); *Eagle Pine; or, Sketches of a New York Frontier Village* (1871).

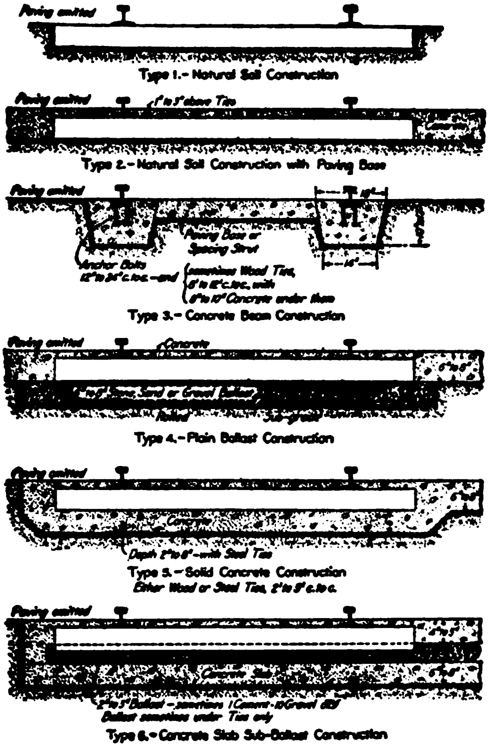
STREET, GEORGE EDMUND (1824–81). An English architect, born at Woodford, Essex. He studied under Sir George Gilbert Scott, from whom he got his partiality for the Gothic style and his talent in restoring mediæval monuments. He designed the theological college at Cuddesden, churches at Oxford and Liverpool, the Crimean Memorial Church at Constantinople, St. Paul's (American) Church at Rome, and the Law Courts in London—his largest and most criticized work. Among his restorations are the cathedrals of York, Bristol, and Carlisle, Jesus College Chapel, Oxford, and Wantage church. Among his writings are *The Brick and Marble Architecture of North Italy in the Middle Ages* (1855), and *Gothic Architecture in Spain* (1865; new edition, 1914), which are classics in their fields.

STREET, JULIAN LEONARD (1879–). An American author, born in Chicago. He was a reporter on the New York *Mail and Express* (now *Evening Mail*) in 1899, and had charge of its dramatic department in 1900–01. His writings, characterized by a rather obvious but yet a genuine humor, include: *My Enemy the Motor* (1908); *The Need of Change* (1909; 2d ed., 1914); *Paris à la Carte* (1912); *Ship-Bored* (1912); *The Goldfish* (1912); *Welcome to our City* (1913); *Abroad at Home* (1914), and contributions to magazines. In 1915 he published a book on Theodore Roosevelt, called *The Most Interesting American*.

STREET RAILWAY. A railway laid upon the public streets of a city or a town, and intended principally for the transportation of passengers. The street railway had its origin in the early tramways of Great Britain (see RAILWAYS), and such roads are still denominated *tramways* in all European countries. Street-railway cars are operated by electricity, either from a storage battery or from a trolley or conductors in a conduit, by cable, or are animal drawn.

A street railway was operated in New York City in 1831–32, on which a horse car, much like an old English stage coach in construction, ran from Prince Street on the Bowery to Yorkville and Harlem, following for some distance the route now occupied by the Fourth Avenue Railway, which still operates under the original charter granted in 1831. The road was known as the New York and Harlem Railroad, and it continued in operation as a horse-car line until 1837, when it was temporarily changed to a steam-car line. In 1845 the operation of the horse cars on the railway line was resumed, and it remained the only horse-car line in New York until 1852, when charters were granted for the Second, Third, Sixth, and Eighth Avenue lines. Street railways were first built in Boston, Mass., in 1856. Philadelphia, Pa., had its first line in 1857. The street railway was introduced into England in 1860 through the efforts of George Francis Train, the first line being started in Birkenhead opposite Liverpool. Roads were laid in Liverpool in 1868, in London in 1869–71, and afterward in Glasgow, Edinburgh, and Dublin. An authority (Dumont, *Automobiles sur rails*, 1898) says that the first horse tramway in France was built in 1856 on a line extending from Paris to Saint-Cloud, and was called the American railway; but that the first horse-car line in Paris itself was not built until 1875. Street-railway enterprises began to be taken up by the South American countries in 1866.

The street-railway rail of 1832 was a wrought-iron bar about 5 inches wide, with a groove from 1¾ inches to 2¼ inches wide and from 1 inch to 1½ inches deep, for the wheel flange. The wide and deep groove in this rail gave trouble by catching the wheel tires of ordinary vehicles and wrenching them. To remedy this fault the step rail was adopted. This consisted of a flat bar having a flat surface from 3 inches to 5 inches wide flanked by a ridge or tread about 1 inch high and 1¾ inches wide. This form of rail came into extensive use, especially in America. Another form of step rail had the tread in the centre flanked by a flat surface on each side. The next development was a return to the grooved rail, but with the groove wedge-shaped and narrow. These early forms of rails were simply iron bars spiked to the tops of longitudinal timbers. This timber was replaced by metal longitudinals, chairs, and supports of various sorts as experience suggested improvements, until finally the attempt of trying to maintain the tread or wearing surface of the rail separate from the supporting body was abandoned and the modern girder rail was originated. The girder rail consists of a base and web like the ordinary T-rail for railways, but has a wide grooved head. With the advent of the girder rail the former difficulty of insecure and uneven joints was largely decreased and at the same time a rail was developed which gave the necessary stiffness for carrying the rapidly increas-


Paving omitted
Type 1.- Natural Soil Construction
Paving omitted
1" to 5" above Ties
Concrete
Type 2.- Natural Soil Construction with Paving Base
Paving omitted
Paving Base or Spacing Strut
Anchor Bolts 12" to 36" c. to c.—and
sometimes Wood Ties, 5' to 12' c. to c., with 8" to 10" Concrete under them
16"
Type 3.- Concrete Beam Construction
Paving omitted
Concrete
6" to 8"
Stone, Sand or Gravel Ballast
Rolled Sub-grade
Type 4.- Plain Ballast Construction
Paving omitted
Concrete
Depth 2" to 8"—with Steel Ties
Type 5.- Solid Concrete Construction
Either Wood or Steel Ties, 2' to 5' c. to c.
Paving omitted
4" to 5"
Concrete Slab
6" to 8"
2" to 5" Ballast—sometimes 1 Cement-10 Gravel dry
Ballast sometimes under Ties only
Type 6.- Concrete Slab Sub-Ballast Construction

DIFFERENT TYPES OF STREET-RAILWAY TRACK CONSTRUCTION.

ing weights of cars which were made possible by the development of mechanical propulsion. The construction of modern street-railway tracks is shown in the diagram (page 589) from *Engineering News*, and is more fully described in the articles on ELECTRIC RAILWAYS and URBAN TRANSPORTATION.

The horse-drawn street car was the most common form of locomotion when street railways were first built in the United States. (There were horse-drawn street cars in New York City in 1916.) Later extensive installations of cable railways were made. With the development of the science of electricity it was found that cars could be operated much more cheaply by electricity than by cable. Cable cars are still in operation where street grades are so steep as to make electrical operation uneconomical. Thus in Seattle, Wash., which lies on a side hill, the cars running up and down hill are cable cars and the cars running along the side of the hill are electric cars.

In construction the cable railway consists of a standard street-railway track having an underground conduit between the rails. In this conduit there runs an endless wire rope cable guided by suitable pulleys. A slot at the top of the conduit permits a grip projecting downward from the bottom of the car to enter the conduit. This grip is provided at its lower end with jaws which can be so operated from the platforms of the car as to grasp and unloose the cable at will.

The accompanying table, which includes both urban and interurban street railways, shows that over 99 per cent of the mileage of the total is operated by electricity. For a description of interurban electric railways, see ELECTRIC RAILWAYS.

COMPARISON OF STREET-RAILWAY DEVELOPMENT 1890 TO 1912

(From the *United States Census Report*, 1912)

ITEMS	1912	1902	1890
Number of companies.	1,260	987	789
Total miles of track...	41,065	22,577	8,123
Electric............	40,808	21,902	1,262
Cable...............	56	241	488
Animal..............	58	259	5,661
Total employees......	282,461	140,769	70,764
Total passenger cars..	76,162	60,290	32,505

Urban electric railways are operated either with overhead trolleys or with the trolley wire put underground, the contact being made through a slot between the tracks, as with cable cars. For a description of the various types of cars and methods of operation, see URBAN TRANSPORTATION.

The distinguishing feature of the street railway is that it operates on public streets or highways and derives its franchise from the town or city in which it operates. In the larger cities it has been found necessary to put some of the passenger railways on elevated structures (see *Elevated Railways* under RAILWAYS) and some under the streets in subways. See PUBLIC UTILITIES, REGULATION OF.

Bibliography. Outside of the electric-railway field (see ELECTRIC RAILWAYS) there are few books of much value relating to street railways. There is available, however, a large volume of periodical literature of high class. Among the sources of information of this class the following may be consulted with advantage: *Reports of the American Electric Railway Association* (Chicago); the *Electric Railway Journal* (New York); the *Engineering News* (New York); and *United States Census Report on Central Electric Light and Power Stations* and *Street and Electric Railways* (Washington, 1912).

STREET-RAILWAY EMPLOYEES, AMALGAMATED ASSOCIATION OF. See RAILWAY BROTHERHOODS.

STREHLENAU, shtrā'le-nou, NIKOLAUS NIEMBSCH VON. See LENAU, NIKOLAUS.

STREITBERG, shtrīt'bĕrk, WILHELM (1864–). A German philologist, born in Rüdesheim, and educated at Münster and Leipzig, where he became docent in 1889. In the same year he was appointed professor of philology at Freiburg, Switzerland, a chair which he resigned in 1899 for a professorship at Münster. In 1909 he was appointed to the chair of Indo-Germanic languages at Munich. In comparative grammar he ranks close to Osthoff and to Brugmann. In 1892 he became editor of the *Anzeiger für indogermanische Sprach- und Altertumskunde*, the annual bibliography of the *Indogermanische Forschungen*, and of a series, entitled *Germanische Elementarbücher*, in 1896, in which he wrote "Urgermanische Grammatik" (1896; rev., 1903) and "Gotisches Elementarbuch" (1897; 4th ed., 1909). Other works by him are: *Zur germanischen Sprachgeschichte* (1892); *Entstehung der Dehnstufe* (1894); *Die gotische Bibel* (2 vols., 1907–10). After 1906 he edited, with Hermann Hirt (q.v.), the series entitled *Die indogermanische Bibliothek;* and from 1909 he was also one of the editors of the *Germanisch-Romanisch Monatsschrift*.

STRELITZ, shtrā'lits. A town in the Grand Duchy of Mecklenburg-Strelitz (q.v.), about 2 miles south of Neustrelitz. It was formerly the capital of the country. It has some manufactures. Pop., 1900, 4165; 1910, 4307.

STREL'TSI, STRELTZI, or **STREL'ITZ.** The Russian Imperial Guard, organized by Ivan IV in the second half of the sixteenth century. At that time and afterward they were the only standing force in Russia, and at times amounted to 40,000 or 50,000 men. They were stationed at Moscow in time of peace, in a special part of the capital. Incessant conspiracies rendered them in time dangerous. In 1698 a revolt of the Streltsi led to a bloody contest in which they were defeated. Peter the Great finally suppressed them (1705).

STREMAYR, shtrā'mīr, KARL VON (1832–1904). An Austrian statesman, born at Graz, where he also studied law, entered the government service, and subsequently was Attorney-General and docent at the University. In 1848–49 he was a member of the Frankfurt Parliament. In 1868 he was appointed councilor in the Ministry of the Interior, and in 1870–79 was Minister of Public Instruction, when he brought about the repeal of the Concordat of 1855. President of the Council after the going out of the Auersperg ministry in 1879, he entered the cabinet of Count Taaffe as Minister of Justice, but resigned in 1880, was appointed vice president and, after Schmerling's resignation in 1891, president of the Supreme Court. He retired in 1899. He was called to a seat in the House of Lords in 1889.

STRENGTH OF MATERIALS. The resistance which materials offer against deformation. Every force or load produces in the structure an internal resistance which balances it, and this internal resistance is called a stress. Three kinds of direct stress may be produced by load or force: a stress tending to pull apart, or tensile stress; a stress tending to push together, or compressive stress; and a stress tending to slide on parallel planes, or shearing stress. Complex stresses (flexure and torsion) are capable of being resolved into tension, compression, and shearing stresses. A unit stress is the stress per unit of area; the unit of area is the square inch in English-speaking countries and the square centimeter in countries where the metric system prevails. In cases of direct stress the total stress is supposed to be uniformly distributed over the area of the cross section. When a tensile or compressive force is applied to a bar of metal, it elongates or is shortened, and up to a certain limit the elongation or shortening is proportional to the load. Beyond this limit the elongation or shortening increases more rapidly than the load. The unit stress at which deformations begin to increase in a faster ratio than the stress is called the elastic limit, or less commonly the elastic strength. When the unit stress in a bar is less than the elastic limit, the bar returns, when the stress is removed, to its original dimensions. When, however, the unit stress is greater than the elastic limit, the bar does not fully return to its original dimensions, but a permanent distortion remains. Therefore, if a material is strained beyond its elastic limit, a permanent injury results to its elastic properties; and for this reason it is the universal practice in designing engineering structures to make certain that the unit stresses never exceed the elastic limit of the material, as it would then be in an unsafe condition and would finally break.

The unit stress which occurs just before rupture takes place is called the ultimate strength of the material. Ultimate strengths of materials are from two to four times as great as their elastic limits. Strength is determined by straining a piece of the material to rupture and observing the elastic limit, ultimate strength, and other phenomena.

Tension. In testing a material under tension a test piece or test specimen, usually 8 inches long and 1 square inch in section, is broken by direct pull. The loads are gradually applied. At first each increment of load produces a proportionate increment of elongation, but after the load has reached a certain amount the elongation begins to increase more rapidly than the load. The unit load recorded just as this change in the rate of deformation takes place is the elastic strength or elastic limit of the material. As the load increases the elongation increases more rapidly than the load and is commonly accompanied by a reduction in area of the cross section of the test piece. Finally the test piece breaks and its ultimate strength is recorded. Record is also taken of the total elongation of the piece and of the total reduction of area. These last two records are indices of ductility. These values vary greatly for different kinds of materials and considerably for different qualities of the same material. In printing figures for illustration, therefore, the best that can be done is to select rough average values. The following figures are taken from Merriman's *Strength of Materials:*

MATERIAL	Elastic limit, lbs. per sq. inch	Ultimate strength, lbs. per sq. inch	Ultimate elongation, per cent
Timber	3,000	10,000	1.5
Cast iron	6,000	20,000	0.3
Wrought iron	25,000	50,000	30.0
Steel	50,000	100,000	15.0

Compression. In testing for compressive strength the test piece used is short and thick, a cube and a short cylinder being common forms. The phenomena are substantially as in tension, first a distortion proportional to the load until the elastic limit is reached, and then a distortion increasing more rapidly than the load until rupture occurs. The manner in which rupture occurs is quite different from that in tension, where the material draws to a smaller diameter and finally parts by a ragged fracture at approximately right angles to the direction of the pull; in compression the test piece first bulges to an increased diameter and then ruptures with a fracture oblique to the direction of the pressure. This method of fracture occurs only when the test piece is thick compared with its height; when the height is great compared with the thickness, lateral flexure or bending occurs and the conditions of rupture are no longer those of simple compression, as it is explained in the succeeding paragraph on the strength of columns. As was the case with tension, only rough average figures of comparative strength can be given, owing to the fact that this strength varies for different materials and with different qualities of the same material. The following figures are quoted from Merriman's *Strength of Materials:*

MATERIAL	Elastic limit, lbs. per sq. inch	Ultimate strength, lbs. per sq. inch
Timber	3,000	8,000
Stone	.....	6,000
Cast iron	20,000	90,000
Wrought iron	25,000	50,000
Steel	50,000	120,000

Shear. Shear is the stress produced by two parallel forces acting on the material in opposite directions, as, for example, do the blades of a pair of shears. If a weight be suspended by a bar which is composed of two shorter bars connected at one end by a rivet or bolt passing through them, the stress brought upon the rivet is a shearing stress. The same stress is exerted by a punching machine in punching holes in metal plates. The shearing strength of materials often differs according to the direction in which shearing forces are exerted. The shearing strength of timber is much less along the grain than at right angles to the grain. The following figures taken from Merriman give the average ultimate shearing strengths of common structural materials:

MATERIAL	Pounds per sq. inch
Timber, longitudinal	500
Timber, transverse	3,000
Cast iron	18,000
Wrought iron	40,000
Steel	80,000

Actual Values. The figures given in the preceding tabular statements show rough average values, useful chiefly to be memorized as a basis for approximation. In careful designing the engineer requires actual values as determined by authoritative tests upon the particular material he is using or proposes to use. These values vary within quite narrow limits for each kind or quality of any material and within broader limits for all kinds and qualities of the same material. The ultimate average strengths of common structural timbers are as follows:

TIMBER	POUNDS PER SQUARE INCH	
	Tensile strength	Compressive strength
Hemlock	8,000	5,000
White pine	8,000	5,500
Chestnut	12,000	5,000
Red oak	9,000	6,000
Yellow pine	15,000	9,000
White oak	12,000	8,000

These values have been obtained by testing small pieces. Timbers of large size such as are actually used in engineering structures will fall from 20 per cent to 50 per cent below these values in strength. These values are also subject to a variation of about 25 per cent according to time of cutting, place of growth, and methods of seasoning. The shearing strength of timber is more variable than either the tensile or the compressive strength. The values average about as follows:

TIMBER	POUNDS PER SQUARE INCH	
	Along the grain	Across the grain
White pine	500	2,500
Chestnut	600	1,500
Yellow pine and oak	600	4,000

The elastic limit of timber is not well defined; it varies from one-third to one-half the ultimate strength in tension. The elongation at the point of rupture in tension is from 1 per cent to 2 per cent.

Tensile and shearing tests of brick are seldom made, but the compressive strength varies from 500 pounds per square inch for soft brick to 10,000 pounds for pressed brick, and to 15,000 pounds for the best qualities of hard-burned paving brick. Concrete, whether reënforced or not, varies in strength, depending upon its mixture and age. This will be found fully discussed under concrete (q.v.). The crushing strengths of the principal building stones of the United States are about as follows:

STONE	POUNDS PER SQUARE INCH	
	Minimum	Maximum
Trap rock	20,000	24,000
Granite	12,000	21,000
Marble	8,000	20,000
Limestone	7,000	20,000
Sandstone	5,000	15,000

Cast iron is so variable in quality that similar specimens will vary from 10 per cent to 20 per cent in strength. Fair average values are 20,000 pounds per square inch in tension and 90,000 pounds per square inch in compression. The elastic limit is poorly defined and the elongation is practically nil, indicating clearly the fact, known to every one familiar with this material, that it is a hard and brittle substance. A direct contrast to cast iron is afforded by wrought iron with a tensile and a compressive strength nearly equal and ranging between 45,000 and 60,000 pounds per square inch, and with an elongation of 20 per cent to 30 per cent and an elastic limit well defined at about 25,000 pounds.

Steel is manufactured in a variety of grades distinguished by the relative amounts of contained carbon, as mild steel, medium steel, hard steel, and extra hard steel. Ordinary structural steel for bridge and building construction has an ultimate tensile strength of from 60,000 pounds to 70,000 pounds per square inch and an elastic limit of from 30,000 pounds to 40,000 pounds per square inch. Nickel steel, or steel containing a small percentage of nickel, has been made with a tensile strength of 277,000 pounds per square inch and an elastic limit of 100,000 pounds per square inch. The later alloy steel is made with due regard to increased tensile strength, and for that reason the tonnage of such steel entering into structural work can be decreased or greater spans employed. The compressive strength of steel is always greater than its tensile strength. The maximum compressive strength recorded for hardened steel is 392,000 pounds or 196 tons per square inch.

The tensile strengths of the common metals are about:

MATERIAL	Pounds per sq. in.	MATERIAL	Pounds per sq. in.
Brass, cast	23,500	Gold wire	27,500
Brass wire	49,000	Lead, cast	2,050
Copper, cast	24,000	Lead wire	1,650
Copper wire	60,000	Platinum wire	56,000
Gold, cast	20,000	Aluminium	25,000

Common mortar composed of one part lime and five parts sand has a tensile strength of from 15 to 30 pounds and a compressive strength of from 150 to 300 pounds per square inch at the age of six months. Natural hydraulic cement will test from 100 to 200 pounds per square inch in tension when one month old, and Portland cement will test from 600 to 800 pounds per square inch at the same age. Mortars and pastes of cement and lime increase in strength with age.

Working Stresses. The loads carried by a structure should never strain the material to an amount at all close to its ultimate strength. Were they to do so the elastic limit of the material would be exceeded and distortion would ensue even though ultimate rupture did not occur. Therefore, in designing a structure a unit stress is adopted which is certain not to cause distortion or rupture, and the size of each member is determined by dividing this unit stress into the total load on the member. This assumed unit stress is called the working stress, and it varies for any material according to the character of the load it is to support. Thus the safe working stress for a varying load is less than for a steady load, and that for a sudden load or shock is less than for a varying load; a load producing tension and compression alternately requires the use of a smaller working stress than does a steady load or a varying load in tension only. In all cases the working stress must be less than the elastic limit of the material. It has long been the practice to call the ratio of the ultimate strength to the working stress the factor of safety. The factors of safety commonly employed for different materials and for different forms of load are thus given by Merriman:

MATERIAL	For steady stress (buildings)	For varying stress (bridges)	For shocks (machinery)
Timber	8	10	15
Brick and stone	15	25	40
Cast iron	6	10	20
Wrought iron	4	6	10
Steel	5	8	15

Resilience. One of the most important properties of a material is its capacity to resist the work of external forces, or its resilience. If a bar is placed in a testing machine and pulled by a force gradually increasing from 0 to F, and this pull produces an elongation equal to *e*, the work done on the bar is the product of the average pull into the elongation, or one-half F*e*. Since the internal stresses in the bar resist the work done by the external force, they must also perform an amount of work represented by one-half F*e*, and the measure of resilience of a material is the product of the average force exerted upon it multiplied by the elongation which this force produces. Elastic resilience is that internal work which has been performed when the internal stress reaches the elastic limit; ultimate resilience is that internal work which has been performed when the material is replaced. Resilience, like work (see WORK), is measured in foot pounds, or, more commonly, in inch pounds. The higher the resilience of a material is the greater is its capacity to resist the work of external forces. Cast iron has very low resilience and wrought iron and steel have high resilience.

Bending Stress. When a beam is loaded it is bent from its original form and takes a curved shape. The fibres on one side of a loaded beam are, therefore, shortened or compressed and the fibres on the opposite side are lengthened or subjected to tension. Midway between the sides, where compression ends and tension begins, there are fibres which are neither shortened nor lengthened, and this layer or surface of fibres is called the neutral surface. A simple beam is a bar resting upon supports at its ends and is the kind most commonly in use. A cantilever beam is a bar resting on one support at the middle, or if a part of a beam projects out from a wall or beyond a support it is called a cantilever beam. In a simple beam the lower part is under tension and the upper part is under compression; in a cantilever beam the reverse is the case. Beams almost universally fail by tearing apart under the horizontal tensile stress developed by bending. Mathematicians have calculated formulas for determining the resilience of beams to bending, the safe loads to be put on beams, etc., but a consideration of these is a matter of some intricacy and the reader is referred to the books mentioned at the close of this article for such information. From these studies, however, the following important laws regarding rectangular beams have been formulated: The strength varies directly as the breadth and directly as the square of the depth; the strength varies inversely as the length; a beam is twice as strong under a distributed load as under an equal load concentrated at its middle point.

Fatigue of Materials. When there is a decrease in the value of the breaking load with an increase of repetition there results what is known as the fatigue of material, first enunciated by A. Wöhler as a result of experiments in a law in which he stated that "ruptures may be caused not only by a force which exceeds the ultimate resistance, but by the repeated action of forces alternately rising and falling between certain limits, the greater of which is less than the ultimate resistance, the number of repetitions requisite for rupture being an inverse function both of this variation of the applied force and its upper limit." This condition can only be determined by an elaborate series of tests and experiments.

Strength of Columns. A bar under compression whose length is greater than about 10 times its thickness is called a column. Columns generally fail under stresses produced by combined compression and bending. The phenomena are very complex, and their investigation is a problem of great intricacy, for whose solution the reader must consult special treatises on the subjects. Full information as to strength and other properties will be found in the handbooks of the Carnegie Steel Company, the Bethlehem Steel Company, and other manufacturers which have been prepared for the use of engineers and architects. Columns are of three kinds: Class *a* includes those with hinged ends; class *b* includes those with one end hinged and one end fixed (the piston rod of a steam engine is a column of this type); class *c* includes those having both ends fixed, these being used in bridge and building construction. It has been found by experiment that class *c* is stronger than class *b* and that class *b* is stronger than class *a*.

Torsion. Torsion is that kind of stress which occurs when external forces tend to twist a body round an axis. A shaft which transmits power is twisted by the forces applied to the pulleys and thus all its cross sections are brought into stress. This stress is a kind of shearing, but the forces acting in different parts of a section are not parallel. Special formulas have been developed by engineers for calculating strength against torsional stress.

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STREPH'ON. In Sidney's *Arcadia*, a shepherd in love with Mania. In literature, a stock name for a lover.

STREPSIP'TERA (Neo-Lat., from Gk. *στρέψαι*, *strepsai*, aor. of *στρέφειν*, *strephein*, to twist + *πτερόν*, *pteron*, wing). A group of insects of rather uncertain rank and position, comprising the curious family Stylopidæ, and now thought to fall in the Coleoptera. The group consists of a small number of species, very singular in structure and habits, apparently forming a connecting link between Coleoptera and Hymenoptera. The species are all small, and in their larval state live parasitically in the bodies of bees, wasps, and certain Hemiptera, forming the genera *Stylops*, *Colacina*, and *Xenos*. The first infests bees of the genus *Andrena*, and *Xenos* occurs in a genus of wasps (*Polistes*). Bees that are carrying or have carried Strepsiptera are said to be stylopized, because the abdomen of the bee is deformed. These parasites do not cause the death of the host. When about ready to transform the larva pushes one end of the body out between two of the abdominal segments of its host. The metamorphosis of the female is very slight, while that of the male is complete. The male leads a short and extremely active life of a few hours only, or in some species of a day. The female never changes position and becomes little more than a sac filled with an enormous number of developing young. When the young emerge they are known as triungulins. How the triungulins find their way to the bee larvæ is not known. It is supposed by some writers that parthenogenesis occurs with the Strepsiptera, but there appears to be no definite proof. The Strepsiptera are also sometimes called Riphiptera.

STREP'TOCOC'CUS. See BACTERIA; PYÆMIA; SEPTICÆMIA.

STRÉPYAN. See PALEOLITHIC PERIOD.

STRESS. See STRENGTH OF MATERIALS.

STRET'FORD. A manufacturing town in Lancashire, England, 3½ miles southwest of Manchester (Map: England, D 3). Pop., 1901, 30,346; 1911, 42,496.

STRET'TO (It., bound). In music, a term which signifies that the movement to which it is prefixed is to be performed rapidly, with a gradual acceleration towards the close. The term "stretto" is also applied to the finale of a fugue, where the subject and answer enter so closely together that they overlap. See FUGUE.

STRICK'LAND, AGNES (1796–1874). An English historian, born in London. She was educated mostly at home under the direction of her father. After writing considerable verse and several historical tales for children, Miss Strickland planned a series of biographies of the Queens of England. In this undertaking she was helped by her sister Elizabeth (1794–1875). *The Lives of the Queens of England*, which historians do not take too seriously, appeared in sections between 1840 and 1848, and filled 12 volumes (rev. ed., 6 vols., 1864–65). Miss Strickland also published: *Letters of Mary Queen of Scots* (1842–43; complete ed., 5 vols., 1864); *Lives of the Queens of Scotland* (1850–59); *Bachelor Kings of England* (1861); *Lives of the Last Four Stuart Princesses* (1872); and a novel, *How Will it End?* (1865). Consult the *Life* by her sister Jane M. Strickland (Edinburgh, 1887), and *Pearls and Pebbles*, by another sister, Mrs. Catherine P. Traill (London, 1894).

STRICKLAND, HUGH EDWIN (1811–53). An English geologist. He studied at Oxford, and in 1850 became reader in geology at that university, succeeding Dr. Buckland, and retaining the post till his death. He was one of the founders of the Geological Society, and of the Ray Society, which, as a result of his influence, undertook the publication of Agassiz's *Bibliographia Zoölogiæ et Geologiæ*, three volumes of which he edited. He was associated with Sir Roderick I. Murchison in the recognition and study of the Silurian system.

STRICT CONSTRUCTIONISTS. In American politics those who maintain that the Federal Constitution should be construed strictly in accordance with its letter, as opposed to broad constructionists, who believe the Constitution should be construed liberally, and have claimed for the general government more or less extensive (implied) powers, not granted specifically by the Fundamental Law. Conflicts between the two groups have recurred frequently in the history of the United States, in controversies over the chartering of a United States Bank, over internal improvements, and over the power of the general government as to restriction or prohibition of slavery in Territories; and it is upon this that, directly or indirectly, party differences in the United States have been largely based. In this connection the decisions of Chief Justice Marshall were of the greatest importance in shaping the Constitution in its most plastic period. The strict constructionist view has been held by the Anti-Federalist and Democratic parties (qq.v.); the broad constructionist by the Federalist, National Republican, Whig, Free-Soil, and Republican parties (qq.v.); though there has been a tendency for the party in power to lean to broad or liberal construction, and for the party in opposition to lean to strict construction. Of recent years, however, this distinction has tended to disappear, and the Federal government has taken over the control of functions heretofore exercised by the States. A good example is seen in the powers of the Interstate Commerce Commission. See CONSTITUTION; UNITED STATES, *History*.

STRIC'TURE (Lat. *strictura*, from *stringere*, to draw tight). A contraction in the calibre of one of the mucous-membrane-lined tubular structures of the body, such as the urethra, the rectum, the œsophagus, or the larynx. The most common form of stricture and the variety generally referred to when the term is used alone is stricture of the urethra. Three varieties are recognized: (1) spasmodic; (2) inflammatory; and (3) organic. The first form is due simply to reflex muscular contraction caused by irritation of some portion of the urethra, as from an ulcerating spot or a sensitive organic stricture. The second form arises from simple inflammatory swelling of some portion of the urethral tract, such as occurs in acute gonorrhœa or after the internal administration of such drugs as cantharides and oil of turpentine. The third, and most frequent variety of stricture, is caused by permanent changes in the tissues of the urethra and those surrounding it. These changes usually consist either in inflammatory thickening of the urethral wall and periurethral tissues or else in actual cicatrization and narrowing of the channel from the accompanying contraction; or both of these conditions may be present at the same time. The initial causes in bringing these changes about are chronic urethritis (*gonorrhœa*) or injuries by caustic or irritant substances.

The results of stricture of the urethra if allowed to persist are often far reaching and disastrous. The bladder, ureters, and kidneys may in turn become the seat of disease from the continued retention of urine, which, unable to find free exit, undergoes decomposition and infection with pus germs; or rupture of the urethra may occur from prolonged retention, allowing extravasation of urine into the surrounding tissues, with death resulting from uræmic poisoning.

The treatment of organic stricture of the urethra is mainly mechanical. It consists in dilation of the contracted area by means of sounds or bougies, and where this method is inapplicable divulsion of the stricture by means of suitable cutting instruments is indicated. After division of the stricture the lumen of the urethra is kept open to the proper degree by the subsequent periodic passage of a sound. Consult Jacobson, *The Operations of Surgery* (6th ed., by R. P. Rowlands, New York, 1915).

STRIEGAU, shtrē'gou. A town in the Province of Silesia, Prussia, 25 miles by rail southeast of Liegnitz (Map: Germany, G 3). Leather products, cigars, sugar, brushes, and whips are the principal manufactures. Basalt and granite are mined in the vicinity. Pop., 1900, 12,858; 1910, 14,587.

STRIGEL, strē'gel, BERNHARD (c.1461–1528). A German portrait and historical painter of the Swabian school, the most important of a family of artists established at Memmingen. He was born at Memmingen and was probably a pupil of Zeitblom at Ulm. He stood in high favor with the Emperor Maximilian I, in whose service he repeatedly journeyed to Augsburg, Innsbruck, and Vienna. His religious paintings, which include four altar wings with scenes from the "Life of the Virgin," in the Berlin Gallery, and 10 paintings illustrating the "Genealogy of Christ," in the Germanic Museum, Nuremberg, are historically interesting, but of less artistic value than his portraits, which, though detailed, are ably handled and luminous in color. Notable examples are those of Konrad Rehlinger (1517), Pinakothek, Munich; "Councilor Cuspinian and Family" (1520), Berlin Museum; "Count John of Montfort," at Donaueschingen; "An Unknown Lady," Metropolitan Museum, New York; and portraits of Emperor Maximilian, in the Strassburg, Munich, and Vienna galleries.

STRIGEL, VIKTORIN (1524–69). A theologian of the Reformation period. He was born at Kaufbeuren, Swabia, studied under Melanchthon in Wittenberg, and became professor at Jena in 1548. He became involved in the synergistic controversy (see SYNERGISM) and was imprisoned for several months in 1559. Ultimately he was forced to leave Jena, and went to Leipzig, where he was charged with holding Calvinistic views (1562), and later to Heidelberg (1567). His chief work was the *Loci Theologici*, published posthumously (1581–84). Consult J. C. T. Otto, *De Victorino Strigelio* (Jena, 1843), and Döllinger, *Die Reformation*, vol. iii (Regensburg, 1848).

STRIGONIUM. See ESZTERGOM.

STRIKE (AS. *strican*, to advance quickly, Ger. *streichen*, to stroke, Goth. *striks*, stroke; connected with Lat. *stringere*, to draw tight). A term used in geology to indicate the line of intersection of a stratum with the plane of the horizon, the strike thus being at right angles to the dip. The line of strike coincides with the outcrop when the surface of the ground is level, or when the dip is vertical. If the dip is constant in one direction, the strike will be a straight line; but with a gradually changing dip, as from south through southeast to east, the strike will be a curve. In the case of a quaquaversal fold it is a complete circle. See DIP.

STRIKES AND LOCKOUTS. A strike, in industry, occurs when there is a cessation of work on the part of a body of employees acting in concert to enforce some demand upon the employer, or to resist some demand of his. The employees are here assumed to take the initiative in ceasing work. When, on the other hand, the employer shuts down his establishment in order to compel workmen to comply with some demand, it is called a lockout.

Certain popular movements in the Middle Ages bear resemblance to strikes, such as the disturbances in England in the second half of the fourteenth century. More like the modern strikes were the contests between different guild (q.v.) organizations, or between journeymen and guildsmen, in both English and continental towns. But as a social problem, as a frequent and apparently enduring feature of the industrial system, strikes belong to the nineteenth and twentieth centuries. The strike has usually been an essential part of the policy of trade unions (q.v.). The existence of the union as the directing agency of a strike has been the chief means in transforming local, half-insurrectionary outbreaks into carefully planned attempts to attain well-recognized ends.

The causes of strikes are manifold, but they chiefly concern the wage question. In prosperous times strikes for increase of wages occur; in times of depression, against a decrease. Demand for a reduction of hours is a frequent cause. They come also for the enforcement of union rules, for recognition of union against nonunion men, and in sympathy with strikes in other trades. The strike is often the first weapon employed by a newly organized body of laborers to strengthen their position. The sympathetic strike has not generally proved advisable, and is regarded with disfavor by some unions. To avoid or put down strikes employers may form organizations or use the lockout. They have at times been accused of instigating violence in order to bring the strike into public disfavor and obtain the aid of troops. On the employees' side boycotting (see BOYCOTT, BOYCOTTING) and picketing of all sorts are apt to occur in a serious strike. The bitter feeling against men who refuse to strike or who come to take strikers' places often makes the more peaceable forms of persuasion end in intimidation or violence. Public sympathy is an almost essential element in the success of any large strike, and is likely to be alienated by violence or the destruction of property. This is well realized, but when disorder or riots occur—often due to a semicriminal floating population—the public may probably fail to lay the blame elsewhere than on the strikers. The magnitude of some strikes in important industries has emphasized the harm done to general business, and the interest which the public has in labor disputes as a third and impartial party. Conciliation and arbitration have come prominently forward as remedies for strikes. In 1888 a Federal law provided for the appointment by the President of strike commissioners in disputes involving interstate commerce, and the Chicago Strike Commission recommended a permanent commission on the subject. The improved organization of trade unions, their increased responsibility, and the use of the trade agreement may lessen the waste of strikes in the future.

Legal Aspect. Any combination of laborers to raise wages was illegal in England until 1824 and in France until 1864. In the United States strikes as such have never been illegal, but until after 1830 it was not definitely settled that strikers could not be arraigned for civil and criminal damages under the conspiracy laws. When a strike represents a combination to injure property or a definite person it is illegal, and the same is true of acts of intimidation, the destruction of property, or the forcible prevention of work. Some forms of sympathetic strikes and of the boycott have been held illegal. Riots are covered by the criminal law. In many States there are special statutes regarding strikes. Thus the common law of conspiracy has been expressly repealed in New York, Pennsylvania, New Jersey, and several Western States, but the statutes usually provide for punishment of the use of force or intimidation. Certain States have special laws regulating strikes on railways or in mines, a few make the municipality or county responsible for damages due to strikes, while Missouri and Wyoming forbid the employment of private officers from without the State for the protection of the employer's property against violence on the part of the strikers. The use of injunctions has been regulated by statute only in Kansas. A difficult question is often involved in determining how far workmen may go in persuading others to join a strike. A leading case is that of the Northern Pacific Railroad (Arthur *vs.* Oakes, 63 F. R., 310), in which the employees were enjoined from (1) intimidating, (2) persuading others to strike, or (3) combining to strike themselves in such manner as to cripple the railroad. On appeal, however, the second and third clauses were abolished. Since the passage of the Interstate Commerce Act (1887) and the Anti-Trust Law (1890) the courts of equity have acquired enlarged powers. Interference with the United States mails or with interstate commerce (in railroad strikes) may be a serious offense. The United States can obtain an injunction against strikers, who, if they violate its provisions, may be summarily punished for contempt of court. In cases where railroads are under receivers the receiver is regarded as an official of the court, and a strike against the road may be as such unlawful. The use of injunctions in labor disputes is by no means new, but was brought into special prominence by the Chicago strike of 1894. As a method of dealing with strikes, the injunction is prompt and effective, but its execution practically involves arrest without indictment and trial without jury; it implies very great power in the hands of courts; and its frequent employment, not always in the wisest way, has created much bitter feeling and distrust of courts among workingmen.

History. In the United States there are a few records of strikes previous to 1800, such as those of the journeymen bakers in New York in 1741, and of the journeymen shoemakers in Philadelphia in 1796, 1798, 1799, and 1805. Something like a modern strike occurred in New York in 1802 among the sailors. They paraded the streets and compelled others to join them, but were dispersed by constables, and their leader was punished. From 1821 to 1834 there are accounts of only a few strikes each year, the records being doubtless very incomplete. These were generally among the building trades, hatters, tailors, shoemakers, and laborers on the Chesapeake and Ohio Canal. "In 1835," says the report of the Commissioner of Labor (1901, p. 721), "strikes had become so numerous as to call forth remonstrant comments from the public press." A number of strikes for a 10-hour day occurred in the thirties, while strikes for eight hours were general in 1872–73. From 1881 to 1900, according to the Reports of the United States Department of Labor, there were 22,793 strikes, involving 117,509 establishments and 6,105,694 employees thrown out of employment. Of the latter 90 per cent were males. The duration of strikes varies of course within wide limits, the average for 20 years being 23.8 days. The statistics of wage loss to employees ($257,000,000) and to employers ($122,000,000) have very little significance. More than $16,000,000 was contributed by labor organizations (the figure is probably too low). Considered by States, 28 per cent of all strikes occurred in New York, 12½ per cent in Pennsylvania, 11.6 per cent in Illinois, 7½ per cent in Massachusetts, and 6 per cent in Ohio. In New York City 5090 strikes are recorded, in Chicago 1737. Considered by industries 19½ per cent of all strikes occurred in the building trades, 11 per cent in coal and coke, 9 per cent in the metal trades, 6.6 per cent in tobacco, 5.6 per cent in transportation. The largest strikes usually occur in mining and railroading, as is shown by the fact that of the total number of striking employees 31 per cent were in coal and coke, 7.9 per cent in transportation, and only 10.9 per cent in the building trades.

Labor organizations ordered 63.46 per cent of the total strikes, and of these 52.86 per cent (of establishments involved) were successful, 13.6 per cent succeeded partly, and 33.54 per cent failed. The corresponding figures for strikes not ordered by organizations are 35.56 per cent, 9.05 per cent, and 55.39 per cent, this advantage of organization appearing for each of the 20 years. As to cause, 28.7 per cent of the strikes were for increase of wages, 11.23 per cent for the same with reduction of hours, 11.16 per cent for reduction of hours, 7.17 per cent against reduction of wages, 3.47 per cent in sympathy with a strike elsewhere, 2.34 per cent against employment of nonunion men, and 2.35 per cent involving recognition of the union.

Among historic American strikes have been the great strikes of 1877 on the Baltimore and Ohio, Pennsylvania, and other railroads, in which much damage to property was done and troops were called out; the telegraph operators' strike in 1883; the strike on the Gould system in 1885; the Homestead strike at the Carnegie works in 1892, the bitterest in American history and involving a sanguinary battle between Pinkerton detectives and unionists; the Chicago strike of 1894, which grew out of an effort of the newly organized American Railway Union to boycott Pullman cars in order to aid strikers at the Pullman works; the bituminous coal strike in the summer of 1894; street-railway strikes in several large cities (1900–01); the steel strike (1901); the great anthracite coal strikes of 1900 and 1902; the Colorado coal strike of 1903–04; the Fall River strike of 1904–05; the Chicago teamsters' strike of 1905; the bituminous coal miners' strike, involving 10 States, March to July, 1906, resulting in a six per cent wages advance for 300,000 men; the shirt-waist makers' strike of New York, 1909, in which 40,000 women, chiefly immigrants, secured substantial concessions in wages and hours; the steel workers' strike at McKees Rocks, 1909, characterized by great violence; the cloakmakers' strike, New York, 1910, involving about 80,000 workers and resulting in the establishment of the preferential union shop; the coal strike in Westmoreland Co., Pa., March, 1910, to July, 1911, carried on with great violence, almost approaching civil war; the Lawrence strike, 1912, involving some 35,000 workers, notable as the first great Eastern strike conducted by the I. W. W.; the strikes of Augusta (Ga.) street-railway employees and of Georgia Railroad employees in the autumn of 1912; the Michigan Copper strike, 1913–14, for advance in wages and reduction in hours; 2700 militia were employed to quell violence, which proved to be due in large part to the action of company guards. In 1913–14 an exceedingly violent strike was carried on in the coal-mining industry of Colorado, the occasion being a demand for the eight-hour day, advance in wages, and removal of certain abuses, such as the truck system. During October and November, 1913, several sanguinary conflicts between strikers and militia and mine guards took place, and in April, 1914, occurred the "Ludlow Massacre," when the strikers' tent colony was fired and two women and 11 children suffocated. Order was restored by Federal troops, who remained on the scene until 1915. Serious disorders attended the West Virginia coal-miners' strike of 1913 and the Paterson silk-workers' strike of 1913, conducted by the Industrial Workers of the World (q.v.).

In England the combination laws were repealed in 1824, and since then a number of statutes have defined the legal position and rights of workmen in labor disputes. The better-developed English unions have adopted a conservative policy in regard to strikes. Employers are more accustomed to dealing on equal terms with their men than is true in the United States. The formation of unions of unskilled laborers has been accompanied by many strikes, among which the great dock strike of 1889 attracted a remarkable amount of public sympathy and assistance. The engineering strike of 1896 roused much discussion as to the effect of unionism on English trade supremacy. In 1900 there occurred in Great Britain 648 strikes and lockouts, involving directly 135,145 employees; 202 of the disputes resulted in favor of the employees, 211 in favor of employers, and 221 were compromised. In 1909 there were 436 strikes, involving 2,773,000 men, of which 79 were won by the strikers and 144 compromised. In 1912 a strike tied up practically the whole coal-mining industry of Great Britain, and led to the enactment of the Coal Mines Act (Minimum Wage). The year 1913 was marked by great industrial unrest in England, 688,000 workers being involved in the strikes of that year. In Germany (1912) there were reported 2510 strikes, of which 415 were successful, 1001 compromised. The highest number of men on strike at any one time was 406,000. In 1890 a famous strike occurred in New South Wales, beginning as a strike of the Shearers' Union against nonunion men, but spreading to the railroads, and finally to nearly all industries. The report (Sydney, 1891) of the commission appointed to investigate it is one of the most valuable books upon the subject.

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STRINDBERG, strind'bĕr-ĭ, (JOHAN) AUGUST (1849–1912). A Swedish author, the greatest of his day and country, whose insatiable curiosity and energy of intellect and imagination drove him through many fields of thought and life, and impelled him to record his experiences in works that represent a wide range of literary kinds and methods. He was born Jan. 22, 1849, at Stockholm—his father a small tradesman, his mother a barmaid. In 1867 he entered Upsala University, where his life was embittered by poverty and his contentious temper embroiled him with his professors, and whence, though he read with tremendous energy, he departed without a degree. Until 1874, when friends procured him a post in the Royal Library, Stockholm, he lived a necessitous Bohemian life, busy with school-teaching, tutoring, journalism, and acting. In his novel *The Red Room* (1879)—startlingly realistic to the Sweden of its day—he offers pictures and opinions, expressed with stinging satire, of the literary and artistic circles in which for some years he moved. In 1872 he repaired to the islands between Stockholm and the open sea, and during his sojourn there learned to know the fisher folk whom he was later to portray. While at the Royal Library he cherished for a time an ambition to be a *savant,* learning Chinese and studying the early relations of Sweden and the Orient, but the drama proved more alluring. His first important play, *Master Olof* (written 1872), was produced in 1878, and helped to inaugurate the revolution against the established conventions of Swedish literature. From 1883 to 1897 he lived mainly abroad, in Switzerland, Germany, France, Denmark, and Italy, but in the last-named year returned to Stockholm, and thenceforth made that city his home. About 1895, while he was in Paris, a serious mental breakdown, induced by his titanic labors and domestic disasters, sent him to a sanitarium. He had plunged into chemical experiments and dreams of the transmutability of the elements, at which he worked like an alchemist of old, shunning everyone, with utter disregard of health. By 1897 he had recovered, and was again in full creative activity. He was thrice unhappily married, the third time to the talented Swedish actress, Harriet Bosse; and he was thrice divorced.

Strindberg's early work had strong romantic elements, and looked to Socialism for the cure of social ills. From the middle eighties to the middle nineties it tended to become naturalistic, and took a skeptical and individualistic turn. A confirmed misogynist, Strindberg developed in this period his case against feminism, and presented his convictions concerning the intellectual, moral, and biological inferiority of women. From his severe mental attack in 1897 he emerged a believing mystic. His complex development cannot here be traced. Suffice it to say that his thought swung from materialistic skepticism to a kind of Swedenborgian mysticism, while in literary method he ranged from romanticism to naturalism and Maeterlinckian symbolism. His interest in Swedish history was always keen, and an important part of his work centred about it. He died May 14, 1912.

A group of his writings which might be described as autobiographic fiction constitutes an illuminating commentary on his life and works. It includes, in addition to *The Red Room* above mentioned, *The Bondwoman's Son* (I–III, 1886–87); *The Author* (1887); *A Fool's Confession* (1888), which concerns his first marriage; *Inferno* (1897) and *Legends*, studies in morbid psychology, related to his own mental attack; *Fairhaven and Foulstrand* (1902); and *Alone* (1907). Among his novels and tales, representative books are the 17 stories in *Swedish Destinies and Adventures* (2 vols., 1882–91); the short realistic studies of married life in the two volumes of *Marriage* (1884 and 1886); *The Natives of Hemsö* (1887), perhaps second to none as a novel of Swedish peasant life, and displaying its author's descriptive powers; *Fisher Folk* (1888); and *Historical Miniatures* (1905). His *Utopias Realized* (1885) expressed his Socialistic views. Among his historical and miscellaneous writings should be mentioned *The New Kingdom* (1882); *The Swedish People* (1882); *A Blue Book* (1907–08), a collection of miscellanies in three volumes; and *Speeches to the Swedish Nation* (1910). Important among his historical plays are *Gustavus Vasa* (1899); *Eric XIV* (1899); *Gustavus Adolphus* (1903); *Charles XII* (1901); and *The Last Knight* (1908). *There are Crimes and Crimes* (1899), *Christmas* (1899), and *Easter* (1901) will be found in different ways characteristic. Realistic and powerful, if repellent, are the dramas *The Father*, in which the misogynist speaks again, and *Miss Julia*, described by the author as a naturalistic play. *Swanwhite* (1902), *The Dream Play* (1902), and *The Dance of Death* (I and II, 1901), with its wide symbolical sweep, were inspired by the example of Maeterlinck. The legendary play *Lucky Pehr*, if not one of his most representative plays, proved widely popular. The trilogy *To Damascus* (I and II, 1898; III, 1904) symbolized his own soul's quest of peace, and points to a return to religion.

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STRING (AS. *strenge*, Ger. *Strang*, string; connected with Lat. *stringere*, to draw tight, Gk. *στραγγός*, *strangos*, twisted). The strings of musical instruments are made either from silk, from the entrails of sheep, or from metal. Formerly the metal strings were made of brass or copper, but now they are generally made of steel (for the pianoforte). For the string instruments (violin, guitar) gut is mostly used. The thinner the string the higher the pitch. Excessive thickness for the lower strings is avoided by winding them with fine copper or silver wire. Recently strings, especially those overspun, have been manufactured from silk. For the violin the highest or E string is also sometimes made of silk, but its tone quality is inferior to that of a gut string. The silk strings are chiefly used by violinists for the purpose of practicing in warm weather, when the moisture of the fingers causes gut strings to snap.

STRINGED INSTRUMENTS. See MUSICAL INSTRUMENTS.

STRINGEN′DO (It., drawing tight, compressing). A term used in music to denote a rather sudden acceleration in the time.

STRING′HALT′ (corruption of *spring* + *halt*, lame). An involuntary movement of one or both hind legs of a horse in which the foot is spasmodically lifted from the ground much higher than it is normally carried. It is most noticeable when the animal is first brought out of the stable, when he is excited, or made to turn suddenly round; it is a form of chorea or St. Vitus's dance. When due to local injury the habit may be corrected by local treatment. Where it remains after the local lesion has healed, the sectioning of the lateral extensor of the foot may relieve the condition.

STRINGHAM, string′*am*, SILAS HORTON (1798–1876). An American naval officer, born at Middletown, N. Y. He was appointed midshipman in the navy in 1809, served on the frigate *President* in her conflict with the *Little Belt*, and in the engagement in which she was captured by a British squadron; fought in the war with Algiers, and served on the *Hornet* against the West India pirates. In 1847, commanding the *Ohio*, he was at the bombardment of Vera Cruz. When the Civil War began he became flag officer of the North Atlantic blockading squadron, and in August, 1861, coöperated with Gen. B. F. Butler to capture forts at Hatteras Inlet. In September he asked to be relieved of command, probably because of criticisms. In 1862 he became a rear admiral on the retired list.

STRIPPING. A term applied to mining operations where it is necessary to strip or remove the surface rock or soil (overburden) overlying a mineral deposit such as coal, copper ore, or iron ore. Beds of coal have been stripped to recover the coal left as pillars for support. The Utah Copper Company offers an example of one of the largest mining stripping operations —in 1909 1,526,000 cubic yards of surface was removed by steam shovels; the average thickness of capping, or surface, was 71 feet.

STROBEL, strô-bĕl′, Edward Henry (1855–1908). An American diplomat, born at Charleston, S. C. He graduated at Harvard in 1877 and at Harvard Law School in 1882. He was Secretary of Legation at Madrid (1885–90), and Minister to Ecuador (1894) and to Chile (1894–97). In 1897 he helped to arbitrate a dispute between France and Chile, and in 1899 was counsel for Chile before the United States and Chilean Claims Commission. He became Bemis professor of international law in the Harvard Law School in 1898, but in 1903 was granted a two years' leave of absence to accept the post of general adviser to the government of Siam, and in 1906 he entered the service of Siam. He published *The Spanish Revolution* (1898).

STROB′ILUS (Lat., pine cone). A conelike group of sporophylls (q.v.) differentiated from the rest of the plant body. Strobili occur in club mosses, are the well-known cones of conifers, and are the precursors of flowers, which are strobili with a perianth.

STROB′OSCOPE (from Gk. *στρόβος*, *strobos*, a whirling + *σκοπός*, *skopos*, watcher). An instrument used for studying the motion of a body where by means of a rapid succession of slits or other openings, or its illumination at regular intervals, the eye receives a series of images on the retina. Where these impressions occur with sufficient rapidity the illusion of motion is produced, and advantage of this is taken in certain toys, scientific instruments, and more particularly in the familiar moving pictures (q.v.). The stroboscope was first devised by Stampfer and Plateau, and consists of a disk or cylinder with a series of slits through which the observer looks at the pictures or moving object. As the disk or cylinder revolves the slits come successively before the eye and through them the observer gets a series of glimpses of the moving object. If each of the pictures represents a successive stage in an action such as the motion of a pendulum, a man or animal running, etc., the illusion of motion is produced, provided that the interval between the glimpses of the pictures is less than the duration of the image on the retina, a time which varies from $\frac{1}{10}$ to $\frac{1}{50}$ of a second. A simple stroboscope or zoëtrope is illustrated in the article Illusion.

Anschütz (q.v.), a German photographer, made an important application of the stroboscope principle in his "tachyscope," by rotating transparent pictures on a drum or disk, and having them illuminated by the momentary glow of a spark from an induction coil through a Geissler tube. Although the period of discharge is very brief, yet the sparks follow with regularity, and as the successive pictures always occupy the same position relative to the eye of the observer, the illumination appears continuous, and the effect of motion is produced. A stroboscopic device is used as a slip meter with induction motors to measure the difference between the synchronous speed and actual running speed. See Illusion; Kinetoscope; Moving Pictures.

STRODTMANN, strōt′män, Adolf (1829–79). A German author, born at Flensburg. He studied at Kiel, and, while taking part in the insurrection of 1848, was wounded and captured by the Danes. On being set at liberty he published *Lieder eines Gefangenen auf der Dronning Maria* (1848). He resumed study at Bonn under Kinkel, but was suspended on account of his political activity. He then published *Lieder der Nacht* (1850) and a biography of Gottfried Kinkel (1850). He went to Paris, to London, and in 1852 to America, where for four years he was by turns bookseller and journalist in New York City and Philadelphia. Returning to Germany in 1856, he became known as a biographer and editor of Heine and as war correspondent for several newspapers during the Franco-German campaign. He translated much from English writers. His most noteworthy volume in this field is *Amerikanische Anthologie* (1870), a group of successful renderings from American lyric poets. He also edited the correspondence of G. A. Bürger (4 vols., Berlin, 1874).

STROGANOV, strŏ′gȧ-nôf. A family of Russian nobles, descended from Anika, a wealthy merchant of Novgorod, who, in the beginning of the sixteenth century, owned extensive salt pits and ironworks in the Ural Mountains. His sons Yakov and Grigori obtained from Czar Ivan IV important territorial grants and trade monopolies, founded several cities and fortified towns, and in 1574 received a deed of gift for the Siberian territory bordering on their possessions. The conquest was accomplished, however, after their death in 1581, by their youngest brother, Semion Anikitch, with the coöperation of Yermak, ataman of the Don Cossacks, when Western Siberia was subdued within two years and annexed to the Russian crown. In 1722 the extraordinary privileges held by the family were taken from the then living representatives, the brothers Alexander, Nikolai, and Sergei, by Peter the Great, who in exchange conferred upon them only the baronial title. A great-grandson of Nikolai was Sergei Grigorevitch (1794–1882), the chief promoter of the archæological excavations on the shores of the Black Sea. He founded and endowed a school of design at Moscow, and acted as curator of the Moscow educational district in 1835–47. His sound judgment in the selection of professors, his munificence and liberal spirit, made this the most brilliant period in the history of the University of Moscow.

STRO′MATOP′ORA (Neo-Lat., from Gk. *στρῶμα*, *strōma*, covering + *πόρος*, *poros*, pore). An extinct genus of hydroid corals, which formed extensive coral reefs during some periods of Paleozoic time. The colonies formed rounded or incrusting and sometimes branching masses that show a concentric lamination and an irregular, cellular, microscopic structure. These hydroid corals are found in fossil coral reefs in the Chazy, Niagara, Lower Helderberg, and Onondaga limestones of New York State, and large specimens, which when polished are of great beauty, have been obtained in the Upper Devonian of the Central States.

STROMB (Lat. *strombus*, sort of spiral snail, from Gk. *στρόμβος*, pine cone, snail, from *στρέφειν*, *strephein*, to turn, twist). A large gastropod mollusk of the family Strombidæ, or more particularly its shell. The species are numerous, found mostly in tropical seas. *Strombus gigas*, the "queen conch," is the largest known univalve. It occurs in the West Indies, on reefs in shallow water, and is fished both for the table and for the shell. Great numbers of shells are imported into Europe and America, and are sometimes called "fountain shell," from use as garden ornaments. Cameo makers cut the outer layer in relief. Pearls of a delicate pink are sometimes found in this shell.

STROMBOLI, strôm′bô-lē. A volcanic island belonging to the Lipari Islands (q.v.).

STROMEYER, shtrō′mī′ẽr, Georg Friedrich Louis (1804–76). A German surgeon. Born in Hanover, he studied medicine in Göttingen, Berlin (M.D., 1826), and Vienna, and became professor of surgery successively at Erlangen, Munich, Freiburg, and Kiel. As a surgeon-general he served in the Schleswig-Holstein war of secession from Denmark (1849–50), in the War of 1866 against Prussia, and in the Franco-Prussian War (1870–71). Stromeyer added much to the knowledge of war surgery. His achievements in connection with subcutaneous myotomy and tenotomy in locomotor surgery place him among the founders of modern orthopedics. He wrote much in his special field. His autobiography appeared in 1875 under the title *Erinnerungen eines deutschen Arztes*.

STROMÖ. See Faroe Islands.

STRONG, Augustus Hopkins (1836–). An American clergyman, educator, and author, born at Rochester, N. Y. He graduated from Yale in 1857, and in 1859 from the Rochester Theological Seminary. After Baptist pastorates at Haverhill, Mass., and Cleveland, Ohio, he returned to the seminary in 1872 to be its president and professor of biblical theology. He retired in 1912 after 40 years of service. Dr. Strong was president of the Baptist Missionary Union in 1892–95 and of the General Convention of Baptists of North America in 1905–10. Among his writings are: *Systematic Theology* (1886; 7th ed., 1903; rev. ed., 3 vols., 1908); *Philosophy and Religion* (1888); *Great Poets and their Theology* (1897); *Christ in Creation and Ethical Monism* (1899); *Miscellanies* (1912); *One Hundred Chapel-Talks to Theological Students* (1913); *Union with Christ* (1913); *Popular Lectures on the Books of the New Testament* (1914).

STRONG, Caleb (1745–1819). A Governor of Massachusetts, born at Northampton, Mass. He graduated at Harvard in 1764, and was admitted to the bar in 1772. During the Revolution he served in the Massachusetts General Court and on the Committee of Safety of his town, and in 1780–89 sat in the Massachusetts Senate. He was a member of the National Constitutional Convention at Philadelphia in 1787. In 1789–96 he was a United States Senator, and he was Governor of Massachusetts from 1800 till 1807 and again from 1812 till 1816. In politics he was an ardent Federalist, and bitterly opposed to the War of 1812. On June 26, 1812, he issued a proclamation for a public fast on account of a war "against the nation from which we are descended, and which for many generations has been the bulwark of the religion we profess." By the advice of the State Supreme Court he refused to comply with the President's request to call out the State militia to help in the prosecution of the war, saying that to the Governor, not to the President, belonged the power to decide when to call out the militia. He published *Speeches and Other Papers, 1800–07* (1808). Consult his biography by Alden Bradford (1820).

STRONG, Eugénie (?–). An English classical scholar, whose maiden name was Sellers. She was educated in France and at Girton College, Cambridge. In 1897 she was married to S. Arthur Strong, late librarian of the House of Lords. She was elected first fellow of Girton College in 1910. From 1909 she was assistant director of the British School of Archæology in Rome. Her publications include: *Roman Sculpture from Augustus to Constantine* (1907); *Art in Rome* (1912); an edition, with Miss K. Jex-Blake, of Pliny, *Historia Naturalis*, xxxiv–xxxvi (includes notes, historical introduction, and translation).

STRONG, George Crockett (1832–63). An American soldier, born in Stockbridge, Vt. He graduated at West Point in 1857; was an ordnance officer with the rank of lieutenant on the staff of General McDowell in the first battle of Bull Run, and later served successively on the staffs of Generals McClellan and Butler. He commanded an expedition sent from Ship Island against Biloxi, Miss., in April, 1862, and another sent against Ponchatoula, and was commissioned brigadier general of volunteers in November, 1862. He commanded a brigade in the operations against Charleston, S. C., in June and July, 1863; made a successful descent on Morris Island on July 10; and on the 18th of the same month was mortally wounded while gallantly leading the assault on Fort Wagner. A commission as major general of volunteers was made out to date from the day of the battle. He published *Cadet Life at West Point* (1862).

STRONG, James (1822–94). An American Methodist lay biblical scholar and educator. He was born in New York City, studied medicine, and graduated from Wesleyan University in 1844. He early taught at Poultney, Vt., and at Flushing, L. I., and was president of the Flushing Railroad and president of the village. He was professor of biblical literature and acting president of Troy University (1858–63), and professor of exegetical theology in Drew Theological Seminary (1868–93). He traveled in the East in 1874, and was a member of the Anglo-American Bible Revision Committee, 1871–81. In 1853 he became associated with Dr. John McClintock in the preparation of the *Cyclopædia of Biblical, Theological, and Ecclesiastical Literature* (rev. ed., 1890), and in 1870 became editor in chief. For more than 35 years he was engaged on an *Exhaustive Concordance of the Bible* (1895).

STRONG, Josiah (1847–1916). An American religious leader and social worker, born at Naperville, Ill. He graduated from Western Reserve College in 1869, and later attended Lane Theological Seminary. He was pastor of Congregational churches in Wyoming and Ohio, secretary of a denominational Home Missionary

Society (1881–84), and general secretary of the Evangelical Alliance for the United States (1886–98). He then organized and became president of the League for Social Service, reorganized in 1902 under his continued presidency as the American Institute for Social Service. After 1908 he edited a periodical called *The Gospel of the Kingdom*. His writings include: *Our Country* (1885; 140th thousand, 1891); *The New Era* (1893); *Religious Movements for Social Betterment* (1900); *Expansion under New World Conditions* (1900); *The Times and Young Men* (1901); *The Next Great Awakening* (1902; 8th thousand, 1905); *The Challenge of the City* (1907); *Our World* (1913); *New World Religion* (1915).

STRONG, Richard Pearson (1872–). An American pathologist. He was born at Fortress Monroe, Va., and was educated at Yale and at Johns Hopkins (M.D., 1897). In 1899 he was sent to the Philippines as president of a government board for investigating tropical diseases. There he remained until 1913, having been director of the government biological laboratory at Manila since 1901, professor of tropical medicine at the University of the Philippine Islands since 1907, and chief physician at the General Hospital in Manila from 1910. He also edited the *Philippine Islands Journal of Tropical Medicine*. In 1913 he was called to a chair at Harvard. In 1914–15, as head of an American Red Cross Sanitary Commission, he was in Serbia, directing an antityphus campaign.

STRONG, Sir Samuel Henry (1825–1909). A Canadian jurist, born at Poole, England. He went to Canada in 1836 with his parents, was educated at the Quebec High School and privately, and in 1849 was admitted to the bar of Upper Canada. He practiced his profession in Toronto. In 1856 he was appointed a member of the commission for consolidating the statutes of Upper Canada and Canada; in 1863 he was created queen's counsel, and in 1869 was made a vice chancellor of the Ontario Court of Chancery. He was called to the Ontario Court of Error and Appeal in 1874 and in 1875 was made a puisne judge in the newly constituted Supreme Court of Canada, of which he served as chief justice in 1892–1902. In 1897 he was made a member of the Judicial Committee of the Imperial Privy Council. In 1893 he was knighted (K.C.M.G.).

STRONG, Theodore (1790–1869). An American mathematician, born at South Hadley, Mass. He was educated at Yale, and after graduation (1812) became tutor in mathematics at Hamilton College, and in 1816 professor of mathematics. In 1827 he accepted the chair of mathematics and natural philosophy in Rutgers College, a position which he retained till 1862, when he retired from active life. Strong made many important contributions to mathematical science. A new geometrical demonstration of the values of the sines and cosines of the sum and difference of two arcs was given by him in 1818. His two principal systematic works are *A Treatise on Elementary and Higher Algebra* (1859) and *A Treatise on the Differential and Integral Calculus* (1869).

STRONG, William (1808–95). An American jurist, born in Somers, Conn. He graduated at Yale in 1828, and was admitted to the bar in Reading, Pa., in 1832. In 1846 and again in 1848 he was elected to the national House of Representatives as a Democrat; and from 1857 until 1868 he was a justice of the Pennsylvania Supreme Court. From 1870 till 1880 he was associate justice of the United States Supreme Court. He was a member of the Electoral Commission that decided the disputed presidential election of 1876 and in that capacity contended that Congress had no power to canvass State returns for presidential electors.

STRONG, William L. (1827–1900). The last mayor of New York previous to the formation of Greater New York. He was born in Richland Co., Ohio; was a dry-goods salesman in Wooster and then in Manchester, Ohio; in 1853 went to New York City, where he engaged in similar business, and in 1869 became the head of the firm of William L. Strong & Co. In politics he was a Republican. From 1895 to 1898 he was mayor, elected on a fusion ticket by Republicans and anti-Tammany Democrats.

STRONGBOW. A surname of Richard Fitz Gislebert, Earl of Pembroke.

STRONGYLUS, strŏn'jĭ-lŭs (Neo-Lat., from Gk. στρογγύλος, round). A genus of nematode worms, parasitic in man and other animals. The only true *Strongylus* infesting man is *Strongylus bronchialis*. The male usually measures more than half an inch, while the female is upward of an inch in length. It is apparently an uncommon parasite, as few cases have been reported, though allied species occur in the lungs and air passages of pigs, calves, and sheep. Closely allied to *Strongylus* is the genus *Eustrongylus*, which contains the species *Eustrongylus gigas*, the largest nematode worm at present known to infest man or any other animal, the male measuring a foot in length, and ¼ of an inch in diameter, while the female is more than 3 feet, its transverse diameter being fully half an inch. The body is cylindrical, more or less tinged with redness; the head obtuse, furnished with a simple oval aperture surrounded by six chitinous nodules. This worm occurs in the kidneys and bladder, sometimes in the abdominal cavity and the omentum, rarely in the lungs and liver of man and other animals. It is said to be most common in weasels.

STRON'TIANITE. A strontium carbonate. It is an important source of strontium compounds.

STRONTIUM, strŏn'shĭ-ŭm (Neo-Lat., from *Strontian*, Argyllshire, Scotland). A metallic element first obtained (in a somewhat impure state) by Davy in 1808, its earth having been recognized as a distinct chemical substance after Cruikshank (1787), Hope (1792), and Klaproth (1793) had discovered that it gives a peculiar coloration if introduced into a flame. Strontium occurs as the carbonate (strontianite), as the sulphate (celestite), as the silicate in combination with barium and calcium (brewsterite), also in small quantities in other minerals, such as aragonite, calcite, and dolomite. It further occurs in mineral and sea waters, and also in the ashes of certain plants. The metal may be obtained by the electrolysis of the moistened hydroxide of the chloride. Strontium (symbol, Sr; atomic weight, 87.6) is a yellow metal with a specific gravity of about 2.5; it melts at a moderate red heat. It is both malleable and ductile, is less electropositive than calcium and the alkali metals, oxidizes quickly on exposure to the air, and burns brilliantly when heated, forming the oxide. It combines with oxygen to form a monoxide (SrO) and a dioxide (SrO_2).

The former is a gray-white, porous, infusible solid that is usually prepared by igniting the nitrate. The hydrate formed by the action of water on the oxide has the property of combining with crystallizable sugar to form a saccharate easily decomposed by carbon dioxide, and hence is extensively used for the separation of sugar from beetroot molasses. The nitrate, which may be prepared by dissolving the carbonate in warm dilute nitric acid and evaporating to crystallization, finds use for pyrotechnic purposes, owing to the red flame with which it burns.

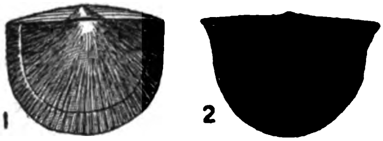
In Medicine. Strontium is used in medicine in the form of the bromide, iodide, salicylate, and lactate. These salts are believed to be less irritating to the stomach and less apt to produce skin eruptions than the corresponding salts of sodium and potassium. They are eliminated more rapidly, but are less powerful. The lactate has been used in diabetes and in the albuminuria of Bright's disease, of rheumatic and scrofulous disorders, and of pregnancy. Where, however, the urine is scanty, or there are symptoms of uremia, the drug should not be administered.

STROPHADES, strŏf'ȧ-dēz (Lat., from Gk. *Στροφάδες*). Two small islands in the Ionian Sea, now Strofadia and Strivali. The name was given from the legend that the sons of Boreas pursued the Harpies to the islands, thence returning (*στρέφειν*, to turn) from their expedition.

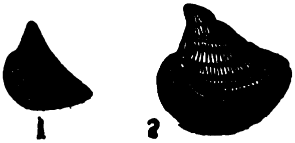
STROPHAN'THUS (Neo-Lat., from Gk. *στρόφος*, *strophos*, twisted, bent, from *στρέφειν*, *strephein*, to turn, twist + *ἄνθος*, *anthos*, flower). A drug consisting of the seed of *Strophanthus hispidus*, a climbing African plant of the order Apocynaceæ. From it certain African tribes prepare a toxic substance known as the Kombé arrow poison. From the seed is obtained its active principle, strophanthin, a bitter glucoside; a white, amorphous, or crystalline powder, soluble in water or alcohol. The physiological action of the drug is much like that of digitalis (q.v.). It slows the action of the heart, increases its contractility, and increases the arterial tension, though less than digitalis. Its action is more rapid, less protracted, and less certain than that of digitalis. It is also less diuretic. In large doses it is a direct poison to the voluntary muscles, which become tonically contracted and pass into a condition resembling *rigor mortis*. Strophanthus is a valuable cardiac stimulant and is used in cases in which digitalis is indicated, but in which, for any reason, it is necessary to substitute another drug. The official tincture is the form generally employed. It is particularly serviceable in nervous disturbances of the heart, as, e.g., that of exophthalmic goitre, when a sedative as well as stimulating action is demanded. It is also useful in cardiac dyspnœa.

STROPHE, strō'fē (Lat., from Gk. *στροφή*, a turning, from *στρέφειν*, *strephein*, to turn, twist). A term which originally designated the evolutions of the Greek chorus from one position to another in the orchestra; then the portion of the song which accompanied this movement. In its ordinary sense, as applied to Greek and Latin lyric poetry, it designates a combination of rhythmical periods to which a following combination corresponds exactly or very closely; these are known respectively as strophe and antistrophe (q.v.). The name is also often applied to the stanza of modern poetry. See Versification.

STRO'PHOME'NA (Neo-Lat. nom. pl., from *στρόφος*, *strophos*, twisted, bent + *μήνη*, *mēnē*, crescent). An important genus of fossil long-hinged brachiopods of Paleozoic age, typical of the family Strophomenidæ. The primitive members of this family are characterized by their general semicircular outline, long hinge lines, and well-developed cardinal teeth, distinct hinge areas, and low beaks. In the secondary derived members of the group the hinge line shortens, the beak lengthens, the hinge area increases in height, and the articulating processes undergo interesting modifications, while correlated modifications take place in the interior of the shell.



1, *Orthothetes chemungensis* (view from the brachial valve); 2, *Strophomena filitexta* (pedicle valve).



1, *Streptorhynchus pelargonatus* (profile); 2, *Derbya bennetti* (profile).

The simplest and earliest member is *Rafinesquina* (Ordovician), with valves normally concavo-convex dorsoventrally, and hinge line simple. *Strophomena* (Ordovician and Silurian) in its embryonic stages has the general form of shell seen in *Rafinesquina*, but the adults have the valves resupinate or recurved so that the dorsal valve is convex and the ventral valve flat or concave. From *Rafinesquina* arises a long line of descendants reaching into Carboniferous times. These genetically related types are *Strophomena* (Ordovician to Silurian), *Orthothetes* (Silurian to Carboniferous), *Derbya* (Carboniferous), *Streptorhynchus* (Upper Carboniferous to Permian). Consult Hall and Clarke, "An Introduction to the Study of the Genera of Palæozoic Brachiopoda," in *Palæontology of New York*, vol. viii, part i (Albany, 1892).

STROPHULUS. See Miliaria.

STROSSMAYER, strôs'mī-ẽr, Joseph Georg (1815–1905). An Austrian Roman Catholic bishop, born at Eszék, Slavonia. After being educated at Diakovár, Budapest, and Vienna he became professor in the seminary at Diakovár, afterward court chaplain in Vienna, and in 1849 Bishop of Diakovár. A leader of the Croatian national party, he promoted the cause of education in various ways, contributed largely to the establishment of the academy and university at Agram, and built the beautiful Romanesque cathedral at Diakovár. He came most prominently into notice at the time of the Vatican Council, in which he was considered the leader of the Inopportunists, or those who considered it inadvisable to define papal infallibility.

STROTHER, strŏTH'ẽr, David Hunter (1816–88). An American author and illustrator, born at Martinsburg, W. Va. Educated as an artist, he first became known to the public in 1852 as

Porte Crayon, the author of a series of amusing papers published in *Harper's Magazine*, descriptive of travel, scenery, and manners in the South. Many of these were afterward collected in *The Blackwater Chronicle* (1853) and *Virginia Illustrated* (1857). He entered the Union army as captain in 1861, became colonel, resigned in 1864, and in 1865 was brevetted brigadier general. From 1879 to 1885 he was consul general to Mexico.

STROUD, stroud. A town in Gloucestershire, England, 9 miles south-southeast of Gloucester, at the confluence of the Frome and Slade (Map: England, D 5). It is the centre of the woolen manufactures of Gloucestershire. The water of the Frome is peculiarly adapted for use in dyeing scarlet and other grain colors; and on this account cloth factories and dye works have been built along its banks for a distance of 20 miles. Pop., 1901, 9188; 1911, 8767. At the Domesday survey Stroud was part of Bisley Parish, from which it separated in 1304.

STROUDS′BURG. A borough and the county seat of Monroe Co., Pa., 53 miles southeast of Scranton, on the Analomink River, and on the New York, Susquehanna and Western, the Wilkes-Barre and Eastern, the Delaware Valley, and the Delaware, Lackawanna and Western railroads (Map: Pennsylvania, L 5). It is in a beautiful region, popular as a summer resort. Five miles distant is the famous Delaware Water Gap. In East Stroudsburg is a State Normal School. There are car and engine works and flour, silk, and woolen mills. Pop., 1900, 3450; 1910, 4379.

STROZZI, strŏt′sē. A noble Florentine family which first attained prominence towards the end of the thirteenth century. From that time until 1530 they appear as the rivals of the Medici, with whom they shared the great offices of state. Becoming very wealthy through their banking establishments in southern Italy, they were able to satisfy their political ambitions. At their most flourishing period towards the end of the fifteenth century they numbered 80 heads of families. Then was built from the plans of Benedetto da Majano and Cronaca that famous palace which has been ranked with the Farnese at Rome and the Vendramin at Venice as one of the three finest in Italy. Cosmo I de' Medici upon his accession in 1537 brought about the fall of the rival house. Various branches of the family took foreign service or settled in Naples, Mantua, and Ferrara. Descendants live in Florence and the title Prince of Forano has been in the family since 1722.

STRUBE, strōō′be, Gustav (1867–). An American composer and violinist, born at Ballenstedt (Germany). He received his first instruction from his father, and his progress was so rapid that at the age of 10 he played in the Ballenstedt Orchestra. In 1883 he entered the Leipzig Conservatory, where his teachers were Hermann and Brodsky (violin) and Jadassohn and Reinecke (composition). After his graduation he played in the Gewandhaus Orchestra, and for a time taught violin at the Mannheim Conservatory. In 1889 he settled in Boston, and from 1891 to 1913 was a member of the Boston Symphony Orchestra, then resigning to become head of the violin department of the Peabody Conservatory, Baltimore. In 1916 he was appointed conductor of the newly founded Baltimore Symphony Orchestra. From 1909 he was one of the conductors of the Worcester (Mass.) Music Festival. His compositions ininclude two symphonies (C minor, B minor); the symphonic poems, *Longing, Fantastic Dance, Echo and Narcissus, Die Lorelei;* the opera *Ramoña;* three overtures, *The Maid of Orleans, Fantastic, Puck;* two concertos for violin; one concerto for cello; an orchestral rhapsody, *Hymn to Eros;* a *Quintet* for wind instruments.

STRUENSEE, shtrōō′en-zā, Johann Friedrich von, Count (1737–72). A Danish statesman and philosopher, born Aug. 5, 1737, at Halle, Saxony. He studied medicine, became the physician of King Christian VII (q.v.) of Denmark (1768), and rose to high favor. In 1771 he was made Minister of State with unusual powers. Since the Revolution of 1660 Denmark had been under the domination of the nobility, who governed the country. Struensee dissolved the council of state and proclaimed the establishment of the ancient royal power. These measures amounted to a revolution, and to a declaration of war against the aristocracy. The Queen and Struensee (now in full power) chose new ministers, and excluded the feeble Christian from management of affairs. In opposition to his predecessors' policy, Struensee endeavored to free Denmark from Russian influence, and to find an ally in Sweden. He put the finances in order, freed industry and trade, encouraged education, and mitigated the penal laws. Serfdom was partially abolished. This revolutionary course produced a reaction, while the clergy were aroused by Struensee's outspoken skepticism. The Queen and Struensee were accused of criminal relations and the King was prevailed upon to sign warrants for the arrest of Struensee. The minister was accused of having conspired against the person and throne of the King, and of being the lover of the Queen. He was sentenced to death and executed April 28, 1772. Queen Carolina Matilda left Denmark in May, 1772, and died in 1775 in the castle of Celle in Hanover. Consult *Struensee et la cour de Copenhague—mémoires de Reverdil* (Paris, 1858).

STRUMA. See Scrofula.

STRÜMPELL, shtrụm′pel, Ludwig (1812–99). A German philosopher, born at Schöppenstedt. He studied philosophy at Königsberg, where he was influenced by Herbart, and continued his studies at Leipzig. From 1849 to 1871 he was professor at Dorpat. Known as a prominent representative of Herbart's philosophy, he published: *Erläuterungen zu Herbarts Philosophie* (1834); *Die Hauptpunkte der Herbartschen Metaphysik kritisch beleuchtet* (1840); *Gedanken über Religion und religiöse Probleme* (1888); *Abhandlungen zur Geschichte der Metaphysik, Psychologie, und Religionsphilosophie* (1896); and *Vermischte Abhandlungen aus der theoretischen und praktischen Philosophie* (1897).

STRUNSKY, strŭn′skĭ, Simeon (1879–). An American essayist, born at Vitebsk, Russia. He was educated at the Horace Mann School, New York City, and at Columbia University, where he graduated in 1900. From 1900 to 1906 he was a department editor of the New International Encyclopædia. From 1906 to 1913 he was an editorial writer on the New York *Evening Post*, and subsequently was literary editor of that paper. In addition to many contributions to magazines, and to his *Through the Outlooking Glass with Theodore Roosevelt* (1912), a clever parody, he wrote: *The Patient*

Observer (1911); *Belshazzar Court, or Village Life in New York City* (1914); *Post-Impressions* (1914). These volumes, for the most part collections of essays originally written for the *Post*, are filled with social and political comment that is quietly humorous or satirical, and shrewdly discerning.

STRUTT, John William, third Baron Rayleigh. See Rayleigh.

STRUTT, Joseph (1749–1802). An English antiquary. He studied engraving and painting, but devoted himself mostly to research in the British Museum. He wrote a number of learned antiquarian works, but lives in literary history on the score of a curious historical romance, entitled *Queenhoo Hall*, edited and completed by Sir Walter Scott (1808) and not without its influence upon Scott's *Waverley*. Strutt's work as antiquary was so well done that it has not yet been superseded. His engravings in the chalk or dotted style are much sought after.

STRUTT, Robert John (1875–). An English physicist, born in Essex, eldest son of the third Baron Rayleigh (q.v.). He was educated at Eton and at Trinity College, Cambridge, where he was a fellow in 1900. Later he became professor of physics at the Imperial College of Science, South Kensington. Strutt published many papers in the *Proceedings* of the Royal Society (of which he was elected fellow in 1905) and in the scientific press, dealing particularly with the origin of radium, radium and the earth's heat, universal distribution of helium, and measurement of geological time from radioactive data. He wrote *The Becquerel Rays and the Properties of Radium* (1904).

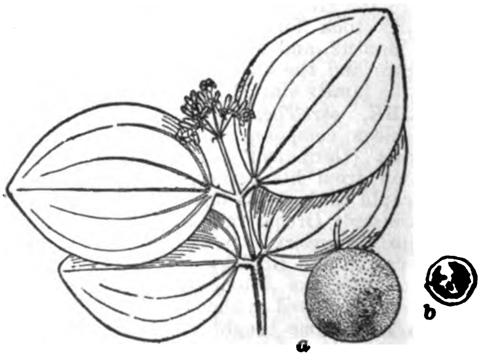
STRUVE, shtrōō′ve, Friedrich Georg Wilhelm von (1793–1864). A Russian astronomer, born at Altona, Germany. He was educated at the University of Dorpat, in 1813 was appointed to a post in the Dorpat Observatory, and in 1839 became director of the newly organized observatory at Pulkova. His observations and researches on double and multiple stars added immensely to the knowledge of these systems. Struve also executed a number of important geodetic operations, such as the triangulation of Livonia in 1816–19, and the measurement of an arc of the meridian in 1822–52. He published: *Observationes Dorpatenses* (1817–39); *Catalogus Novus Stellarum Duplicium et Multiplicium* (1827); *Stellarum Duplicium et Multiplicium Mensuræ Micrometricæ* (1837); *Etudes d'astronomie stellaire* (1847); *Stellarum Fixarum Imprimis Duplicium et Multiplicium Positiones Mediæ* (1852). All these works are fundamental in the history of double-star astronomy. He published also *Arc du méridien de 25° 20′ entre le Danube et la mer glaciale* (2 vols. and 1 vol. plates, 1857–60).

STRUVE, Gustav von (1805–70). A German revolutionist, born in Munich. He was an ardent Liberal, and in 1848 took part with Hecker and others in the first revolt in Baden. After the defeat at Staufen he was captured and sentenced to five years of solitary confinement. Released by the Revolutionists in 1849, he became the leader of the Republican party in the Constituent Assembly of Baden. Forced to flee again, he went first to Switzerland, then to England, and finally, in 1851, to the United States. Here he composed his *Allgemeine Weltgeschichte* (1853–60), a history of the world from the standpoint of radical republicanism. When the Civil War broke out he served for a time as an officer in the Eighth New York Regiment, but in 1863 returned to Europe, where he lived for a time in Coburg, then in Vienna until his death. Among his numerous other works are: *Das öffentliche Recht des deutschen Bundes* (1846); *Geschichte der drei Volkserhebungen in Baden* (1849); *Das Revolutionszeitalter* (1860; 7th ed., 1864); *Das Seelenleben* (1869).

STRUVE, Otto Wilhelm von (1819–1905). A Russian astronomer, born at Dorpat. In 1862 he became director of Pulkova Observatory in succession to his father, whose chief assistant he had been since 1837. In 1889 he retired and settled in Karlsruhe. In his examination of the northern heavens he discovered 500 binary stars and also determined the parallax of several stars, and observed the variability of the light coming from the nebula of Orion and the several stars hidden in the nebula. He also determined a new value of the precession constant (1841), calculated the dimensions of the ring of Saturn, determined the mass of Neptune, and made observations on solar velocity and the extent of the corona. Struve made numerous contributions to the *Memoirs* of the St. Petersburg Academy, and edited 14 volumes of *Observations de Pulkova* (1869–93).

STRYCHNINE, strĭk′nĭn, or **STRYCH′NIA** (from Lat. *strychnos*, from Gk. *στρύχνος*, *strychnos*, plant of the nightshade kind). A poisonous alkaloid ($C_{21}H_{22}N_2O_2$) obtained from ripe seeds of *Strychnos nux-vomica* and the St. Ignatius bean. It occurs in right square octahedrons or prisms, colorless and inodorous, scarcely soluble in water, but easily so in alcohol, ether, and chloroform. Pure sulphuric acid forms with it a colorless solution, which, on the addition of bichromate of potash, acquires an intensely violet hue, speedily passing through red to yellow. If, indeed, the solution is diluted with water while it is red and ammonia is added, it becomes a violet purple, changing to yellow. Another test for strychnine depends upon its tetanic effect on the voluntary muscles of animals. Strychnine is intensely bitter, and will impart this quality to 20,000 times its weight of water. Its therapeutic actions are similar to those of Nux Vomica (q.v.). See Alkaloids; Antidote; Brucine.

STRYCH′NOS (Lat., from Gk. *στρύχνος*, *strychnos*, *τρύχνος*, *trychnos*, plant of the nightshade kind). A genus of about 100 species of trees, shrubs, and climbers of the family Loganiaceæ. To this genus belongs *Strychnos nux-vomica*, an East Indian tree of medium size,



NUX VOMICA (*Strychnos nux-vomica*).
a, fruit; *b*, seed.

whose fruit, produced in great abundance, is about the size of a small orange. Its disk-shaped seeds, the nux vomica of commerce, yield the alkaloids strychnine and brucine. The wood of the tree is very hard and durable. The clearing nut and St. Ignatius bean are produced by species of this genus, to which also belongs the South American tree (*Strychnos toxifera*) from the bark of which curare or woorali is obtained. Another species is the upas tieuté (*Strychnos tieute*) of Java, a large climbing shrub, whose bark is reputed poisonous. The wood of a climbing species (*Strychnos colubrina*), found in the north of India, is claimed to cure snake bites. The bark of *Strychnos pseudo-quina*, a Brazilian species, is used as a substitute for cinchona. The climbing species are provided with curious hooked tendrils by which they attach themselves to trees.

STRYJ, strī'y'. A town in Galicia, Austria, 40 miles south of Lemberg (Map: Austria, H 2). It has a castle. Its industries include the manufacturing of leather, matches, and iron products. Stryj was captured but later evacuated by the Russians in the war which began in 1914. See WAR IN EUROPE. Pop., 1900, 23,673; 1910, 30,206.

STRY'KER, MELANCTHON WOOLSEY (1851–). An American clergyman and college president, born at Vernon, N. Y. He graduated at Hamilton College in 1872 and at Auburn Theological Seminary four years later. Between 1876 and 1892 he was pastor of churches in Auburn, N. Y.; Ithaca, N. Y.; Holyoke, Mass.; and Chicago. In the latter year he was elected president of Hamilton College. His publications include: *The Song of Miriam* (1888); a hymnal *Church Song* (1889); *Dies Iræ* (1893; new ed., 1910); *Lattermath* (1896); *The Well by the Gate* (1903); *Baccalaureate Sermons* (1905); *An Outline Study of the History of the Bible in English* (1914); *An Outline Introduction to the Sundry Parts of the Bible* (1915).

STRYPE, JOHN (1643–1737). A church of England historian and antiquary. He was born in London, studied at Cambridge, entered the church, and held for many years, with other smaller livings, the curacy of Leyton, in Essex. His works fill 13 large folio volumes. *Ecclesiastical Memorials*, relating to religion and the Church of England under Henry VIII, Edward VI, and Mary, is his best work, forming, with Burnet's more readable *History of the Reformation*, a consecutive and full account of the reformed Anglican Church. His complete works were reprinted with general index by R. F. Laurence (28 vols., Oxford, 1820–28). His *Memorials of Thomas Cranmer* were republished in 1848–54, and edited by E. P. Barnes in 1853.

STU'ART, or **STEWART**. A Scotch and English royal family. Its origin is traced to Fitzflaald, a Norman, who accompanied the Conqueror to England. His second son, Walter (died 1117), entered the service of David I of Scotland, who conferred lands on him, and the dignity of Steward of Scotland, which became hereditary, and his descendants bore this as a surname, some of the house later modifying it to Steuart or Stuart. For seven generations the stewardship continued from father to son. Walter, the third steward (grandson of the first), held, in addition, the office of Justiciary of Scotland. Alexander, fourth steward, was Regent of Scotland in Alexander III's minority. James, fifth steward, was one of the six regents of Scotland after the death of Alexander III; and Walter, sixth steward, by his marriage with Marjory, daughter of Robert Bruce, eventually brought the crown of Scotland to his family. His son, Robert, seventh high steward, was Regent (1338–41) and afterwards during the captivity of his uncle, David II, 1346–57. On the death of David II (1371) he ascended the throne as Robert II, and died in 1390. (For the subsequent history of the royal family see ROBERT II and III; JAMES I, II, III, IV, V; MARY STUART; JAMES I (of England); CHARLES I and II; JAMES II; MARY II; ANNE.) In the person of James II the line of Stuart was driven from the English and Scottish thrones. The claims of the house were upheld by James's son, the Old Pretender (see STUART, JAMES FRANCIS EDWARD), and by the latter's son, the Young Pretender. (See STUART, CHARLES EDWARD.) A brother of the latter was HENRY BENEDICT MARIA CLEMENT, Cardinal York, born 1725. After Culloden (1746) he went to Rome, took orders, and was advanced to the purple by Benedict XIV in 1747. During his brother's life he was known as Cardinal York; but after his death he assumed the title Henry IX, King of England. The expulsion of Pius VI from Rome, and other events following the French Revolution, drove him to Venice, aged, infirm, and reduced to poverty. George III settled on him an annuity of £4000. He died in 1807 at the age of 82, the last direct descendant in the male line of the royal Stuarts.

The female line of the Stuarts is represented by the descendants of Henrietta Maria, daughter of Charles I, who was married to Philip, Duke of Orleans, brother of Louis XIV of France. This princess had two daughters, of whom the elder, Mary, was Queen of Charles II of Spain, and died childless; the younger, Anna Maria, married Victor Amadeus II, Duke of Savoy and King of Sardinia, and was mother of Charles Emmanuel III, King of Sardinia, and grandmother of Victor Amadeus III of Sardinia. See SAVOY, HOUSE OF.

The branch of the family which the Act of Settlement called to the throne on the death of Queen Anne was descended from the Electress Sophia of Hanover, granddaughter of James I (VI) by her mother, the Princess Elizabeth Stuart (q.v.), Electress Palatine and Queen of Bohemia.

The cadets of the House of Stuart, descendants of Robert II, are represented by some of the most noble titles in Scotch and English history. Consult: Mark Noble, *Historical Genealogy of the Royal House of Stewart* (London, 1795); Andrew Stuart, *Genealogical History of the Stuarts* (ib., 1798); Samuel Cowan, *The Royal House of Stuart from its Origin to the Accession of the House of Hanover* (2 vols., ib., 1908).

STU'ART, LADY ARABELLA, or ARBELLA (1575–1615). The daughter of Charles Stuart, Earl of Lennox, a younger brother of Lord Darnley (q.v.). She was next in the line of succession to her cousin James I of England, and her relationship to Elizabeth gave rise to plots, including one by Sir Walter Raleigh in 1603, to place her on the throne. Several schemes to marry her were defeated by Elizabeth, but in 1610 her secret marriage to William Seymour (q.v.), grandson of the Earl of Hertford, was discovered. Seymour was imprisoned in the Tower and his wife put in the custody of the

Bishop of Durham, but she fled to a French vessel, in which her husband, who had escaped from the Tower, was also to sail. He did not reach it, but took another vessel, while her ship was captured, and she spent the last five years of her life in the Tower, dying insane. Consult: E. T. Bradley, *The Life and Letters of Lady Arabella Stuart* (London, 1889); B. C. Hardy, *Arabella Stuart* (ib., 1913).

STUART, Charles Edward Louis Philip Casimir, often called the Young Pretender (1720–88). A claimant to the British throne—the eldest son of James Edward, known as the Old Pretender, born at Rome. After military service on the Continent, Charles, encouraged by the French government, decided to make an armed attempt to obtain the British crown. The French aid did not come, and he landed almost alone, Aug. 2, 1745, on an islet in the Hebrides. The Highland clans joined him, and Charles pressed on to Perth, where he was aided by Lord George Murray. The government troops were defeated at Prestonpans, Sept. 21, 1745, and Carlisle was taken in November. Lord George Murray outmanœuvred his opponents, and soon had a clear road to London. Early in December the Highlanders were in Derby. Panic prevailed in London. But England did not witness the expected Stuart rising, and Murray was cut off from his base of supplies. In consequence his retreat began December 6, the Duke of Cumberland pursuing. On April 16 (new style April 27), 1746, the rebels were defeated at Culloden Moor. From April to September Charles Edward lay concealed in the north with a price on his head, hunted by soldiers, but safe with the clansmen. He finally reached France after many hairbreadth escapes. Thereafter his life was chiefly marked by dissoluteness. He was in London in 1750, and again in 1752 and 1754, in the vain hope of fomenting another rising. In 1772 Charles married Louisa, Princess of Stolberg (see Albany, Louisa Maria Caroline), but owing to his brutality they separated in 1780. Thereafter Charles lived chiefly at Florence in the company of a daughter born to him by Miss Walkenshaw, his mistress. He died at Rome. Consult: A. C. Ewald, *Life and Times of Prince Charles Stuart, Count of Albany* (2 vols., London, 1875); Andrew Lang, *The Prince Charles Edward* (ib., 1900).

STUART, Charles Macaulay (1853–). An American Methodist Episcopal clergyman, editor, and educator, born in Glasgow, Scotland. He graduated from Kalamazoo College (Mich.) in 1880 and from Garrett Biblical Institute in 1883. From 1896 to 1909 he was professor of sacred rhetoric in Garrett Biblical Institute, and then for two years he edited *The Northwestern Christian Advocate.* In 1911 he was chosen professor of ethics and philosophy of religion in Wesleyan University, and later in the same year he was elected president of Garrett Biblical Institute. He edited *The Methodist Hymnal* (1905) and *The Manifold Message of the Gospel* (1913), and wrote: *The Life and Selected Writings of Francis Dana Hemenway* (1896), with C. F. Bradley and A. W. Patten; *Gospel Singers and their Songs* (1891), with F. D. Hemenway; *The Vision of Christ and the Poets* (1896); *Story of the Masterpieces* (1912); *In Memoriam Charles J. Little* (1912).

STUART, Elizabeth (1596–1662). See Elizabeth Stuart.

STUART, Gilbert (1755–1828). An early and important American portrait painter. He was born at Middletown, near Newport, R. I., Dec. 3, 1755, and painted his first portraits when only 13, having had no instruction. In 1770 he was befriended and taught by Cosmo Alexander, who took him to Scotland, but upon Alexander's death Stuart was forced by poverty to return to America after a year's absence. A maturing talent brought him frequent commissions, and in 1775 he went to London for further study. After much adversity, during which he supported himself for a time as an organist, in 1778 he formed the acquaintance of Benjamin West, with whom he lived and worked for four years. He then began portrait painting independently, and soon became very successful, living in a most lavish manner. After a stay of five years in Dublin, whither he went in 1787 to escape his debts and other entanglements, he returned to America in 1792, his impelling motive being to paint the portrait of Washington. He remained in New York for two years, then removed to Philadelphia, where the first Washington portrait was painted in 1795; at a still later period he lived in the city of Washington, and finally from 1806 in Boston, where he died. The Stuart portraits of Washington, representing the subject in the later years of his life, are the most famous of both artist and sitter. One of the best is the well-known "Gibbs-Channing" portrait, now in the Metropolitan Museum, New York. After 1796 he painted the portrait known as the "Athenæum" portrait (Boston Museum), showing the left side. A full length was painted for the Marquis of Lansdowne in 1796. Nearly 40 replicas of his various Washington portraits have been traced. The historical societies of Boston, New York, and Philadelphia, and other American collections have many examples of his work.

Stuart was an entirely independent and original master. His execution is surprisingly sure, the color pure and delicate, with a pleasing freshness and diffused light effects. He devoted his chief attention to the heads, which are rendered with force and truth, and admirably characterized, the remainder of the picture being treated as merely accessory. The list of his sitters includes the first five presidents of the United States, Edward Everett, John Jay, Jacob Astor, Judge Story, W. E. Channing, Josiah and Edmund Quincy, O. H. Perry, Jerome and Madame Bonaparte. He is especially well represented in the Metropolitan Museum, by the early portraits of Josef de Jaudenes y Nebot, then Spanish chargé d'affaires, and his wife, and by many others, including a second strong likeness of Washington dated 1803. During his residence in England he painted King George III, also George IV while Prince of Wales, Louis XVI of France (at Paris), Mrs. Siddons, Sir Joshua Reynolds, Benjamin West, and many others. Consult: Mason, *Life and Works of Gilbert Stuart* (New York, 1879); *Masters in Art,* vol. vi (Boston, 1907); C. H. Caffin, *American Masters of Painting* (New York, 1913); Samuel Isham, *History of American Painting* (ib., 1915).

STUART, Henry. See Darnley, Lord.

STUART, Henry Benedict Maria Clement, Cardinal York (1725–1807). The second son of James Edward Stuart, the Elder Pretender. See Stuart.

STUART, James. Regent of Scotland after the abdication of Queen Mary. See MURRAY OR MORAY, JAMES STUART, EARL OF.

STUART, JAMES (1713–88). An English painter, archæologist, and architect, born in London. Until nearly 30 years of age he was a poor fan painter, but in 1741 he found means to go to Rome, where he studied Latin and Greek and became interested in archæology. From 1751 to 1755, with Nicholas Revett, he studied antiquities in Athens. Upon their return to England they published, through the encouragement and aid of the Society of Dilettanti, *The Antiquities of Athens, Measured and Delineated by James Stuart, F.R.S. and F.S.A., and Nicholas Revett, Painters and Architects* (1762). The book, as the earliest accurate account of the monuments of Athens, attracted widespread attention; it still has great value. Through its influence the classical style in architecture became widely popular. A second volume of the *Antiquities* was published posthumously in 1789, a third in 1795, and a fourth in 1814. A third edition of the first three volumes was published in 1841 for Bohn's *Illustrated Library*.

STUART, SIR JAMES (1780–1853). A Canadian jurist and statesman. He was born at Fort Hunter, N. Y., was educated at King's College, Windsor, Nova Scotia, and was called to the bar in 1801. Having attained a wide reputation as a successful lawyer, he represented Montreal in the Lower Canada House of Assembly in 1808–17, and was leader of the English party who aimed at predominance in the Legislature and the reunion of the two provinces. He went to England in 1822 to advocate his views, and in 1825 was appointed Attorney-General for Lower Canada. By reason of his independent attitude he was suspended from office in 1831 by Lord Aylmer, the Governor-General, and the suspension was afterward confirmed by the British Colonial Secretary. Lord Durham, however, in 1838 approved of Stuart's course and appointed him Chief Justice of Lower Canada. Stuart drafted the Act of Union which became law in 1841. He was made a baronet in 1840.

STUART, JAMES EWELL BROWN (1833–64). An American soldier, prominent in the Confederate cavalry during the Civil War. He was born in Patrick Co., Va., attended Emory and Henry College, and graduated at the United States Military Academy in 1854. He was lieutenant on the Texas frontier, taking part against the Apache. In 1857 his regiment was sent to Kansas to maintain peace, and later he served against the Cheyenne. In 1859 he was sent out from Washington to assist Col. R. E. Lee in the putting down of the John Brown raid at Harper's Ferry. In April, 1861, he was promoted to the rank of captain, but resigned from the United States army upon receiving notice of the secession of Virginia, and was commissioned lieutenant colonel of Virginia troops. At the first battle of Bull Run he won distinction as a cavalry commander, and became brigadier general, in charge of the cavalry brigade of the Army of Northern Virginia. He made successful raids and was in the Seven Days' Battle. In July, 1862, he was commissioned major general of cavalry, and afterward made a dash upon General Pope's headquarters, making prisoners of several of his staff. This was followed the same night by a raid on Manassas Junction. He was distinguished in the second battle of Bull Run and at Antietam, made a raid into Pennsylvania, guarded the Confederate right at Fredericksburg, and aided Stonewall Jackson at Chancellorsville. After the death of Jackson and the wounding of A. P. Hill, he commanded Jackson's corps temporarily. He took part in Lee's Gettysburg campaign. In the Wilderness he won several successes; and when Sheridan advanced upon Richmond Stuart confronted him at Yellow Tavern, where the Confederates were defeated and General Stuart mortally wounded. He died May 12, 1864. Consult H. B. McClellan, *Life and Campaigns of Major General J. E. B. Stuart* (Boston, 1885).

STUART, JAMES FRANCIS EDWARD (1688–1766). The son of James II of England by his second wife, Mary Beatrice, daughter of the Duke of Modena, known as the Chevalier St. George, or the Old Pretender. Prince James, born but a few months before his father's dethronement, was groundlessly alleged to be a supposititious child, and was involved in his father's exclusion from the crown. In 1715 his party, known in history as the Jacobites, endeavored to place him on the throne by force. In Scotland the Earl of Mar, with about 5000 men, was checked by royal forces under the Duke of Argyll at Sheriffmuir (q.v.), and in England the rising, headed by the Earl of Derwentwater, ended by the surrender of the insurgents at Preston, when Lords Derwentwater and Kenmure were beheaded and others executed and attainted. James escaped to France, and later resided in obscurity, principally at Rome. In 1719 he married one of the wealthiest heiresses in Europe, Maria Clementina Sobieski, granddaughter of John Sobieski, King of Poland. His son Charles Edward was the Young Pretender. Consult: Martin Haile, *James Francis Edward* (New York, 1907); Alice Shield, *The King over the Water* (ib., 1907).

STUART, JOHN. See BUTE, third EARL OF.

STUART, JOHN MCDOUALL (1815–66). A British explorer, born at Dysart, in Fifeshire. In 1838 he emigrated to South Australia and in 1858 began his work of exploration in Central Australia. In October, 1861, he started northward, and in July, 1862, arrived at Van Diemen's Gulf. For this exploit he received from South Australia the grant of £2000, offered to the first colonist who crossed the continent. He published *Explorations in Australia* (2d ed., 1865).

STUART, MARY. See MARY STUART.

STUART, MOSES (1780–1852). An American scholar and teacher. He was born at Wilton, Conn., and graduated at Yale in 1799. He abandoned law for theology. He was pastor of a church in New Haven (1806–09), but is best known for his service as professor of sacred literature at Andover Theological Seminary (1810–48). He was an inspiring teacher, an indefatigable student, and one of the first to make German scholarship known in America. He prepared several Hebrew grammars, the last being a translation of Rödiger's *Gesenius* (1846). With Edward Robinson he translated Winer's grammar of New Testament Greek (1825), and he also translated writings of John and others on methods of biblical study (1821), and Ernesti's *Elements of Interpretation* (1822). A volume of *Exegetical Essays* was published in 1867. Consult Williston Walker, *Ten New England Leaders* (New York, 1901).

STUART, RUTH MCENERY (1856–). An American story writer, whose richly humorous negro sketches have a leading place among their kind. She was born in Avoyelles Parish, La., and was educated at New Orleans. In 1879 she was married to Alfred O. Stuart, a cotton planter. In later life she made her home in New York City. Among her publications are: *A Golden Wedding and Other Tales* (1893); *Carlotta's Intended* (1894); *The Story of Babette* (1894); *Sonny* (1896); *In Simkinsville* (1897); *Moriah's Mourning* (1898); *Holly and Pizen* (1899); *The Woman's Exchange* (1899); *Napoleon Jackson* (1902); *George Washington Jones* (1903); *The River's Children* (1904); *Second Wooing of Salina Sue* (1905); *Aunt Amity's Silver Wedding* (1908); *Sonny's Father* (1910); *Daddy-Do-Funny's Wisdom Jingles* (1913); *Cocoon* (1915); *Plantation Songs* (1916).

STUART-JONES, HENRY (1867–). An English classical scholar, born at Leeds. He was educated at Rossall School and at Balliol College, Oxford. In 1903–05 he was director of the British School of Classical Studies at Rome. Of Trinity College, Oxford, he was a fellow from 1890 to 1906, and in 1911 was elected research fellow, to undertake a revision of Liddell and Scott's Greek Lexicon. His publications include: *Select Passages of Ancient Writers Illustrative of the History of Greek Sculpture* (1895); *The Roman Empire* (1908); *Classical Rome* (1910); *Catalogue of Ancient Sculptures in the Capitoline Museum at Rome* (1912); *Companion to Roman History* (1912).

STUBBS, CHARLES WILLIAM (1845–1912). An English divine and author, born in Liverpool. He graduated at Sidney Sussex College, Cambridge, in 1868. Thereafter he held various livings in the Anglican Church until 1894, when he was appointed Dean of Ely. After 1906 he was Bishop of Truro. Among his writings are: *Christ and Democracy* (1883); *God's Englishmen* (1887); *The Land and the Labourers* (1890); *Christ and Economics* (1893); *Christus Imperator* (1894); *Charles Kingsley and the Christian Social Movement* (1898); *The Social Teaching of the Lord's Prayer* (1900); *Pro Patria* (1900); *Cambridge and its Story* (1904; 3d ed., 1912); *The Christ of English Poetry* (1905). He is also the author of four volumes of verse, *The Conscience* (1884), *Brightnoth's Prayer* (1899), *Castles in the Air* (1904), and *Cornish Bells* (1910). A selection of his *Sermons, Speeches, and Pastoral Letters* was published in 1915.

STUBBS, GEORGE (1724–1806). An English animal painter, engraver, and anatomist. He was born in Liverpool, and after studying independently in England and Italy, became the chief pioneer of animal painting in Great Britain. In 1758 he began his famous *Anatomy of the Horse* (completed 1766) for which he drew and engraved all the plates. He did some curious work in enameling on large plates and painted and engraved rustic and classical pictures, but is celebrated chiefly for his paintings of horses which, although of a type now obsolete and somewhat crude in color, have never been surpassed for truth and accuracy. He is represented in South Kensington Museum and the National Gallery, but his best known pictures, including "The Grosvenor Hunt," "Horse Affrighted by a Lion," "Warren Hastings," "Horses Fighting," and 16 famous race horses are in private collections.

STUBBS, or **STUBBE,** JOHN (c.1543–1591). An English Puritan zealot, born in Norfolk. He was possessed of a fiery zeal against Catholicism, and was so opposed to the Queen's proposed marriage with the Duke of Anjou that, in 1579, he published a pamphlet entitled *The Discoverie of a Gaping Gulf wherein England is like to be Swallowed by Another French Marriage if the Lord Forbid not the Banes by Letting her Majestie see the Sin and Punishment thereof.* Though the pamphlet spoke of the Queen in respectful and loyal terms, Stubbs, his publisher, and the printer were found guilty on a charge of disseminating seditious writings and were sentenced to have their right hands cut off. This cruel punishment, was, in fact, inflicted upon Stubbs and the publisher in the market place at Westminster. Stubbs was, however, loyal to the Queen.

STUBBS, or **STUBBES,** stŭbz, PHILIP (c.1555–c.1610). An English Puritan pamphleteer. In 1583 he wrote, in denunciation of the social follies and vices of the age, *The Anatomie of Abuses;* and in the same year published *The Rosarie of Christian Praiers and Meditations.* He wrote also *A Christall Glasse for Christian Women* (1590), and numerous pamphlets. Both *The Anatomie* and *A Christall Glasse* were very popular, and were several times republished. The former was reprinted in 1836 by Trumbull, and both were edited with forewords and notes by Dr. F. J. Furnival (2 vols., 1877–82). Consult vol. ix of Henry Morley's *English Writers* (London, 1892).

STUBBS, WILLIAM (1825–1901). An English historian and prelate. He was born at Knaresborough, in Yorkshire, and educated at Ripon Grammar School and at Christ Church, Oxford, being elected to a fellowship at Trinity in the year of his graduation (1848), and ordained in the same year. His *Registrum Sacrum Anglicanum*, a calendar of the English bishops from St. Augustine (1858), won for him the appointment of librarian at Lambeth Palace. In 1866 he was appointed regius professor of modern history at Oxford, and during the 18 years of his tenure he had an exceedingly wide influence on historical study in England. His great *Constitutional History of England* (1874–78; 9th ed., 1913) at once took rank as the standard authority on the subject. He was appointed canon of St. Paul's in 1879, Bishop of Chester in 1884, and Bishop of Oxford in 1889. His historical work was all of the careful modern type, based on faithful study of contemporary documents, many valuable specimens of which he edited. His *Historical Introductions to the Rolls Series* have been published in one volume (ed. Hassall, London, 1903). Other notable works are: *Seventeen Lectures on the Study of Mediæval and Modern History* (1886; 3d ed., 1900) and *Councils and Ecclesiastical Documents Relating to Great Britain and Ireland,* edited with A. W. Haddan (1869–73). Posthumous works are: *Lectures on European History* (1904); *Letters 1825–1901* (1905); *Lectures on Early English History* (1906); *Ordination Addresses* (1901), *Visitation Charges* (1904), and *Germany in the Middle Ages* (1908). Consult Gross, *Sources and Literature of English History* (New York, 1900), and W. H. Hutton, *Letters of William Stubbs* (London, 1906).

STUC'CO (It., from OHG. *stucchi*, Ger. *Stück*, piece, patch; connected with Ger. *Stock*, Eng. *stock*, stake, club). A term applied somewhat indiscriminately to the finer and more durable kinds of plaster and plastering. both for external and internal use. In Europe, especially southern Europe, it forms the most common finish for the exteriors of ordinary buildings, especially in cities, where it is employed even for those of a monumental type, as in Vienna, and its use for the like purpose is increasing in the United States. Exterior stucco usually has a good proportion of cement in its composition, and should be applied in several coats. It may be kalsomined or painted with oil paint. Sgraffito (q.v.) decoration is frequently used upon stucco in Italy. For interior work it is used with an admixture of plaster of Paris (q.v.) or fine marble dust, and is then capable of receiving a high finish, and even of being polished. Scagliola or imitation marble is a variety of stucco. The Greeks used stucco to give a finer surface to their coarse stonework, even in their columns, before the finer marbles were used. The Romans of the Republican period often stuccoed the exterior surfaces of their temples. Stucco was later used for interior decoration both of vaults and ceilings, molded while wet into exquisite designs in low relief (e.g., Pompeii and Roman thermæ), tombs (on the Via Latina), and private houses. Those found near the Farnesina in Rome and now in the Museo delle Terme are among the most charming decorative works of any period. Early Christian art continued the style, as is shown by the well-preserved internal decoration of the baptistery of the cathedral in Ravenna. It was not unknown to the Middle Ages, witness the angels in the church at Hildesheim, and it again became popular during the Renaissance, being profusely used in the ceilings of the later period, often with rococo designs.

STUCK, shtụk, Franz, Knight von (1863–). A German painter and sculptor, one of the most prominent German artists of his time. Born at Tettenweis, Bavaria, the son of a miller, he studied at the Munich Academy under Lindenschmit, but was most influenced by the works of Böcklin, and became first known through his drawings for *Fliegende Blätter*, and the two series of art-industrial designs which appeared in Vienna under the titles *Allegorien und Embleme* and *Titel und Vignetten*. His first paintings, "The Guardian of Paradise," "Innocentia," and "Fighting Fauns," exhibited in Munich in 1889, were awarded the gold medal, initiating a series of artistic successes attendant upon his well-known landscapes enlivened with centaurs, fauns, and nymphs, and his impressive delineations of human passions. Of the latter the figure of "Sin" (1893), Eve enfolded by a huge serpent, and, on a larger scale, the allegory of "War" (1894), both in the Pinakothek at Munich, have become particularly famous. In the meanwhile he had painted "Expulsion from Paradise," a "Pietà" (1892), and "Crucifixion" (1892, Stuttgart Museum), a startling deviation from the traditional treatment of this subject. Continued progress in the artist's power of expression was shown in "The Sphinx" (1895, National Museum, Budapest), "Evil Conscience" (1896), and "Procession of Bacchantes" (1897, Bremen); and in such later productions as "Pan" (1908), "Scherzo" (1909), "Innocentia," "Pallas Athene, Spring Procession" (1909), and "The Wounded Amazon." Among his very individual portraits are several of himself, one of his wife, and one of Fritzi Scheff. His plastic work, small figures in bronze, exhibits the same powerful realism in the treatment of form as do his paintings. A characteristic example is the statuette of a "Faun" (National Gallery, Berlin; replicas Kunsthalle, Hamburg, and National Museum, Budapest). One of the original leaders in art Secession (q.v.), Stuck at first met with much hostility, but later came to be considered one of the great leaders in German art. He received the highest awards, became a member of the principal German academic and secessionist societies, a knight of several German and foreign orders, and professor in the Munich Academy. His art captivates by the power and originality of its design and by its strong decorative qualities. Although the color lacks charm, it is quite appropriate to the weird character of his subjects. His drawings are of great power and his etchings important. Consult O. J. Bierbaum, "Stuck," in *Künstler-Monographien*, vol. xlii (Bielefeld, 1899). For his drawings see H. W. Singer, *Franz Stuck: Zeichnungen* (Leipzig, 1912), and for reproductions of his entire works the large publication by Hanfstängl (Munich, 1909).

STUCK, Hudson (1863–). An American Protestant Episcopal clergyman and alpinist. He was born in England, but came to the United States in 1885, and in 1892 graduated from the theological department of the University of the South (D.D., 1907). Ordained a deacon and priest, he was rector of Grace Church, Cuero, Tex., in 1892–94, then served as dean of St. Matthew's Cathedral at Dallas, Tex., until 1904, and thereafter was archdeacon of the Yukon. Archdeacon Stuck was a deputy to the General Convention of his church in 1898, 1901, and 1913. On June 7, 1913, with three companions, Harry Karstens, Robert G. Tatum, and Walter Harper, he reached the summit of the highest peak of the Denali or Mount McKinley group in Alaska (c.20,500 ft.), his party being the first to perform this feat. Preliminary preparations for the climb were made in the winter of 1912–13, the ascent from the lowest base camp was begun April 11, and on May 3 the party had established its immediate climbing base at the head of the Muldrow glacier. On North Peak (c.20,000 ft.) a flagstaff left by the Pioneer Expedition in 1910 was found. On South Peak, the ultimate goal, the corrected mercurial barometer reading was 13.6 inches and water boiled at 174.9°. In recognition of his achievement, Archdeacon Stuck was elected a fellow of the Royal Geographical Society, London. Consult his *Ascent of Denali* (*Mount McKinley*) (New York, 1914). He published also *Ten Thousand Miles with a Dog-Sled* (1914).

STÜCKELBERG, shtụk′*e*l-bĕrk, Ernst (1831–1903). A Swiss genre and historical painter. He was born in Basel, and studied in Bern under Dietler, and in Antwerp, Paris, Italy, and Munich, where he won a gold medal in 1869. His most important work is the frescoes in Tell's Chapel on Lake Lucerne (1878–87). They are well composed and poetic in conception, but hard in color. He also painted a symbolic fresco in the Basel Gallery; historical pictures, such as "A Helvetian Sacrifice" and "Earthquake in Basel" (Basel Museum); Italian scenes, and serious genre scenes, mostly of child life. These include "The Marionettes" (Basel) and "Youthful Love" (Cologne).

STUCKENBERG, stụk′*e*n-bĕrg, John Henry Wilburn (1835–1903). An American Lutheran clergyman and author, born at Bramsche, Hanover. He emigrated to America with his parents in his youth and settled in the West, graduated from Wittenberg College, Ohio, in 1857, and studied in the universities of Halle, Göttingen, Berlin, and Tübingen. Coming back to America, he was ordained a Lutheran minister and held pastoral charges in Pennsylvania and Iowa. In 1873 he was made professor of theology in Wittenberg College, but in 1880 went to Germany again, where he became pastor of the American Chapel in Berlin. After many years in this service he returned to America and took up his residence in Cambridge, Mass. His later years were largely devoted to the study of theoretical sociology, to which he made valuable contributions. His chief works are: *History of the Augsburg Confession* (1869); *Christian Sociology* (1880); *Life of Immanuel Kant* (1882); *Sociology* (1903).

STUCLEY, stŭk'lĭ, or **STUKELY,** Thomas (c.1525–78). An English adventurer. About 1552 he went to France, and there gained the favor of the King, Henry II, who sent him to England to obtain information to be used in a projected attack on Calais. Stucley, however, revealed the nature of his mission to the English government, but, instead of being rewarded, was imprisoned in the Tower. In 1563, with the patronage of Queen Elizabeth, he pretended to join Ribault's colonization expedition to Florida, but instead turned privateer, and seized many French, Spanish, and Portuguese vessels. After two years of this life he was seized at Cork, but apparently was not brought to trial. For several years afterward he was employed in Ireland, but, having intrigued with Spanish agents, he ultimately fled to Spain. In 1571 Stucley commanded three vessels at the battle of Lepanto, and seven years later, while in the service of Sebastian of Portugal, was killed in the battle of Alcázar in Morocco. He became the hero of numerous ballads and plays. One of these, *The Famous History of the Life and Death of Captain Thomas Stukely*, was printed "as it hath been acted," in London in 1605. It was reprinted in Richard Simpson's *School of Shakespeare* (1878), with a biography of Stucley prefixed.

STUDBOOK. A genealogical record of blooded stock. The British Studbook for horses is the oldest in existence and was first commenced in 1791. All the facts that are in existence regarding the evolution through systematic breeding of the modern horse is obtained through the British Studbook. There are records for cattle and dogs in America and England.

STUDDING-SAIL TACK BEND. See Knotting and Splicing.

STUDER, shto͞o'dẽr, Bernhard (1794–1887). A Swiss geologist, born at Büren, Canton of Bern. He studied at Bern, Göttingen, and Paris, and in 1825 was made professor of mineralogy in the Bern Academy, later becoming professor in the University of Bern, which he helped to establish and where he labored continuously until 1873. Some of the more important of his works are: *Beiträge zu einer Monographie der Molasse* (1825); *Geologie der westlichen Schweizeralpen* (1834); *Lehrbuch der physikalischen Geographie und Geologie* (1844–47); *Geologie der Schweiz* (1851–53); *Zur Geologie der Berner Alpen* (1866).

STUDNICZKA, sto͞od-nĭts'kȧ, Franz (1860–). An Austrian classical scholar, born at Jaslo. He studied at the universities of Prague and Vienna. In 1889 he became professor of classical archæology at Freiburg, in 1896 at Leipzig. Later he became director of the Archæological Institute of the University of Leipzig. His publications, consisting almost wholly of articles in the learned periodicals, include: *Kyrene, eine altgriechische Göttin* (1890); "Tropæum Trajani," in *Abhandlungen der Sächsichen Gesellschaft der Wissenschaften*, vol. xxii (1904); "Kalamis," (ib., vol. xxv, 1907); "Ara Pacis" (ib., vol. xxvii, 1909); "Symposion Ptolomaios II" (ib., vol. xxx, 1913).

STUHLMANN, shto͞ol'män, Franz (1863–). A German zoölogist and African explorer, born in Hamburg. After studying at Tübingen and Freiburg, he went to East Africa in 1888, and during the revolt of the Arabs in 1890 entered the German corps of defense as a lieutenant, and was severely wounded at Mlembule. After his recovery he joined the expedition of Emin Pasha to the lake region, was sent ahead from Undussuma to Lake Victoria, and reached the coast in July, 1892, at Bagamoyo, whence he returned to Germany with valuable cartographic material and rich collections, to which he added copiously on another trip to German East Africa, undertaken in 1893–94 by order of the government. In 1908–10 he was secretary of the Colonial Institute in Hamburg. He published *Zoologische Ergebnisse einer in die Küstengebiete von Ostafrika unternommenen Reise 1888–90* (1893–1901); *Mit Emin Pascha ins Herz von Afrika* (1894); *Beiträge zur Kulturgeschichte von Ostafrika* (1909); etc.

STUHLWEISSENBURG, shto͞ol'vīs'en-bụrk (Hung. *Székes-Fehérvár*). A royal free city, capital of the county of the same name, Hungary, 35 miles southwest of Budapest (Map: Hungary, F 3). The episcopal palace and the cathedral are noteworthy edifices. The manufactures of woolens, silks, and knives are extensive and the agricultural interests prominent. Stuhlweissenburg is the *Alba Regia* of the Romans. From the eleventh to the sixteenth century the kings of Hungary were crowned there; afterward the ceremonial took place at Pressburg. The city was held by the Turks from 1543 to 1688, with the exception of the period 1601–02. Pop., 1900, 32,167; 1910, 36,625.

STUKELY, Thomas. See Stucley, Thomas.

STUKELY, stŭk'lĭ, William (1687–1765). An English antiquary, born at Holbeach, Lincolnshire. He graduated at Bennet (Corpus Christi) College, Cambridge, in 1708. With Roger Gales he made long antiquarian tours in various parts of England. Among his many published works are: *An Account of a Roman Temple and Other Antiquities, near Graham's Dike in Scotland* (1720); *Itinerarium Curiosum* (1724; 2d ed., 1776); *Stonehenge* (1740); *Abury, a Temple of the British Druids* (1743); *Palæographia Britannica* (1743–52); *The Philosophy of Earthquakes* (1750; 3d ed., 1756); *The Medallic History of Marcus Aurelius Valerius Carausius* (1757–59).

STÜLER, shtụl'ẽr, Friedrich August (1800–65). A German architect, born in Mühlhausen, Thuringia. He studied in Berlin and in France and Italy. Appointed court inspector of buildings at Berlin in 1830, he was two years later put at the head of the architectural commission of the Royal Palace. His principal buildings include the New Museum (1843–55), several churches, and parts of the Royal Palace in Berlin, the Academy of Sciences at Budapest, the

National Museum of Stockholm (1850–66), the Museum at Cologne (1855–61), the reconstructed Winter Palace at St. Petersburg, the University at Königsberg (1844–63), and the reconstruction of the Stolzenfels Castle and the Hohenzollern Castle (1850–67).

STULL TIMBERING. See Mining.

STUMM-HALBERG, shtụm, Karl Ferdinand, Baron von (1836–1901). A German manufacturer and political leader, born in Saarbrücken. He studied in Bonn and Berlin, and in 1858 became the head of the family firm which had for many years owned the great ironworks at Neunkirchen. He was a member of the Prussian Chamber from 1867 till 1870, and of the Reichstag from 1867 till 1881 and from 1889 till his death, in 1901, and was one of the founders of the German Reichspartei. In 1882 he became a member of the Prussian House of Lords and was created Baron in 1888. Over his thousands of workmen he exercised a paternalistic rule, and furnished them with hospitals, technical schools, a library, model dwellings, and other advantages. He was bitterly hostile to Socialism.

STUMPF, shtụmpf, Carl (1848–). A German psychologist and philosopher, born at Wiesentheid, Bavaria. He studied at Würzburg and Göttingen, being especially influenced by the teachings of F. Brentano and R. H. Lotze. After becoming privatdocent at Göttingen in 1870, he was appointed to the chair of philosophy successively at Würzburg (1873), Prague (1879), Halle (1884), Munich (1889), and Berlin (1894), where he instituted the psychological seminar. In 1895 he became a member of the Prussian Academy of Sciences, and in 1907–08 was rector of Berlin University. His publications include numerous monographs upon psychology, æsthetics, ethnology, epistemology, and especially upon psychological acoustics. They comprise: *Ueber den psychologischen Ursprung der Raumvorstellung* (1873); *Tonpsychologie* (1883–90); *Tafeln zur Geschichte der Philosophie* (3d ed., 1910); *Psychologie und Erkenntnistheorie* (1891); *Beiträge zur Akustik und Musikwissenschaft* (1908–15); *Philosophische Reden und Vorträge* (1910); *Die Anfänge der Musik* (1911). Stumpf is best known by his contributions to the psychological study of sensations of tone and their use in music, though his later philosophical writings attracted widespread attention.

STUNDISTS, shtụn'dists (from Ger. *Stunde*, hour, lesson; so called from their meetings to read the Bible). A Russian sect of German origin. It has gained many converts among the peasants since 1870, and has attracted the hostile attention of the government. The Stundists bear some resemblance to the Baptists, give to the Sacrament a purely symbolic interpretation, and hold communistic views concerning property. They are most numerous in Little Russia and Bessarabia. Consult A. F. Heard, *The Russian Church and Russian Dissent* (London, 1887), and H. Dalton, *Der Stundismus in Russland* (Gütersloh, 1896).

STUPA, stōō'pȧ. A form of Buddhist architecture in India. See Tope.

STU'PART, Robert Frederic (1857–). A Canadian meteorologist. He was born near Toronto, Ontario, and was educated at Upper Canada College. In 1872 he entered the Canadian meteorological service and for some years was senior inspector and probability officer at the Toronto Magnetic Observatory. In 1884–85 he went to Hudson Strait with the expedition sent to report on the navigation of the strait, and was in charge of the chief observation station there. In 1894 he was appointed superintendent and director of the meteorological service of the Dominion and of the Magnetic Observatory, Toronto. He was president of the Royal Astronomical Society of Canada in 1902–03 and of the Canadian Institute in 1906–07.

STURDEE, stûr'dē, Sir Frederick Charles Doveton (1859–). A British naval officer. He entered the navy in 1871 and early saw service in Egypt. In 1899–1902 he was assistant director of naval intelligence. Subsequently he served as chief of staff of the Mediterranean fleet (1905–07) and of the Channel fleet (1907). As rear admiral he commanded the Third Cruiser Squadron in 1912 and the Second Cruiser Squadron in 1912–13. Promoted vice admiral in the latter year, in 1914 he became chief of the war staff at the Admiralty. On Nov. 1, 1914, the British warships *Monmouth* and *Good Hope*, part of a squadron under command of Sir Christopher Cradock, were sunk in an action off the Chilean coast by a German squadron under Admiral von Spee. To avenge this defeat the Admiralty placed Sturdee in command of a fleet which on December 8 attacked and destroyed the German squadron (except for the *Dresden*) off the Falkland Islands in the South Atlantic, sinking the cruisers *Scharnhorst*, *Gneisenau*, *Leipzig*, and *Nürnberg*. The *Dresden* was afterward sunk in Chilean waters. Von Spee was lost with his flagship, the *Scharnhorst*. Sturdee received the K.C.B. in 1913 and was made Baronet in 1916.

STURDY. A parasitic disease of sheep. See Gid.

STURDZA, stōōrd'zȧ, Alexander (1791–1854). A Moldavian publicist and diplomat, who was educated in Germany but was afterward in the diplomatic service of Russia. His *Mémoire sur l'état actuel de l'Allemagne*, published at the Congress of Aix-la-Chapelle in 1818, by order of Alexander I, aroused great indignation in Germany because of the unbecoming levity with which its author arraigned the German national character and branded the universities as hotbeds of the revolutionary spirit and of atheism. In 1819 Sturdza settled at Dresden, married a daughter of Hufeland, and subsequently retired to his estate of Mansyr, Bessarabia, and later to Odessa. His writings include, besides the work mentioned: *La Grèce en 1821* (1822); a biography of Hufeland (1837); and *Œuvres posthumes religieuses, historiques, philosophiques et littéraires* (1858–61).

STURDZA, Demeter (1833–). A Rumanian statesman and author. He studied political science at Munich, Göttingen, Bonn, and Berlin, became Minister of Public Instruction in 1859, and was one of the most zealous promoters of the overthrow of Cuza and the election of Prince Charles of Hohenzollern in 1866. In the cabinet of Bratianu (1876–88) he held repeatedly ministerial posts, and in 1895–96 presided over a National-Liberal ministry. Again in 1897–99, in 1901–04, and in 1907–09 he held the premiership, together with the portfolio of foreign affairs. He wrote: *Uebersicht der Münzen und Medaillen des Fürstentums Rumänien* (1874); *La marche progressive de la Russie sur le Danube* (1878); *Europa, Russia, Romania* (1888); *La question des portes de fer et des* *cataractes du Danube* (1899); *Charles I, roi de Roumanie* (1899 et seq.).

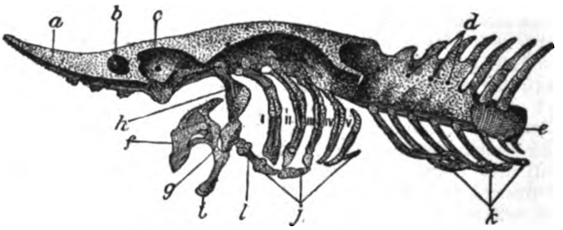
STURE, stōō'rė. A noble family of Sweden which played a very prominent part in the affairs of that country in the fifteenth and sixteenth centuries and became extinct in 1616. Its chief representatives were: (1) Sten Sture the Elder (died 1503). He was a son of Gustaf Sture and the nephew of King Charles VIII, on whose death, in 1470, he became Regent of Sweden, in spite of the opposition of the Swedish nobility, who supported the claims of Christian I of Denmark. He defeated the Danish King in the battle of Brunkeberg, near Stockholm (1471). He introduced printing, and founded the University of Upsala (1477). In 1497 he was forced to resign his place to John of Denmark, but regained power in 1501 and ruled till his death (1503). He was followed by (2) Sten Sture the Younger, a kinsman, who, aided by the peasantry, foiled the plan of the nobles to place Trolle, one of their own number, in power, gained the regency for himself, twice defeated (1517 and 1518) Gustaf Sture, Archbishop of Upsala, whom he had deposed in 1517, and was himself defeated and mortally wounded in a battle against Christian II of Denmark at Bogesund in 1520. His widow, Christina Gyllenstierna, held Stockholm until the new King guaranteed a constitutional government.

STURGE, stûrj, Joseph (1793–1859). An English philanthropist and abolitionist, born in Gloucestershire. About 1818 he became a corn factor at Bewdley, and in 1822 moved to Birmingham, where he was chosen alderman. He toured the West Indies; published *The West Indies in 1837* (1837), to show the evils of slavery; contributed largely to the work to benefit negroes freed by English law; and in 1841 toured the United States with John Greenleaf Whittier to investigate slavery there. In 1842 he joined the Chartists, but was defeated in his candidacy for Parliament. Subsequently he gave much time to promoting international arbitration.

STUR'GEON (OF., Fr. *esturgeon*, Sp. *esturión*, It. *storione*, from ML. *sturgio*, *sturio*, sturgeon). A large fresh-water fish of the ganoid family Acipenseridæ. Sturgeons have an elongated, subcylindrical body, armed with five rows of bony plates or bucklers, each bearing a median keel. The head is covered by bony plates joined by sutures. The snout is produced; the mouth is inferior, opening on the under side of the head, protractile and without teeth. Just anterior to the mouth there are four barbels. The tail has the upper lobe much larger than the lower. There is a single dorsal fin, placed like the anal fin far back. They have a large air bladder, connected by a tube with the œsophagus. About 25 species, in two genera, are recognized, all inhabitants of fresh waters and seas in northern regions. Most of the species are migratory and ascend streams to spawn, but some live permanently in fresh waters. They spawn in the spring and summer, and are prolific, a large female producing from two to three million eggs, constituting from a fifth to a third of its entire weight. They feed on small animals and plants, which they suck into the mouth. The common sturgeon (*Acipenser sturio*), of the coasts and rivers of Europe and northeastern America, has been known to weigh 500 pounds. The lake or rock sturgeon (*Acipenser rubicundus*), once very abundant in the Great Lakes and the Mississippi valley, attains a weight of 200 pounds, but the average is much less. Its sides are reddish, often with irregular blackish spots. Very peculiar in its prolonged paddle-shaped snout is the "shovelnose" or "white" sturgeon (*Scaphirhynchus platyrhynchus*), pale olive in color and about 5 feet long. It is a denizen of the Western and Southern States. Similar species occur in Asia. The largest of American sturgeons is that of the Pacific coast (*Acipenser transmontanus*) called "white" in comparison with the rare "green" sturgeon (*Acipenser medirostris*). The former weighs 300 to 600 pounds and is used as food, but the latter, nearly as large but olive green, is not eaten. The great Russian "beluga" or "huso" (*Acipenser huso*) is very large and has been known to become 20 to 25 feet long and to weigh 3000 pounds. This species, once abundant in the Danube, Volga, and other large rivers emptying into the Black and Caspian seas, has furnished mainly the salted roe called caviar (q.v.), though some comes from the small sterlet (*Acipenser ruthenus*) of the same region. The air bladder is also utilized for making isinglass.

A FOSSIL STURGEON.

A long-beaked sturgeon (*Belonorhynchus striolatus*) fossil in the Trias and Lias formations of the Old World.



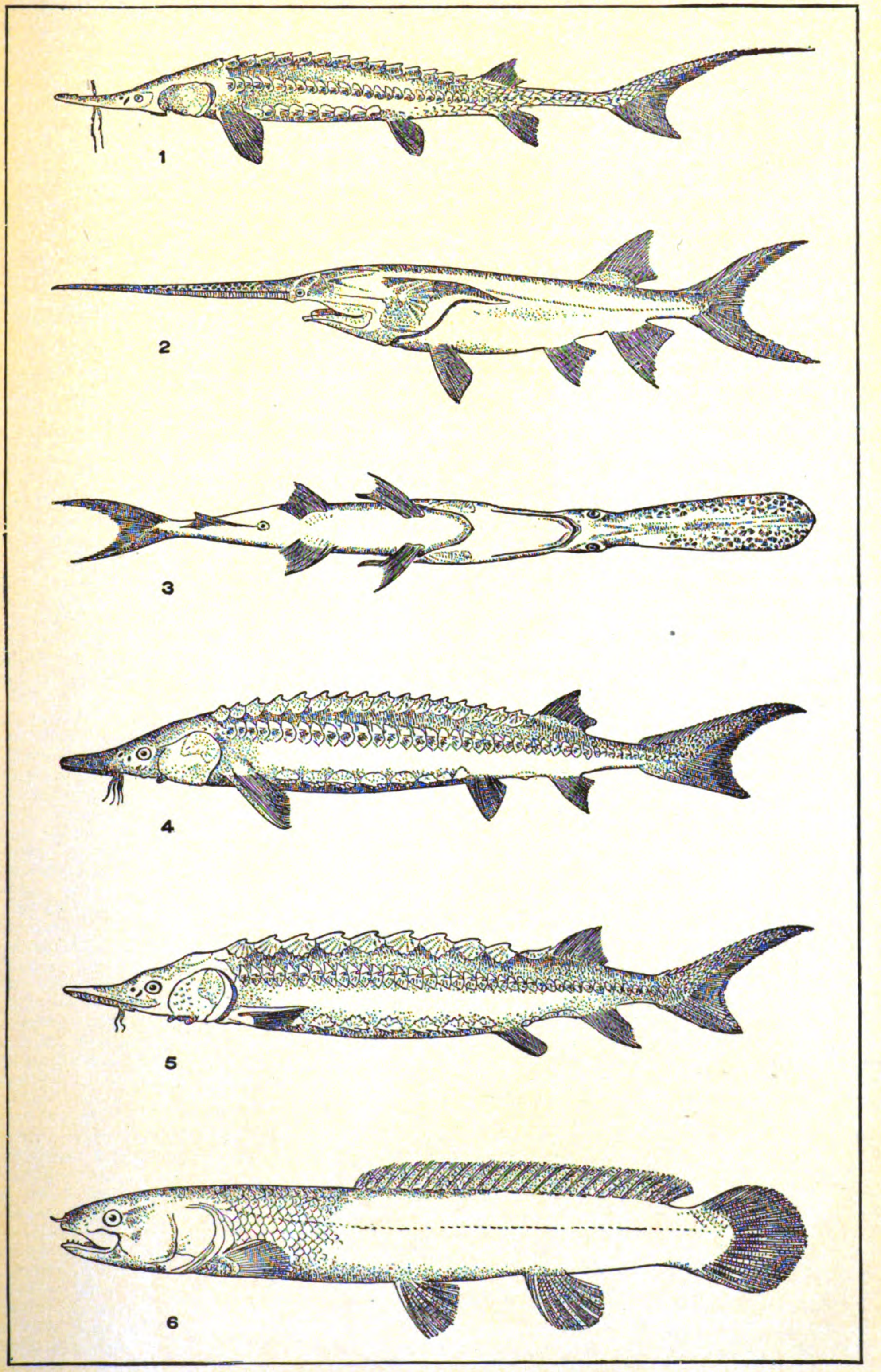
SKULL OF A STURGEON WITH MEMBRANE BONES REMOVED.

a, rostrum; *b*, nasal capsule; *c*, eye socket; *d*, foramina for spinal nerves; *e*, notochord; *g*, quadrate bone; *h*, hyomandibular bone; *i*, mandible; *j*, basibranchials; *k*, ribs; *l*, hyoid bone; I, II, III, IV, V, branchial arches.

Fossil sturgeon remains indistinguishable from the corresponding portions of the skeletons of modern species have been found in rocks as old as the Eocene. Earlier less specialized ancestral forms are *Chondrosteus* of the Jurassic and perhaps also the still older *Palæoniscus* of the Permian and *Cheirolepis* of the Upper Devonian. Consult authorities cited under Fish and Fisheries. See Cheirolepis; Chondrosteus; Palæoniscus; and Plate of Sturgeons.

STURGEON, stûr'jŭn, William (1783–1850). An English electrician, born at Whittington, Lancashire. As early as 1823 he constructed a soft-iron electromagnet, and in 1830 described for the first time the process of amalgamating the zinc plate of a battery with mercury. In 1832 he constructed an electromagnetic rotary engine, the first contrivance by means of which any considerable mechanical force was developed by the electric current. Five years afterward he produced an electromagnetic coil for giving shocks. In 1836 he founded the first electrical journal, the *Annals of Electricity*.

STURGEONS, PADDLE-FISH, AND BOWFIN



1. SHOVEL-NOSED STURGEON (Scaphirhynchus platyrhynchus).
2. PADDLE-FISH (Polyodon spathula), side view.
3. PADDLE-FISH, ventral view.
4. LAKE STURGEON (Acipenser rubicundus).
5. COMMON STURGEON (Acipenser sturio).
6. BOWFIN (Amia calva); in proportion to the other figures much enlarged.

Among his works are: *Experimental Researches in Electro-Magnetism, Galvanism, etc.* (1830); *Lectures on Electricity* (1842); *Twelve Lectures on Galvanism* (1843); *Scientific Researches* (1850).

STURGEON BAY. A city and the county seat of Door Co., Wis., 45 miles northeast of Green Bay, on a canal connecting Green Bay and Lake Michigan, and on the Ahnapee and Western Railroad (Map: Wisconsin, F 4). There are canning establishments, shipyards, stone quarries, and manufactories of boxes, beer, flour, foundry and machine-shop products, etc; and extensive fruit-growing interests. The city has a State fish hatchery, a public library, Peninsula State Park, Indian burial grounds, and government lighthouses. Pop., 1900, 3372; 1910, 4262.

STURGEON FALLS. A town in the Nipissing District, Ontario, Canada, on Lake Nipissing and on the Canadian Pacific Railway (Map: Ontario, F 1). It is the starting point of tourists for French River and the western part of Lake Nipissing. Pop., 1901, 1418; 1911, 2199.

STUR'GIS. A city in St. Joseph Co., Mich., 36 miles south by east of Kalamazoo, on the Grand Rapids and Indiana and the Lake Shore and Michigan Southern railroads (Map: Michigan, D 7). It is of some industrial importance, the leading manufactures being furniture, steel gocarts, stair and drapery rods, plumbers' brass goods, shears, garments, farm tanks, corn poppers, and foundry and machine-shop products. Pop., 1900, 2465; 1910, 3635.

STURGIS, RICHARD CLIPSTON (1860–). An American architect, born in Boston. He graduated from Harvard (1881). After studying architecture in London, he began practice in Boston, where he succeeded to the business of John H. Sturgis in 1887. He was architect of the Franklin Union, Boston; Brookline (Mass.) Public Library; First National Bank, Boston; Perkins Institution for the Blind; the cathedral at Manila, Philippine Islands; and, with Edmund M. Wheelwright (q.v.), of the new Museum of Fine Arts, Boston. Sturgis served as president of the Boston Society of Architects in 1910–14 and of the American Institute of Architects in 1914–15.

STURGIS, RUSSELL (1836–1909). An American architect and author, born in Baltimore. He studied architecture in New York and in Europe, and practiced his profession from 1865 till 1880. Within this period he designed Battell Chapel, Farnam Hall, Durfee Hall, and Lawrence Hall of Yale College; the Farmers' and Mechanics' Bank at Albany; the Homœopathic Medical College and Flower Hospital in New York. In 1878 he became professor of architecture and the arts of design in the College of the City of New York. He was an industrious writer, contributing to a large number of dictionaries, encyclopædias, and periodicals, and ranked as one of the foremost American scholars in the history of architecture and decoration. His writings include: *Manual of the Jarves Collection of Early Italian Pictures* (1868); *European Architecture: An Historical Study* (1896); *Annotated Bibliography of Fine Art* (1897); *How to Judge Architecture* (6th ed., 1903); *Appreciation of Sculpture* (1904); *The Artist's Way of Working in the Various Handicrafts and Arts of Design* (1905; 2d ed., 1910); *The Appreciation of Pictures* (1905); *A History of Architecture* (vols. i–ii, 1906–09; completed, vols. iii–iv, by A. L. Frothingham, Jr., 1915). He contributed to the first edition of the NEW INTERNATIONAL ENCYCLOPÆDIA and was editor and chief author of a *Dictionary of Architecture and Building* (1901–02).

STURGIS, SAMUEL DAVIS (1822–89). An American soldier, born at Shippensburg, Pa. He graduated at West Point in 1846, served through the Mexican War, and was a prisoner at Buena Vista. In the Civil War he was obliged to abandon Fort Smith, Ark., of which he was commandant, but saved his command. As major of the Fourth Cavalry he served in 1861 under General Lyon, and succeeded to his command at Wilson's Creek (q.v.). Sturgis was prominent at South Mountain, Antietam, Fredericksburg, and commanded the cavalry of the Department of the Ohio in 1863–64, capturing Vance and routing Martin's Confederate cavalry. Later he took part in an expedition against Forrest. In 1869 he became colonel of the Seventh Cavalry. He was Governor of the Soldiers' Home near Washington (1881–85), and in 1886 he retired.

STURLUSON, SNORRI. See SNORRI STURLUSON.

STURM, shturm, AUGUST (1852–). A German poet, son of Julius Sturm. He was born at Göschütz. He studied at Jena, Leipzig, and Berlin, first theology, afterward law, which he practiced at Naumburg after 1884. In 1880–82 he had been a government official at Rudolstadt and then for two years had lived in Berlin. Besides the epic poems, *Merlin* (1892), *Kaiser Friedrich der Edle* (1896), *König Laurins Rosengarten* (1897), and *Der König von Babel* (1902), he published *Hohenzollernsagen, Balladen* (1898); the lyrics *Auf Flügeln des Gesanges* (1883; 2d ed., 1909); *Lied und Leben* (1889); *Siegfrieds Tod* (1904); several dramas, notably *Die Liebesburg* (1910), and prose sketches, *Sylter Skizzen* (1887); also *Revision der gemeinrechtlichen Lehre vom Gewohnheitsrecht* (1900) and other juridical works.

STURM, stųrm, JACQUES CHARLES FRANÇOIS (1803–55). A French mathematician, born at Geneva, Switzerland. He was educated at the Academy of Geneva, and in 1827, with his friend Colladou, took the *Grand prix de mathématiques* for the best memoir on the compression of liquids. The famous theorem that bears his name was discovered in 1829. A statement of the results secured by this theorem requires the definition of Sturm's functions: If $f(x)=0$ is freed from equal roots, and $f(x)$ be divided by $f'(x)$ (the derivative of $f(x)$) and the last divisor by the last remainder, changing the sign of each remainder before dividing by it, until a remainder independent of x is obtained, or else a remainder which cannot change its sign, then $f(x)$, $f'(x)$, and the successive remainders, constitute Sturm's functions. The theorem asserts that if, as x increases, $f(x)$ passes through the value zero, Sturm's functions lose one change of sign; if any other of Sturm's functions vanishes, there is neither loss nor gain in the number of changes of sign; the number of roots of $f(x)=0$ between a and b is equal to the difference in the number of changes of sign in Sturm's functions, when $x=a$ and when $x=b$. In 1838 Sturm began teaching in the Ecole Polytechnique, and two years later was elected to the chair made vacant by the death of Poisson.

STURM, shtųrm, or **STUR'MIUS,** JOHANNES (1507–89). A German educator, born near

Cologne, and educated at Leyden and Louvain. In 1537 he organized the Strassburg Gymnasium, which he directed for 43 years. Through his system of gradation of classes, and classification of literary material for use in schools, he shaped the practice of secondary education in German schools, and exercised considerable influence on the Jesuit system of education.

STURM, Julius (1816–96). A German poet, born at Köstritz, Reuss. After studying theology at Jena (1837–41), he was private tutor to the hereditary prince Henry XIV of Reuss, then pastor at Göschütz, near Schleiz, in 1851–57, and at Köstritz from 1857 to 1885. He died at Leipzig. All his lyrics reveal him as a poet of deep religious sentiment and genuine national spirit. The religious poems are incorporated in the collections *Fromme Lieder*, three parts (1852; 1858; 1892; 12th ed., 1893 et seq.); *Zwei Rosen oder das Hohelied der Liebe* (1854); *Von der Pilgerfahrt* (1868); *Gott grüsse dich* (1876); *Dem Herrn mein Lied* (1884); *Palmen und Krone* (1888); and others; while the volumes with secular contents include: *Für das Haus* (1861); *Lieder und Bilder* (1870); *Kampf- und Siegesgedichte* (1870); *Spiegel der Zeit in Fabeln* (1872); *Kinderleben* (1877), illustrated by Ludwig Richter; *Immergrün* (1880); *Natur, Liebe, Vaterland* (1884); *In Freud und Leid* (1896). For his biography, consult Hepding (Giessen, 1896) and Hoffmann (Hamburg, 1898).

STURM, Rudolf (1841–). A German mathematician. He was born at Breslau, where he was educated at the university. He served as professor at the Technische Hochschule of Darmstadt in 1872–78, at the Akademie (now University) of Münster in 1878–92, and thenceforth as professor of mathematics at Breslau. His works include: *Synthetische Untersuchungen über Flächen 3. Ordnung* (1867); *Elemente der darstellenden Geometrie* (1874; 2d ed., 1900); *Das Gebilde ersten und zweiten Grades der Liniengeometrie in synthetischer Behandlung* (3 vols., 1892–96); *Die Lehre von den geometrischen Verwandtschaften* (4 vols., 1908–09); *Maxima und Minima in der elementarischen Geometrie* (1910).

STURT, Charles (1795–1869). An Australian explorer. He was born in Bengal, India, of English parents, was educated in England, entered the British army, and in 1825 went to New South Wales. In 1828 he headed an exploring expedition which penetrated the interior of Australia and discovered the Darling River. On a second journey (1829–30) he discovered the Murray River, which he descended to Lake Alexandrina. Another expedition in 1844 reached the centre of the continent. He held several high colonial positions. He became totally blind as a result of the hardships he had undergone, and returned in 1853 to England. There he died just before the date when he was to have received the K.C.M.G. He published *Two Expeditions into the Interior of Southern Australia 1828–31* (2 vols., 1834), and *Narrative of an Expedition into Central Australia in 1844–46* (2 vols., 1849). Consult N. G. Sturt, *Life of Charles Sturt* (London, 1899).

STURZ, shtụrts, Helferich Peter (1736–79). A German author, born at Darmstadt. He studied law (1753–58) at Jena, Giessen, and Göttingen, was appointed secretary in the department of foreign affairs at Copenhagen in 1764, soon after private secretary to Count Bernstorff, and in 1768 went with the retinue of King Christian VII to England and France. Involved in Struensee's downfall in 1772, he was imprisoned and banished from Copenhagen, but appointed again to a position at Oldenburg in 1773, and died at Bremen. His title to the reputation as one of the most tasteful German prose writers is amply demonstrated by the exquisite *Briefe eines Reisenden* (1777), and his *Erinnerungen aus dem Leben des Grafen von Bernstorff*. Consult the biography by Max Koch (Munich, 1879).

STUTTERING. Imperfect action of the organs of articulation resulting in defective speech. See Stammering.

STUTTGART, shtụt′gȧrt. The capital of the Kingdom of Württemberg, Germany, situated at an elevation of 890 feet (Map: Germany, C 4). Stuttgart occupies a delightful site surrounded by attractive suburbs and amid vine-clad heights. The pronounced adherence of its many fine architects to the Renaissance types explains the stately appearance of the city.

The spacious Königstrasse extends diagonally from southwest to northeast through the old or inner city and borders the majestic Schlossplatz—the centre of interest. Here rises the impressive King William column (1841), 93 feet high, embellished with allegorical figures. Here too are the splendid Königsbau, the palace of the Crown Prince, the Residenz-Schloss (palace), the royal theatre, and the royal stables. The fine statue of Schiller by Thorwaldsen, erected in 1839 by national subscription, is near by. Adjacent also is the striking Gothic Stiftskirche, begun in 1436. Southeast of the Old Palace is the palace of King William II, where the fine modern Neckarstrasse begins its course northeastward. In the immediate vicinity are housed the Württemberg archives and also the extensive and valuable natural-history collections of Stuttgart. The royal public library near at hand contains upward of 603,000 volumes, 5500 manuscripts, and many specimens of early printing. The library building holds also the museum of Württemberg antiquities, among which may be seen ceramics, weapons, and articles taken from ancient tumuli and lake dwellings. In the rear of the library is the large modern Palace of Justice. Between the library and the Residenz-Schloss stands a spacious and famous academy—the Karlsschule. Extending northeast from this vicinity and along the Neckarstrasse is the beautiful Schlossgarten. It embraces 200 acres, is 2 miles long, and is embellished with ponds, flower designs, and sculptures. Here are found the botanic gardens, the mint, and the notable Stuttgart museum of art with its collections of sculpture and painting. In the northwest section of the city stands the Technical High School (1386 students in 1913–14) facing the delightful Stadtgarten—one of the popular resorts. In the eastern part of Stuttgart is the immense new Liederhalle. In the vicinity of the Schlossplatz is found the modern Renaissance edifice of the Landesgewerbe Museum.

Among the prominent newer buildings in Stuttgart are the Queen Olga buildings, the new Town Hall, the Catholic church of St. Nicholas, and the Peace Church. The Uhlandshöhe and the Jägerhaus may be especially noted among the delightful resorts in the environs, as well as the royal country seat Wilhelma—a fine Moorish structure begun in 1842. Stuttgart has an art academy, the Württemberg Art Union with a permanent exposition of modern masters, a technical high school with sections for architecture, civil, electrical, and mining engineering, chemistry and pharmacy, mathematics and natural science, an exposition of export products, the provincial industrial museum, a famous conservatory of music, an industrial and commercial library, and a veterinary school. It is the leading printing and book-publishing city of south Germany. Among its prominent manufactures are furniture, carriages, pianos, paper, leather, chemicals, colors, jewelry, bells, cigars, portmanteaus, chocolate, and especially cottons. Hops, cloth, and horses form special items in the trade. The city is governed by an overburgomaster, two advisers, and a council of some 24 members. Pop., 1900, 176,699; 1910, 286,218, mainly Protestants.

Stuttgart is first mentioned in 1229. It became the official capital of Württemberg in 1482; but it did not begin to improve and assume its present splendid proportions until about 1800. Consult: Klaiber, "Stuttgart," in *Europäische Wanderbilder* (Zurich, 1892); Widmann, *Wanderung durch Stuttgart und Umgebung* (Stuttgart, 1896).

STUTTGART, stüt'gärt. A city in Arkansas Co., Ark., 51 miles by rail southeast of Little Rock, on the St. Louis Southwestern and the Chicago, Rock Island and Pacific railroads. It makes large shipments of rice, oats, hay, and potatoes, and has rice mills, a handle factory, irrigating pump and screen works, an iron and brass foundry, and a saw mill. Pop., 1900, 1258; 1910, 2740.

STUYVESANT, stī've-sant, Peter (1592–1672). A Dutch Governor of New Netherland. He was born in Holland; early entered the military service of the Dutch in the West Indies, and in 1635 was made Director of the Colony of Curaçao. In 1646 the Dutch West India Company appointed him Director General of their colony in North America, New Netherland, where he soon gained the confidence of the colonists by his efficient administration and public improvements. He reconciled the Indians, made hostile by former unjust treatment, and arranged with the New England commissioners, in 1650, the boundaries between English and Dutch territories, but this was not entirely satisfactory to the Dutch colonists, who claimed he had ceded considerable territory rightfully theirs. A convention of delegates in 1653 demanded for the people a share in the appointment of local officers, but Stuyvesant ordered them to disperse, claiming his authority was not from the people, but from God and the Dutch West India Company. The protracted contentions of the Dutch and the Swedes near the Delaware River became more critical in 1654, when the Swedish Governor seized the fort built by the Dutch where Newcastle now stands. To end this trouble, Stuyvesant in 1655 with 600 men sailed up the Delaware, recaptured the fort, and established the Dutch authority over the entire territory. After nine years of comparative quiet, in 1664 a force of English soldiers arrived under Colonel Nicolls, who demanded a surrender of the government, on the ground that the whole territory had been given by royal charter to the Duke of York. The town at the time contained 1500 inhabitants and was defended by a stone fort and 20 cannon. Stuyvesant at first refused, but finding the people anxious to exchange rulers, he yielded to the English demand. Stuyvesant, in 1665, reported personally to the authorities in Holland, but soon returned to New York, where he spent the remainder of his life, cultivating an extensive farm called the Bouwerij (Bowery). He was buried where St. Mark's Church now stands, and the elaborately inscribed stone that covered his grave is built into the eastern wall of the church. Consult: E. B. O'Callahan, *The History of New Netherland* (New York, 1848); Bayard Tuckerman, *Peter Stuyvesant* (ib., 1893); J. S. C. Abbott, *Peter Stuyvesant* (ib., 1898).

STYE, or **STY** (formerly also *stian*, from AS. *stigend*, stye, pres. part. of *stigan*, Ger. *steigen*, to rise), or Hordeolum. The popular name for an acute inflammation occurring around the follicle of an eyelash. It begins as a small, red, tense swelling, accompanied with considerable itching and a feeling of stiffness. In a few days pus forms; a yellowish point appears at the apex of the swelling; and when the cuticle gives way, pus and a small slough of connective tissue escape, after which there is a general remission of the symptoms, and the eyelid soon resumes its natural state.

The treatment includes the use of cold compresses of boric acid solution to abort the stye, hot ones to hasten suppuration, and evacuation of pus when it appears. Errors of refraction should be corrected and the general health improved in order to prevent recurrence.

STY'LITE. See Pillar Saint.

STY'LOBATE (Lat. *stylobata*, *stylobates*, from Gk. *στῦλος*, *stylos*, pillar + *βαίνειν*, *bainein*, to go). The topmost step of the crepidoma (*κρηπίδωμα*) or substructure of a Greek temple. This consists of the foundations, or stereobate, and the surrounding steps, usually three in number. On the topmost step, the true stylobate, rest the columns. The term is sometimes extended to apply to the whole series of steps.

STYLOGRAPHIC PEN. See Pen.

STY'LONU'RUS (Neo-Lat., from Gk. *στῦλον*, *stylon*, acc. sg. of *στῦλος*, *stylos*, pillar + *οὐρά*, *oura*, tail). A gigantic extinct arachnid, allied to *Eurypterus*, with a body about 6 feet in length and with five pairs of legs, of which the posterior pairs are much elongated, and a long spine on the tail. It is found in the Silurian and Devonian of Scotland and of New York and Pennsylvania. See Arthropoda; Eurypterida; Merostomata.

STYM'PHALUS. See Hercules.

STYP'TIC. An agent employed in surgery for the purpose of checking the flow of blood by application to the bleeding orifice or surface. See Bleeding.

STY'RAX. See Storax.

STYRIA, stĭr'ĭ-à (Ger. *Steiermark*). A duchy and crownland of Austria (Map: Austria, D 3). Its area is 8658 square miles. The northern part of Styria belongs to the region of the central Alps, while the southern part is occupied by the Styrian Alps. The plains are generally small, but there are a large number of fruitful valleys along the rivers, the chief of which are the Enns, Mur, Drave, and Save. There are many mountain lakes and mineral springs. Styria has a large proportion of productive land; the forests cover nearly one-half of the surface. Arable land (not including gardens, vineyards, and pastures) amounted in 1912 to 418,259 hectares, or nearly 19 per cent of the total area. Wheat, rye, corn, oats, and barley are leading crops. Hay is grown in large quantities, and cattle-raising is very important, especially in upper Styria. Grapes and fruits are cultivated to a lesser extent. In mineral production Styria is one of the important crownlands of Austria. In 1912 it produced 1,791,150 metric tons of iron ore (over 61 per cent of the total Austrian output), 3,091,397 tons of lignite, and 14,031 tons of graphite. It has also lead, zinc, sulphur, salt, and a great variety of useful earths and stones. The value of the mineral output in 1912 was about $8,759,400. The manufacturing industries are chiefly connected with the mineral products. There are large mills for the production of rails, sheet iron, wire, and smaller iron and steel articles. There are also several extensive machine shops, glassworks, distilleries, breweries, tobacco factories, and paper mills. The principal domestic exports are fruits, timber, cattle, and metal products. The Diet of Styria is composed of 87 members, representing the landed aristocracy, the towns and industrial centres, the rural communities, and chambers of commerce. In the lower house of the Austrian Reichsrat Styria is represented by 30 delegates. In 1911 Styria had 919 public elementary schools, attended by 202,542 children, or about 95 per cent of the school population. Pop., 1900, 1,356,494; 1910, 1,444,157. Over 70 per cent are German and over 29 per cent Slovenian; about 98 per cent are Roman Catholic. The principal towns, with 1910 population, are: Graz (q.v.), the capital, 151,781; Marburg, 27,994; Eggenberg, 12,745; Leoben, 11,025.

History. Under Roman control the territory of Styria formed a portion of both Pannonia and Noricum, and was even then famous for its iron and steel. During the period of the great migration of nations the various invaders of the Italian peninsula swept through or settled in this district and at the close its population was essentially Slavic. It was a portion of the empire of Charles the Great, and was later included in the Carinthian mark erected against the Hungarians. Soon after the middle of the eleventh century the Margrave Ottokar styled himself Margrave of Steier, whence the region came to be known as Steiermark (Styria). In 1192 the region that is now the Duchy of Styria became a portion of the possessions of the dukes of Austria, and after belonging for a time to Ottokar II of Bohemia, passed in 1276 into the possession of the Hapsburgs. The Reformation was welcomed by the people, but the intolerance of the Austrian rulers drove many of the inhabitants into exile.

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STYRIA, Ottokar of. See Ottokar of Styria.

STYX (Lat., from Gk. Στύξ, from *στυγεῖν*, *stygein*, to hate, loathe). In Greek legend, one of the rivers of the lower world; it was originally, perhaps, the only stream which separated the region of the dead from the living. One-tenth of Oceanus streamed down to form the Styx, the other nine-tenths surrounded the earth. As the goddess of this stream, Styx was the eldest daughter of Oceanus, and became, by the Titan Pallas, mother of Zelos, Nike, Cratos, and Bia (Emulation, Victory, Might, and Force), with whom she joined Zeus at the beginning of the struggle with the Titans. For this she was made the guardian of the sacred oaths which bound the gods. She was described as living in the far west, in a house with silver pillars, where the water streamed from above. Thence Iris brought the water by which the gods swore, and terrible suffering awaited the divinity who committed perjury. With the development of the conceptions of the lower world, the rivers received various names, and Charon was introduced as the ferryman of souls across the Styx. The name was also given to a waterfall in northeastern Arcadia, near Nonacris. The water descends over a cliff some 600 feet high on the side of Mount Chelmos into a wild and rugged glen, and the surroundings suggested to the Greeks the gloomy entrance to the lower world.

SUABIA. See Swabia.

SUAHELI, swȧ-hē'lĭ. A people of Africa. See Swahili.

SUAKIM, swä'kĭm, or **SUAKIN,** swä'kĭn. A seaport of Egyptian Sudan, on a small island in the Red Sea (Map: Africa, H 3). It is connected with the desert mainland by a railroad bridge. The town consists of two main parts. The government buildings and the residences of the official class in the one section present an imposing appearance in direct contrast to the wretched dwellings of the natives in the other section. Saukim is conspicuous as the embarking place for African pilgrims traveling to Mecca. It has a well-protected harbor and is an important shipping point for the products of the interior. These include ivory, tobacco, and gums. The trade is increasing, but the city suffers from the competition of Port Sudan. The domestic manufactures are lance heads, cutlery, and leather cases. Suakim was founded by the Turks, and was a slave port until the traffic was suppressed. The vicinity of Suakim was a battle ground between the Anglo-Egyptians and Osman Digna in 1884 and 1890. Pop., 1905, 10,500.

SUANITIANS, swȧ-nĭsh'*a*nz, or **SWANS.** One of the Georgian peoples of the Caucasus, dwelling in the Transcaucasian Province of Kutais between the Imeritians and the Mingrelians (qq.v.). See also Georgians.

SUARDI, swär'dē, Bartolommeo, called Bramantino (c.1460–1529). An Italian painter and architect of the Lombard school. He studied in Milan and was early influenced by Foppa. Later he became the assistant and imitator of Bramante, whence his surname. He distinguished himself as an engineer at the defense of Milan in 1523 and was appointed court architect to Duke Francis (II) Sforza in 1525. His types have grandeur and sensitiveness, his architectural backgrounds are very fine, and his color scheme is original. Among his best-known paintings are the frescoes of "St. Martin" and "Madonna and Angels" (Brera, Milan); "Adoration of the Magi" (Layard Collection, Venice); "Flight into Egypt" (Santa Maria del Sasso, Locarno); "Ecce Homo" (Certosa of Pavia) and "Calvary" (New York Historical Society).

SUÁREZ, swä'rȧth, Francisco (1548–1617). A Spanish theologian and scholastic philosopher. He was born at Granada, entered the Jesuit

Order in 1564, and came under the direction of the great ascetic Rodríguez during his novitiate at Medina del Campo. The general of the society, Aquaviva, called him to teach in Rome (1580–85). Returning to Spain for reasons of health, he taught at Alcalá, Salamanca, and Coimbra. Besides his thorough knowledge of the schoolmen, and especially of Thomas Aquinas, whom he usually follows, he displays remarkable familiarity with the writings of the first Christian centuries. His complete works were reprinted in 28 volumes (Paris, 1856–61). Consult Werner, *Franz Suarez und die Scholastik der letzten Jahrhunderte* (Regensburg, 1861).

SUÁREZ MUJICA, swä′rȧs mōō-hē′kȧ, EDUARDO (1850–). A Chilean statesman and diplomat, born in Santiago and educated at the university there. As acting Secretary of Foreign Affairs (1882–88), Governor of Atacama (1901–03), member of Congress (1903–09), and Minister of Justice and Public Instruction (1908) he proved his ability as a public official. He began his diplomatic career in 1909 as Minister to Mexico and Cuba, and two years later was appointed Minister (from 1914, Ambassador) to the United States. He took an active part in Pan-American affairs, being a member of the Niagara Falls Conference to discuss the relations of the United States and Mexico (1914) and of the Pan-American Conference on Mexico (1915), which determined on the recognition of Carranza.

SUAVIS. See LOMBARD, LAMBERT.

SUBALTERNATE PROPOSITIONS. See OPPOSITION.

SUBANDHU, sōō-bänd′hōō. A Sanskrit novelist, who lived probably in the latter part of the sixth century A.D. Apart from a few verses he is known as the author of the *Vāsavadattā*, a highly artificial romance dealing with the love of Prince Kandarpakētu for the Princess Vāsavadattā. The action of the novel is very slight, and the style abounds in long compounds, conceits, and assonances. The novel is important in Sanskrit literary history as being the first of the romantic school, and thus being the acknowledged model for the *Kādambari* and the *Harṣacarita* of Bana (q.v.). It has been edited by Hall (Calcutta, 1859) and Vidyasagara (ib., 1874), and in Telugu script at Madras (1862); and has been edited and translated into English with an admirable introduction and lexicographical appendix by L. H. Gray (New York, 1913). See NOVEL.

SUBANUN, sōō-bä′nün. A partially Mohammedanized tribe which inhabits the Sibuguey Peninsula of Mindanao. Their garments and dwellings resemble those of the Moro. Each settlement has a headman, with a home large enough to accommodate several families. Their agriculture is still primitive, with a scant yield. The deficiency is supplied by forest products and game. Consult E. B. Christy, *Subanuns of Sindangan Bay* (Manila, 1909). See PHILIPPINE ISLANDS.

SUBBITUMINOUS COAL. See COAL.

SUBCON′SCIOUSNESS. A term applied, somewhat indefinitely, to degrees of consciousness which are lower than the highest degrees of attention, or even lower than the conscious levels accessible to introspection. Its principal uses are: (1) as an arbitrary term, referring to a recognized form of psychoneural disease (e.g., hysteria, q.v.) and not implying a theory or description of that disease (Janet). (2) As the obscure or non-focal content of consciousness, which is observable but unobserved (Stout). Observation in this sense is usually equivalent to cognition, and the obscurity of the subconscious processes is a matter of awareness rather than of attentive clearness. (See ATTENTION; MEANING; NOETIC CONSCIOUSNESS.) (3) As dissociated passive ideas, which exist alone, partially or entirely out of associative relations to the ideas of consciousness proper. (4) As dissociated active ideas, which exist apart from the normal or personal consciousness, but which are actively functioning either to become conscious or to produce some effect upon the behavior or the physiological state of the individual (Sidis, Freud). (5) As a dissociated personality, psychologically complex and internally organized, which functions and develops independently (Prince). Such a dissociated personality or coconsciousness may be thought of as alternating with the principal or personal consciousness, or as persisting simultaneously with it. In the latter case, there may be an alternation of the dominance of the two consciousnesses, or both consciousnesses may appear, by the inconsistent behavior of the individual, to be in effective function at the same time. (See DOUBLE CONSCIOUSNESS; HYSTERIA; TRANCE.) (6) As the sum of all material reproducible in consciousness (Sidis). The theory here is that an idea, in order to be reproduced in memory, must in the meantime be conserved as idea; and since it is obviously not conscious, it must be subconscious. (7) As the physiological (nervous) phenomena which are correlated with the idea and account for its reproduction (Münsterberg, Ribot, Prince). On this view the idea, which is psychological, is conserved, not in kind, but by the nervous system. (8) As a psychical concept, which explains the apparent conservation of ideas without implying that the subconscious is phenomenally actual (Hart). (9) As a teleological principle, which insures the production, with lowered oversight, of (mental) sequences that present a more or less striking infusion of cohering purpose (Jastrow). (10) As the absolute, a philosophical conception.

It should be observed that, on most of these views, the subconscious baffles introspection, is phenomenally unobserved, and is inferred in order to explain certain psychological phenomena. If, however, we cannot observe the subconscious as actual, we have no reason to assume that it is conscious at all, and the term becomes a misnomer. In this case, then, as in others, we must look to the nervous system for the explanation of psychical phenomena and of facts of behavior; and our point of view will thus coincide approximately with the seventh above.

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Morton Prince, *The Unconscious* (ib., 1914). See Double Consciousness; Trance; Hypnotism, Hypnosis; and, in general, Attention; Consciousness; Mental Pathology; Psychotherapy; Unconscious, The.

SUBCONTRARY PROPOSITIONS. See Opposition.

SUB'DEA'CON. A member of a major order in the Roman church, who is bound to celibacy. The subdiaconate apparently originated later than the episcopate, presbyterate, and diaconate, and probably developed from the last named as deacons rose in importance. It is first mentioned in a letter of Pope Cornelius (255). The function of the office is to assist the deacon, in modern times especially in the celebration of the Eucharist. In the Roman Catholic church the subdeacon of the mass is not necessarily or usually a priest. Consult Reuter, *Das Subdiaconat* (Augsburg, 1890), and see Deacon; Orders, Holy.

SUB'DOM'INANT. The interval one-fifth below the tonic, and the fourth degree of the scale.

SUBIACO, so͞o'bē-ä'kō (Lat. *Sublaqueum*). A city in the Province of Rome, Italy, in the Sabine Mountains, 47 miles by rail east of Rome, on the Teverone (ancient Anio) (Map: Italy, D 4). Here are to be seen walls and terraces of one of Nero's villas, and the famous monasteries of Santa Scolastica (founded in 507) and of San Benedetto, the cradle of the Benedictine order of monks. Here in 1465 the Germans Arnold Pannartz and Conrad Schweinheim published the first book printed in Italy, and copies of their editions of Lactantius, Cicero, and Augustine are still in the monastery library, which has lost, however, most of its precious manuscripts. San Benedetto contains thirteenth-century frescoes and paintings. Pop. (commune), 1901, 8005; 1911, 8215.

SUBIN'FEUDA'TION (from Lat. *sub*, under + ML. *infeudatio*, infeudation, from *infeudare, infeodare*, to confer in fee). The act by which a feudal lord granted a portion of his lands to a tenant upon condition that the latter hold of the former subject to the incidents of feudal tenure. This was accompanied with the feudal ceremonies usual in those times. It was by this means that the feudal manors of England were created. As this practice tended to evade the feudal rules against alienation it was forbidden by the famous statute of Quia Emptores. See Feudalism; Manor; Real Property; Tenure.

SUBJECT (OF. *subject, suject*, Fr. *sujet*, from Lat. *subjectus*, subject, inferior, from *sub*, under + *jacere*, to throw). A person who by reason of birth in a country or naturalization under its laws owes allegiance to its sovereign power. The term is almost exclusively employed to denote such a person under a monarchical form of government; whereas, the word citizen is applied to a member of a republic. The rights, privileges, and duties of subjects, of course, depend upon the form of government, and they may differ in political rank and station; thus a duke or an earl is as much a subject of the crown of England as a peasant, although the former is entitled to certain dignities and honors which the latter does not possess. Until recent times (1870 in England) European governments almost universally refused to recognize the right of a subject to change his allegiance, but they now generally concede this. The policy of the United States in permitting aliens to become citizens by naturalization has probably influenced such nations in changing their arbitrary and despotic attitude on this question, as, of course, it would lead to international difficulties if a naturalized citizen of the United States were to be treated as a subject of the nation whose sovereignty he had renounced in order to become a citizen of the Republic. Consult A. P. Morse, *Treatise on Citizenship* (Boston, 1881). See Alien; Allegiance; Citizen; Naturalization, and the references there given.

SUBKINGDOMS, Animal. See Classification of Animals.

SUB'LAPSA'RIAN. See Infralapsarian.

SUBLICIAN (sŭb-lĭsh'an) **BRIDGE** (Lat. *Pons Sublicius*). The most ancient of the bridges over the Tiber at Rome, ascribed by tradition to Ancus Marcius. The Sublician remained the only bridge at Rome until the second century B.C. It was twice carried away and restored and its piers remained through the Middle Ages. The last remnants were destroyed in 1877. Consult S. B. Platner, *The Topography and Monuments of Ancient Rome* (2d ed., Boston, 1911).

SUB'LIMA'TION (Lat. *sublimatio*, an uplifting, from *sublimare*, to uplift, from *sublimis*, lofty, from *sub*, under + *limen*, threshold). A term applied to the distillation of those volatile solids that, when heated, pass into the gaseous state without melting. Such substances, including iodine, arsenic (i.e., arsenious acid), the chlorides of iron and aluminium, certain organic compounds, etc., may be readily freed by sublimation from nonvolatile impurities. It may be observed that all solids, theoretically without exception, give off more or less vapor, i.e., sublime, even at extremely low temperatures, and of course the evaporation (q.v.) is accompanied by absorption of heat. Ordinarily the rate of evaporation of solids is too small to prevent the temperature from rising to the melting point on the application of heat. But in the case of solids that are very volatile and have a somewhat high melting point the heat applied may be largely used up by the rapid evaporation, and so the temperature cannot rise high enough for the substances to melt. Of course, by placing such substances in a closed vessel and thus preventing free evaporation, they may be readily caused to melt.

SUBLIME PORTE. See Porte.

SUBLIM'INAL CONSCIOUSNESS (from Lat. *sub*, under + *limen*, threshold). Literally a degree of consciousness below a certain theoretical limit of intensity or clearness. See Subconsciousness; Unconscious, The.

SUBLITTORAL FACIES. See Paleontology.

SUBMARINE BOAT. See Torpedo Boat, Submarine.

SUBMARINE GUN (from Lat. *sub*, under + *marinus*, pertaining to the sea, from *mare*, sea). A gun which discharges its projectile beneath the surface of the water. In 1797 a Frenchman, M. Reveroni Saint-Cyr, proposed to arm a catamaran with a submarine gun, but no attempt is known. Robert Fulton and other Americans attempted the construction of effective submarine guns, but without practical results. Ericsson was the most successful, and his experiments extended over several years.

The difficulty of securing accuracy, the shortness of range, and the improvement of the automobile torpedo tended to discredit the gun. Torpedoes are now discharged from submerged tubes, but these are not properly guns, as the projectile force is merely sufficient to clear the torpedoes from the ship's side. In the Davis torpedo a gun is fitted which fires its projectile through the enemy's bottom upon contact or being stopped by a torpedo net. See Torpedo.

SUBMARINE MINES. See Mine, Submarine; Torpedo.

SUBMARINE TELEGRAPH. See Telegraphy, Submarine.

SUBMARINE TORPEDO BOAT. See Torpedo Boat, Submarine.

SUBMAX'ILLARY GANGLION (from Lat. *sub*, under + *maxilla*, jaw, jawbone). One of the four sympathetic ganglia lying in the cephalic region, sometimes called cranial ganglia. The latter term is rather misleading, as none of the ganglia are within the cranial cavity. The submaxillary ganglion is situated above the deep portion of the submaxillary gland. (See Salivary Gland.) It is connected by filaments with the lower border of the gustatory nerve (nerve of taste, supplying the tongue). It also receives motor filaments from the chorda tympani nerve, a branch of the facial. It is small, rounded, and of a reddish-gray color; its branches of distribution, five or six in number, arise from the lower part of the ganglion, and supply the mucous membrane of the mouth and Wharton's duct, some being lost in the submaxillary gland. The other three ganglia are Meckel's, the ophthalmic, and the otic (qq.v.).

SUBMERSIBLE TORPEDO BOAT. See Torpedo Boat, Submarine.

SUBORDINARY. A class of charges in heraldry (q.v.).

SUB'ORNA'TION OF PERJURY. The offense of procuring a person to commit perjury. The crime will not be committed unless both the person inducing and the person testifying have knowledge that the testimony is false. Although only a misdemeanor at common law, in most jurisdictions to-day it is punished with the same severity as perjury. See Perjury.

SUBPŒ'NA (Lat. *sub pœna*, under penalty, the initial words of the writ in its original form). A mandatory writ or process issued by a court, a quasi-judicial body, or an official having judicial powers, commanding a person or persons named therein to appear at a certain time and place and testify or furnish documentary evidence in an action or judicial proceeding. Originally a subpœna was used only to compel attendance of witnesses in court, but by statute in most States many officials and bodies having judicial powers, such as boards of commissioners, coroners, legislative committees, etc., are authorized to compel the attendance of witnesses by this process.

A subpœna intended only to compel the attendance of a witness for the purpose of giving testimony is known as a subpœna ad testificandum. Where it is necessary to put in evidence documents which are in the possession of a witness, he may be compelled to appear and produce them by a subpœna duces tecum. This form of subpœna is substantially like the one above mentioned, except that it specifically enumerates as far as possible the books, papers, and documents desired. In some code States a "notice to produce" served by one attorney in an action on his opponent serves the same purpose. It is no excuse that the papers are of a private nature; they must be produced nevertheless, and the court will then upon inspection rule whether they are privileged or not. Where the documents are incriminatory of the person directed to produce them, however, they need not be brought to court.

In most States a subpœna may be served by any person of discretion, who usually must be 18 years of age or upward, and service is made by delivering a copy of the subpœna to the witness personally, at the same time showing him the original, and paying or tendering his legal fees and expenses, which are fixed by statute. Failure to appear in obedience to a subpœna is a contempt of court. It is usual for the party who caused the service of the subpœna to apply to the court for an order directing the witness to show cause why he should not be punished for contempt. Such a witness is also liable in a civil action for all damages which may have been caused by his nonappearance to the party calling him. A witness may be excused, in the discretion of the court, upon reasonable cause, as illness, death in family, etc. Prior to 1852 a defendant was summoned to answer an action in a court of chancery in England by a subpœna ad respondendum. This practice has been superseded there by service of a copy of the bill instead, but still obtains in some jurisdictions in the United States. Such a subpœna corresponds more nearly in its purposes to a summons than a subpœna as above described. Consult authorities referred to under Procedure. See Evidence; Summons; Witness.

SUB'ROGA'TION (ML. *subrogatio*, from Lat. *subrogare*, *surrogare*, to substitute, from *sub*, under + *rogare*, to ask). The treatment of one who has paid the debt or fulfilled the obligation of another, which as between himself and that other should have been paid by the latter, as though he were the assignee of the creditor's claim. The payer is then said to be subrogated to all the rights and remedies of the creditor against the primary debtor. The doctrine upon which this subrogation is based was originally applied by courts of equity, but is now generally applied by courts of law to all cases where one pays a debt on which he is secondarily liable, although the debt may be legally discharged by the payment. Equity, for the purpose of working out justice between the parties by repaying the advances made, deals with the case as though the debt were still in existence, and gives to the person paying the debt precisely the same rights and remedies as belonged to the original creditor, but in no case does one by subrogation acquire any higher or different rights. It will thus be seen that the analogy between subrogation and assignment is complete, one who is entitled to be subrogated to a claim or demand being treated as though he were an assignee of the claim or demand. The only difference between them is the source and not the character of the right, the right to subrogation arising by operation of law and the right of an assignee arising by voluntary act of the parties.

Since the principle is of equitable origin the maxim that one asking the aid of equity must come into court "with clean hands" applies; and subrogation will take place only where the person satisfying the obligation was under a legal or equitable obligation to do so. Thus a person may not voluntarily pay the debt of another and still be subrogated to his rights against third parties.

Some of the more important cases in which the doctrine is applied are: (1) Where a junior mortgagor pays off a mortgage prior to his own, when equity will compel an actual assignment of the mortgage by the prior mortgagee. (2) When one pays a debt to the payment of which he is entitled to contribution by others, or for which others are primarily liable and he only secondarily, as in the case of a surety. In these cases, since the sole relief sought is payment of money, courts of law apply the doctrine, and give a complete remedy. (See CONTRIBUTION; QUASI CONTRACT; SURETYSHIP.) (3) In some jurisdictions, particularly in England, when one paying money to a corporation under an ultra vires contract cannot recover in quasi contract, although it is used by a corporation in paying its corporate indebtedness, in which case the person so advancing money is subrogated to the rights of the original creditor. (4) In the case of insurance contracts and contracts of indemnity generally whenever the insurer or indemnitor pays the indemnity due under his contract, he is entitled to be subrogated to the rights of the person indemnified against third parties which may in any manner reduce the loss or obligation indemnified against. See CHANCERY; EQUITY; INDEMNITY; INSURANCE.

SUBSCRIP'TION (Lat. *subscriptio*, from *subscribere*, to subscribe, write under, from *sub*, under + *scribere*, to write). A popular rather than a technical term in law signifying a written contract by which a person agrees to contribute a sum of money for a specified purpose. The subscription may be made either as a gift, or it may be made as an offer to pay the money subscribed in exchange for property to be delivered to the subscriber. Whenever the person or corporation in whose favor the subscriptions are made has performed work or incurred expense or liability, relying upon such subscriptions, the courts have generally held that such expense or liability is a sufficient consideration for the subscription to make it a legally enforceable contract, entitling such persons or corporation to sue upon it. It has also been held that when there are several subscribers and each subscriber has fair notice that others are expected to subscribe to the same object or purpose, the promise of each subscriber is consideration for the promises of all the others. The soundness of such a doctrine may well be doubted and the authorities upon this point are in conflict. A subscription for stock of an existing corporation is generally deemed to be a mere offer which may be withdrawn at any time before acceptance, but which may be accepted at any time before withdrawal of the subscription by an allotment of the stock to the subscriber. Upon such acceptance the subscription becomes a valid contract which may be enforced by the corporation. A subscription for stock in a corporation to be formed will not generally ripen into a contract upon the incorporation of the company and the allotment of the stock, since there was no promise in existence at the time of the making of the offer of subscription. Where several of such subscribers mutually agree to take stock, however, the agreement of each will bind him contractually towards all the others. See CONSIDERATION; CONTRACT; CORPORATION; STOCKHOLDERS.

SUBSIDENCE. See ELEVATION AND SUBSIDENCE.

SUB'SIDIES (Lat. *subsidium*, relief, aid, auxiliary force, from *subsidere*, to sit down, remain, subside, from *sub*, under + *sedere*, to sit). A term in English history having reference to special tax assessments upon persons and not directly upon real property; in general European politics it has reference to grants of money to an ally to aid in the prosecution of war; while as a current economic term it applies to grants of money made by the state in aid of individual enterprises. See BOUNTY; MERCHANT MARINE; SHIPPING SUBSIDIES.

SUBSOILING. See PLOW, PLOWING.

SUBSTANCE (OF. *substance*, *substaunce*, Fr. *substance*, from Lat. *substantia*, being, essence). A term frequently used in logic and metaphysics with varying meaning. Substance is correlative with quality or attribute. Every substance must have attributes, and every attribute must be the attribute of some substance. The substance gold has the attributes weight, color, etc. Now it is not difficult to identify attributes and to give a definite meaning to our conception of them. But what is the substance to which they belong? What is left of gold, e.g., when its color, characteristic hardness, specific gravity, chemical affinities, etc., have been all catalogued among its attributes or qualities? Now, however difficult it may prove to answer this question when once it is raised, popular thought and popular philosophy assume that everything whatsoever possesses, besides its attributes, a substratum; that they rest upon or inhere in something that holds the attributes together, without being itself an attribute. Without being clear in details on the subject it is assumed that the attributes could not hang together so consistently and persistently by themselves. The problem is solved by metaphor. The very terms "substance," "substratum," "inherence" are all metaphorical, but no plain statement is made of what is figuratively alluded to.

This vague view appears at the very dawn of philosophical speculation, having been doubtless an inheritance from prescientific and precritical thinkers, and has persisted through all the centuries up to the present. When speculation began in the Western world, an attempt was made to identify the assumed substance with some well-known type of experienced object. Substance appears in the doctrine of the Ionic philosophers (see IONIAN SCHOOL) as air or earth or water, in Heraclitus (q.v.) as fire, but in Parmenides (q.v.) it becomes an abstraction, pure being. In Aristotle we have a more critical view, according to which the individual realities of experience are substances, while species are second substances. The Stoics returned to the idea of a substrate as the bearer of attributes, and this view persisted through the Middle Ages as the only one advocated, except by the Nominalists. (See NOMINALISM.) In modern philosophy Descartes and Spinoza share this substrate theory. Leibnitz moved away from this static conception and regarded substance as a being capable of action or "primitive force," but it was his great opponent Locke who definitely acknowledged that substance, while apparently a necessary inference, is in reality unknowable.

Berkeley went further. Locke had accepted the existence of material as well as spiritual "powers"; Berkeley maintained that "the supposition of external bodies is not necessary for producing our ideas, since it is granted they are produced sometimes, and might possibly be produced always in the same order we see them in at present, without their concurrence." Hence "there is not any other substance than *Spirit*, or that which perceives." About this substance, however, Berkeley could give no consistent account. At one time we are told that thing or being "comprehends under it two kinds entirely distinct and heterogeneous, which have nothing in common but the name, viz., Spirits and Ideas. The former are active, invisible substances—the latter are inert, fleeting, or dependent beings, which subsist not by themselves, but are supported by or exist in minds or spiritual substances." But in another place we are told that "*the soul always thinks;* and in truth whoever shall go about to divide in his thoughts or abstract the *existence* of a spirit from its *cogitation*, will, I believe, find it no easy task." Hume developed the idea contained in the last quotation and arrived at the result that all substance is an "unintelligible chimæra."

Kant emphasized the "relations" which united perceptions, and found in them the essence of substance. Substance with him is a category of relation which, when schematized, i.e., brought into relation with time and space, becomes "the permanence of the real in time, or the idea of the real as presupposed in the empirical determination of time, and as persisting while all else changes." But this view has a defect. There is too much absoluteness in the conception. It is not necessary that there should be anything which persists through all changes. It is only necessary that there should be some quality which remains *relatively* unchanging, while other qualities change. The relatively permanent quality forms then the nucleus around which the changes gather as variations of a thing. The same thing does not always remain unchanged in the same quality. Now it may be this quality, now that. On this account some philosophers prefer to regard substantiality as shifting from time to time.

But perhaps a more empirical definition of substance can be obtained from the theory of judgment. Going back to Aristotle's' conception of substance (*οὐσία*) as that of which predication is made, we find (see JUDGMENT) that predication is always made of a synthesis of attributes. The orange is yellow, grows on a tree, developed from a flower, is going to be eaten by me next minute, etc. The orange is the synthesis of all these quantities or attributes, some of which may be past and some not yet existent. The only object of which all the qualities of an orange are predicable is the totality of the predicable qualities. This totality exists at any one time, not as a whole, but in part. Now the synthesis of all the qualities which appear to common sense as the qualities of a thing is itself in this view regarded as the substance of that thing. Used in this sense substance is no longer what its etymology indicates, viz., a something standing behind phenomena, but it is what the Greek term *οὐσία* means, viz., the being of which attributes are predicable. A realistic modification of this view is possible according to which substance would be the synthesis of such qualities as have existence outside of experience. See METAPHYSICS; PHILOSOPHY; SCHOLASTICISM.

SUBSTANTIVE COLORS. See ADJECTIVE COLORS.

SUB'STANTIVE LAW (Lat. *substantivus*, self-existent, substantial, real, from *substantia*, being, essence, material). That branch or division of the whole law which defines and establishes human rights and privileges with reference to property and prescribes rules of conduct to be observed by mankind in the various relations of life. All other law may be classed as adjective or remedial, i.e., as dealing with the methods of enforcement and maintenance of the normal conditions established by the substantive law, and the rectification of such abnormal social conditions as may arise. For convenience the substantive law is subdivided into various branches according to the subject matter to which it relates. For example, we speak of the law of real property, of personal property, the law of domestic relations or persons, etc. It is to be found both in legislative enactments and in the rules and precedents of the common law. See LAW and the authorities there referred to.

SUB'STITU'TION (Lat. *substitutio*, a putting in the place of another, from *substituere*, to put in the place of another, from *sub*, under + *statuere*, to place, from *stare*, to stand). A mathematical operation by which one expression is replaced by another. The term has, however, come to have a technical meaning in modern mathematics, and this has led to an important branch known as the theory of substitutions. If n elements, $a_1, a_2, a_3, \ldots . a_n$ are given, and $a_1, a_2, a_3, \ldots . a_n$ and $a'_1, a'_2, a'_3, \ldots . a'_n$ are two arrangements of these elements, the operation of passing from the first of these arrangements to the second is called a substitution of the n elements. It follows that there are $n!$ substitutions of n elements, including the identical substitution, which leaves the order of the letters unchanged. A substitution which in place of the arrangement $a_1, a_2, a_3, \ldots . a_n$ gives $a'_1, a_2', a_3', \ldots . a'_n$, is represented by the symbol

$$\begin{pmatrix} a_1 & a_2 & a_3 & \ldots . & a_n \\ a'_1 & a'_2 & a'_3 & \ldots . & a'_n \end{pmatrix}$$

If a_1 is replaced by a_2, a_2 by a_3, $\ldots . a_{n-1}$ by a_n' and a_n by a_1, the substitution is said to be cyclic, and is more conveniently represented by $(a_1\ a_2\ a_3 \ldots a_n)$, or even by $(1\ 2\ 3 \ldots n)$, than by the more elaborate symbol

$$\begin{pmatrix} a_1 & a_2 & \ldots . & a_{n-1} & a_n \\ a_2 & a_3 & \ldots . & a_n & a_1 \end{pmatrix}$$

Similarly the substitution $\begin{pmatrix} abcdef \\ cedafb \end{pmatrix}$ may be written $(acd)\ (bef)$, meaning that while a changes to c, c to d, and d to a, b at the same time changes to e, e to f, and f to b. This symbolism is further extended thus: Consider $(ab)\ (ac)$; this means that a changes to b, b to a, and a to c, and c back to a, a result which evidently may also be indicated by (abc), so that $(abm)\ (ac) = (abc)$. But the same reasoning shows that $(ac)\ (ab) = (acb)$. Hence if $s_1 = (ab)$ and $s_2 = (ac)$, $s_1 s_2 \neq s_2 s_1$. For convenience, $s_2 s_1$ is called the *product* of s_1 and s_2 in the order given, from which it appears that the commutative law of multiplication does not hold true in the theory of substitutions. If in the product $s_1 s_2 s_3 \ldots\ldots s_n$ we have $s_1 = s_2 = \ldots\ldots s_n$, the product is called the *power* of each substitution. If a substitution leaves all the elements unchanged in order, it is called an *identical* substitution and is represented by 1. If the product of two substitutions, like

$$\begin{pmatrix} a_1 & a_2 & \ldots\ldots & a_n \\ a'_1 & a'_2 & \ldots\ldots & a'_n \end{pmatrix} \text{ and } \begin{pmatrix} a'_1 & a'_2 & \ldots\ldots & a'_n \\ a_1 & a_2 & \ldots\ldots & a_n \end{pmatrix}$$

is 1, each is called the *inverse* of the other, and if the first is represented by s, the second is represented by s^{-1} ss^{-1} equaling 1.

A collection of substitutions is said to form a *group*, if the product of any two is another of the same collection. This may be illustrated outside the field of substitutions by the three cube roots of unity 1, $-\tfrac{1}{2}+\tfrac{1}{2}\sqrt{-3}$, $-\tfrac{1}{2}-\tfrac{1}{2}\sqrt{-3}$, the product of any two being another of the same collection. The six substitutions $s_0 = 1$, $s_1 = (xyz)$, $s_2 = (xzy)$, $s_3 = (yz)$, $s_4 = (zx)$, $s_5 = (xy)$ also form a group. The number of substitutions of a group is its *order*, and this is always a factor of $n!$. Thus in the group given the order is 6, and this is a factor of 3!. If all substitutions of a group H are contained in another group G, H is called a *subgroup* of G and the order of H is a factor of that of G. A group whose operations are all permutable with one another is called an *Abelian group*.

Lagrange (1770) was one of the first to undertake a scientific treatment of substitutions in connection with the theory of the quintic equation. He invented a "calcul des combinaisons," the first real step towards the theory of substitutions. Ruffini (1799) was the next to undertake a serious study of the subject, again in the attempt to show the impossibility of solving the quintic. To Galois (q.v.), however, the honor of establishing the theory is usually ascribed. He found that if $r_1, r_2, r_3, \ldots\ldots r$ are the n roots of an equation, there is always a group of permutations of the r's such that (1) every function of the roots invariable by the substitutions of the group is rationally known, and (2), reciprocally, every rationally determinable function of the roots is invariable by the substitutions of the group, a discovery that eventually led to the proof of the insolubility of the quintic. A. L. Cauchy was the first of the well-known French mathematicians to recognize the importance of the theory, and numerous important propositions are due to him.

Bibliography. A. L. Cauchy, *Exercises d'analyse et de physique mathématique*, vol. iii (Paris, 1844); Serret, *Cours d'algèbre supérieure* (3d ed., ib., 1866); Jordan, *Traité de substitutions et des équations algébriques* (ib., 1870); Eugene Netto, *Theory of Substitutions and its Application to Algebra*, English translation by F. N. Cole (Ann Arbor, 1892); L. C. Autonne, *Sur le décomposition d'une substitution linéaire, réelle, et orthogonale* (Lyons, 1903); William Burnside, *Theory of Groups of Finite Order* (2d ed., New York, 1911); Harold Hilton, *Homogeneous Linear Substitutions* (Oxford, 1914).

SUBSTITUTION, Theory of. See Chemistry (historical section).

SUB'TERRA'NEAN HOUSES. See Earth Lodge.

SUBTRAC'TION (Lat. *subtractio*, a taking away, from *subtrahere*, to take away, from *sub*, under + *trahere*, to draw, drag). The inverse of addition, and one of the fundamental processes of arithmetic and algebra. It is the operation which has for its object, given the sum of two expressions and one of them, to find the other. The given sum is called the *minuend*, the given addend is called the *subtrahend*, and the addend to be found is called the *difference* or the *remainder*.

SUBU'RA. A district of ancient Rome in the valley between the Esquiline, Quirinal, and Viminal hills. It bore an evil reputation as the resort of peddlers, footpads, and prostitutes. Consult S. B. Platner, *The Topography and Monuments of Ancient Rome* (2d ed., Boston, 1911).

SUBVENTION. See Shipping Subsidies.

SUBWAYS (for Pipes and Wires). Underground galleries which contain and render accessible at any point the multitudinous pipes and wires beneath city pavements; or else ducts for inclosing underground wires only, in such a way as to make them accessible at intervals. Subterranean passages for the accommodation of street traffic are either nothing more than streets or footpaths placed in tunnels, which need no description, or they are underground railways, which are described in the articles on Urban Transportation and Tunnel. In connection with these, pipe and wire subways are often built, and this plan has been adopted for some future New York underground systems.

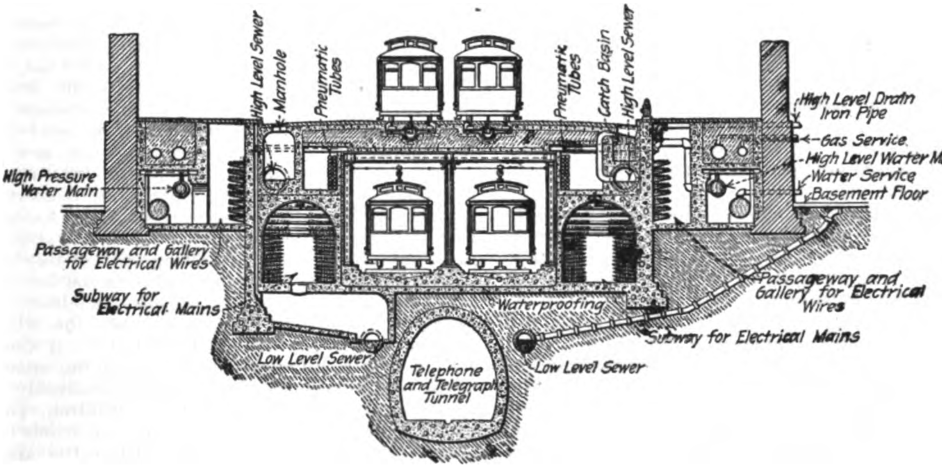
The chief advantages of subways for pipes and wires are: (1) They increase the life and general serviceability of pavements and prevent the interruption to traffic caused by street excavations to gain access to pipes when simply buried in the ground. (2) They facilitate both the inspection and repair of all classes of underground furniture, and thus lessen the number of troublesome and dangerous leaks from water and gas mains; they also aid in the prevention of electrolysis, or the electrical decomposition of iron and lead conduits through stray electrical currents. (3) Ventilated and relatively dry subways may greatly lengthen the life of pipes and wires through better protection against corrosion than is possible when they are laid directly in the earth.

One of the earliest attempts to avoid the disturbance of pavements was carried out in Liverpool, where a gallery 2½ feet wide was built under the sidewalk and in it were placed an oval pipe sewer 27 × 18 inches, a 10-inch water main, and a 10-inch gas main. The bottom of the trench was 13 feet below the surface of the sidewalk. Little or no provision for repairs was made. The London subways date from 1861 or 1862, when one was built in a new street from Covent Garden Market to St. Martin's Lane. A few months later a subway was built at Nottingham, England. Subsequently a number of subways were added to the first ones built in London and Nottingham. In London there are among other subways a long one under the Thames Embankment and one beneath the new street called Kingsway, built by the London County Council. Subways have also been built in other British towns. The London subways contain gas, water, electric light, hydraulic-power supply, telephone, and telegraph mains. The placing of wires and a great variety of pipes in the sewers of Paris is one of the notable features of that city.

In the United States the nearest approach to subways like those of Europe is at St. Paul, where a number of miles of sewers have been constructed in the form of tunnels in the soft sand-rock which underlies the city, and water mains have also been placed, separately, in similar tunnels. Branch tunnels connect with the houses in the same general way as branches lead to the buildings along the line of the European subways. Besides the sewers and water mains at St. Paul, some private companies have placed telephone lines in like tunnels. Tunnels for telephone cables have been constructed in Chicago, and are also utilized for conveying freight and express by means of small electric cars. A short length of pipe and wire subway was built in Chicago in 1915.

Electrical Subways. In a growing number of the larger cities of the United States electrical wires for light and power, together with the ordinary and the police and fire-alarm telegraph lines, are also placed underground. Electrical subways consist of a single pipe or tube, or a group of such, designed to protect underground wires from injury due to settlement of the earth or the picks and shovels of workmen. At the same time these subways afford access to the wires through manholes placed at intervals, for repairs, connections, or the drawing in of new wires. The most common materials used for the conduits or ducts are wrought iron, earthenware, and wood, but sometimes cast iron, and again ordinary or more rarely bituminous cement concrete is used. In place of tubes troughs of cast iron, earthenware, or wood, covered with the same material, are sometimes employed. Wrought-iron pipes similar to gas pipes are commonly embedded in concrete, and they may be laid in trenches lined with cement or wood. The various classes of electrical wires and cables are generally insulated before being placed in subways. (See ELECTRIC LIGHTING; ELECTRIC RAILWAYS; TELEGRAPH; TELEPHONE; ETC.) The wires and cables are drawn into the closed electrical subways through manholes at intervals of 200 to 300 feet by means of ropes or rods. Aside from cities subways or underground tubes are maintained in railway terminals and for certain long-distance telephone cables and telegraph conductors along certain railway lines.

Bibliography. Consult Mason, "Street Subways for Large Towns," and discussion thereon, in *Transactions of the Society of Engineers* (London, 1895), and articles in *Engineering News* (New York), for descriptions of numerous subways for pipes and wires.



CROSS SECTION OF CHICAGO STREET, SHOWING PROPOSED ARRANGEMENT OF SUBWAYS.

SUBWAYS. See TUNNEL; URBAN TRANSPORTATION.

SUCCES'SION (Lat. *successio*, from *succedere*, to follow, succeed, from *sub*, under + *cedere*, to yield). At civil law (q.v.) succession signifies in general the substitution of one person for another in an existing legal relation. Acquisition of a right previously held by another is termed *active* succession; subjection to a duty previously resting upon another, *passive* succession. When single rights or duties are thus transferred the succession is said to be *singular*. When a person receives all the rights and duties of another that are capable of transfer the succession is said to be *universal*. The most important case of universal succession is inheritance, which at civil law signifies the transfer to one or more heirs or personal representatives of the rights and obligations of a person deceased. Heirs may be designated by a last will or testament (q.v.); in the absence of a valid testament they are designated by general laws. In the latter case civilians speak of inheritance or succession *ab intestato* (q.v.). Inheritance may also be determined, in part, by laws which give certain persons rights of succession of which they cannot be deprived by a testator except on legally defined grounds. For such limitations upon the power of testation at civil law, see TESTAMENT. Blackstone describes succession at common law as the method by which one set of persons constituting a corporation aggregate acquired the property of the corporation by succeeding another set of persons. See DEATH DUTIES.

SUCCESSION AB INTESTATO (Lat., from one intestate). 1. **Roman Law.** In early Roman law, as in early law in general, succession was governed by the organization of the family. According to the Twelve Tables the inheritance vested (1) in the *sui*, i.e., the members of the decedent's family, who were under his household authority. (See PATRIA POTESTAS.) The sons and the unmarried daughters and the widow who had been *in manu* (see MARRIAGE) had equal shares. Children of a predeceased son received their father's share. Failing *sui*, the inheritance passed (2) to the nearest agnate (i.e., the nearest collateral relative in the male line). If there was no agnate the inheritance went (3) to the *gens* or clan. Under this system kinship gave no right except in so far as it coincided with the family organization. Emancipated sons and daughters, married daughters and their descendants, and all cognates (relatives in the female line) were excluded from succession. On the other hand, adopted children and the wife *in manu* had the same rights as the other *sui*. In the subsequent development of the law there was a steady movement towards fuller recognition of kinship. This movement began with the prætorian reforms at the close of the Republican period. Emancipated sons and daughters and married daughters were admitted to inherit with the *sui*, on condition of "collating" (i.e., putting into hotchpot) their separate property. Failing agnatic relatives, cognates were admitted; and failing cognates, the husband and wife who had established a free or "consistent" marriage succeeded one to the other's estate. Later Imperial legislation placed cognates and agnates on the same footing, as far as the direct line was concerned (ascendants and descendants). Justinian in his 118th Novel abolished all preference of agnates. Under Justinian's rules the inheritance went (1) to descendants; (2) to ascendants, brothers and sisters of the full blood and their children; (3) to brothers and sisters of the half blood and their children; (4) to the nearest collateral relative; (5) to the surviving spouse; and (6) to the fiscus. Illegitimate children had no rights of succession except from the mother.

II. **Mediæval European Law.** The early German law of inheritance, with the Roman, was based on the family, but it gave no such preference to kinship in the male line, except as regarded succession to real property. As regarded such property, however, a preference not only of the male line over the female, but of male heirs over female, is visible in the earliest written laws; and this preference was emphasized and made general in mediæval Europe by the development of the feudal system. In German law there appeared also a distinction between sword goods and spindle goods, i.e., between things used by men and things used by women, and a tendency to prefer male heirs as regarded sword goods and female as regarded spindle goods. Another German idea was that, when the nearest heirs were of the half blood, property that had come to the decedent from the father's side should go to the paternal relatives, while property that had come from the mother's side should go to the maternal relatives ("paterna paternis, materna maternis"; in Spanish law, "troncalidad"). Sporadically manifested, moreover, was a disinclination to allow property to ascend, with resultant rules preferring brothers and sisters and their descendants to parents.

As between collaterals rights of succession at German law did not depend wholly on nearness of kinship. Descendants of a nearer common ancestor were regularly preferred to descendants of a more remote common ancestor. Inheritance vested (1) in descendants of the decedent; (2) in descendants of his parents; (3) in descendants of his grandparents; (4) in descendants of his great-grandparents, and so on. Within each such group the nearest of kin took the inheritance. This is described by modern writers as the "lineal-gradual" or "parentela" system. Coupled with a preference of the male line and of males within that line it became the (original) feudal law of succession, and (with preference of the eldest male added) it determined the English law of inheritance of real property.

III. **Modern Civil Codes.** In modern European legislation the Roman principle of universal succession has generally reasserted itself: the same rules generally govern inheritance of realty and of personalty. In all the codes the inheritance vests primarily in descendants. Failing these different rules prevail. At French law the inheritance passes, in second instances, to parents, brothers, and sisters and the children of brothers and sisters, all of whom take precedence of grandparents. The Spanish code prefers all ascendants, and the German code prefers parents, to brothers and sisters. In the absence of descendants, ascendants, and of brothers and sisters and their descendants, the French, Italian, and Spanish codes confer the inheritance upon the nearest collateral; but the French code provides that if there be collaterals both on the paternal and the maternal side the inheritance shall be divided. The Austrian and the German codes follow the parentela system.

The surviving spouse is better treated than at Roman law. Under the Code Napoléon, indeed, the surviving spouse had no right except by antenuptial contract or, in the absence of such contract, by operation of the general law of matrimonial property; but by the law of March 9, 1891, he or she has a life interest in a portion of the property, which is at most one-fourth if there are children, but rises to one-half if there are no children. There are similar provisions in the Italian and Spanish codes; but at Spanish law if the decedent has neither descendants, ascendants, nor brothers or sisters or nephews, the surviving spouse takes the whole estate absolutely; and at Italian law, if there are no legitimate children, the surviving spouse takes from one-fourth to one-third absolutely as against parents and illegitimate children, two-thirds as against collaterals, and the whole estate if there is no collateral within the sixth degree (e.g., a second cousin). The German law is even more liberal: the surviving spouse takes one-fourth absolutely as against children; one-half to three-fourths as against parents, brothers and sisters, and grandparents; and the whole as against the decedent's other relatives.

As to illegitimate children different rules prevail. The French, Italian, and Spanish codes give no rights of inheritance to such children unless they have been recognized. Such a recognized child inherits in concurrence with legitimate children, taking, however, only half the share of a legitimate child. When there are no legitimate children the rights of recognized illegitimate children are greater. By the French law of March 25, 1816, they take the whole estate as against all collaterals, except brothers and sisters and their children. In the German code the illegitimate child, although recognized, has no right of succession in the estate of his father or in those of his father's relatives; but in the mother's estate and in those of her relatives such a child has the same rights as if born in wedlock. For a treatment of subjects in English and American law, see DESCENT; DISTRIBUTION; HEIR; INHERITANCE.

SUCCESSION DUTY. See DEATH DUTY.

SUCCESSION WARS. The name given to wars arising out of conflicting claims of succession to the throne. Among such wars that have been waged in Europe the following deserve special notice: (1) The War of the Spanish Succession, 1701–14; (2) that of the Polish Succession, 1733–35; (3) that of the Austrian Succession, 1740–48; and (4) that of the Bavarian Succession, 1778–79.

War of the Spanish Succession. This war arose on the death without male heirs of Charles II (q.v.), King of Spain, of the house of Hapsburg, Nov. 1, 1700. The nearest natural heir to the throne was of the royal Bourbon line of France, Charles's elder sister having married Louis XIV; but, to prevent any possible union of the two crowns, a solemn renunciation had been exacted both from Louis and his Queen, for themselves and their heirs. Failing the Bourbons, the next heirs were the descendants of the younger sister of Charles, who had married the German Emperor Leopold I, ruler of Austria, from whom no renunciation had been exacted; and the only issue being a daughter, who had married the Elector of Bavaria, and borne a son, Joseph Ferdinand, this prince was regarded both by Charles II and the Spanish people as rightful heir. As he died in 1699, the question of succession was reopened. Louis XIV claimed the throne for himself, as the son of Philip IV's eldest sister, being, however, again legally barred here by another solemn renunciation. The Emperor Leopold maintained that the Bourbons had by these two renunciations lost all rights of succession, and he claimed the throne as the son of Philip IV's younger sister. (See Hapsburg, *Family Table*.) Leopold handed his claim to his second son, the Archduke Charles. The Austrian party at first preponderated in Spain; but Louis undermined Austrian influence, and his grandson, Philip of Anjou, was declared the heir (Oct. 2, 1700). On the death of King Charles, Philip appeared in Spain and was recognized as monarch. The Emperor Leopold at once took up arms and sent an army into Italy under Prince Eugene, who defeated the French general Villeroi at Chiari on Sept. 1, 1701. William III, regarding the union of France and Spain under the Bourbons as a menace to the naval interests of England and Holland, and stirred up by the action of Louis XIV in recognizing the Pretender, James Edward Stuart, determined to revive the Grand Alliance against France, and entered into a coalition with Austria and her allies in the German Empire, including Prussia. Savoy, Bavaria, and other German States joined the Bourbons. William's policy was continued by Anne, who succeeded to the English throne in March, 1702, and immediately declared war.

In 1702 Churchill (the future Marlborough), with an English-Dutch-German army, made a victorious advance against the French in the Spanish Netherlands; while a German army under the Margrave of Baden crossed the Rhine and encountered Villars, who proved too powerful for them. In Italy, Prince Eugene, after taking Villeroi prisoner at Cremona (January, 1702), was checked by Vendôme. In 1703 Marlborough gained fresh successes and the Duke of Savoy joined the Grand Alliance. The first great blow was struck on Aug. 13, 1704, when the combined Austrian-German-British army under Marlborough and Prince Eugene defeated the French and Bavarians under Tallard at Blenheim (q.v.). A few days before Gibraltar had fallen to the English. The campaigns of Marlborough in Germany and of Eugene in Italy in 1705, while successful, were not very important. In 1706 Marlborough suddenly attacked the French and Bavarians under Villeroi at Ramillies (q.v.), and routed them. The victory of Eugene over Marsin at Turin in the same year shattered the French power in Italy.

Meanwhile in 1704 the Archduke Charles landed at Lisbon with a British and Dutch army and invaded Spain. Next year the Earl of Peterborough and Sir Clowdisley Shovell landed with a small body of troops in Catalonia. Attacked from both east and west, the Bourbon forces were beaten and driven across the Pyrenees. After Peterborough's departure the Bourbon commander, the Duke of Berwick (q.v.), made head against his antagonists, and by his victory at Almansa (April 25, 1707) recovered the whole of Spain except Catalonia. In the Netherlands Marlborough and Prince Eugene defeated Vendôme's army at Oudenarde (1708), and the capture of Lille, Ghent, and Bruges followed. France, nearly exhausted, made overtures of peace, but the demands of the allies were so exorbitant that Louis XIV preferred to continue the war. The French under Villars suffered another great defeat in September, 1709, at the hands of Marlborough and Prince Eugene at Malplaquet (q.v.). The death of Emperor Joseph I, the successor of Leopold I (April 17, 1711), and accession in the Austrian dominions and in the German Empire of his brother, Charles VI, rescued France, for England now became lukewarm in support of a cause the success of which would result in the union of Austria and Spain; and the English Tories coming into power, England concluded an armistice with France in 1712. Prince Eugene still carried on the war, aided by Holland, but was compelled to give way; and in the spring of 1713 Holland, Prussia, and Savoy joined England as parties to the Peace of Utrecht (q.v.). The Emperor Charles VI was forced to conclude a treaty of peace at Rastatt, March 7, 1714, and later the formal treaty of Baden (in Aargau), Sept. 7, 1714, ended the struggle, leaving Philip on the Spanish throne, but with the provision that the crowns of France and Spain should never be united in the same person; while Austria obtained the Spanish Netherlands, the former Duchy of Milan, Naples, and Sardinia. Sicily was awarded to Savoy, but exchanged for Sardinia. Gibraltar and Minorca were ceded to England, which acquired Arcadia from France. The conflict between English and French in America as part of the War of the Spanish Succession is known as Queen Anne's War.

Consult: William Coxe, ***Memoirs of the Kings of Spain of the House of Bourbon*** (3 vols., London, 1813); De Vault, ***Mémoires militaires relatifs à la succession d'Espagne*** (Paris, 1835); Stanhope (Lord Mahon), ***History of the War of the Succession in Spain*** (London, 1836); A. Parnell, ***The War of Succession in Spain*** (London, 1888); J. W. Fortescue, ***History of the British Army*** (ib., 1899); ***Cambridge Modern History***, vol. v (New York, 1908), containing a bibliography; K. von Noorden, ***Europäische Geschichte im 18ten Jahrhundert: Der spanische Erbfolgekrieg*** (3 vols., Düsseldorf, 1870–83), the most comprehensive work on the subject. See Louis XIV.

War of the Polish Succession. In 1733 Augustus II of Poland and Saxony died and Stanislas Leszczynski (q.v.), whose daughter had married Louis XV of France, was elected King by the Diet through French influence.

Some of the nobles were determined that the crown should pass to Augustus (Frederick Augustus II of Saxony), son of the late King. Russia and Austria supported Augustus and a Russian army placed him on the throne. Stanislas withdrew to the fortress of Danzig, where he held out until June, 1734. France, in retaliation for Austria's support of Augustus III, declared war on the Emperor. The French forces invaded Lorraine and fought successfully on the Rhine (1733–34). Charles Emmanuel III of Sardinia took up arms against Austria, and in 1734 Don Carlos, son of Philip V of Spain, seized the opportunity to undertake the conquest of the Two Sicilies, wrested from Spain in the War of the Spanish Succession. The Austrians were overthrown at Bitonto on May 25, 1734, and in 1735 Don Carlos was crowned King of the Two Sicilies. By the preliminaries of Vienna (Oct. 3, 1735), Austria relinquished the possession of these regions. Augustus III was recognized as King of Poland, though Stanislas retained the royal title and was given for life the duchies of Lorraine and Bar, which were afterward to revert to France. Francis Stephen, dispossessed Duke of Lorraine, received the Grand Duchy of Tuscany. France lent its guarantee to the Pragmatic Sanction (q.v.) and Parma and Piacenza were given the Emperor by Don Carlos. The definitive Peace of Vienna was not signed till 1738. Consult *Cambridge Modern History*, vol. vi (New York, 1909).

The War of the Austrian Succession. This struggle arose after the death of the Emperor Charles VI (q.v.), in 1740. In accordance with the Pragmatic Sanction (q.v.) Charles VI's daughter and heiress, Maria Theresa, had received assurances of support from most of the European powers, but hardly had she ascended the Austrian throne when she found her dominion contested on every side. Frederick the Great of Prussia reasserted an old claim and invaded and seized Silesia. Charles Albert, Elector of Bavaria, claimed to be rightful heir to the Hapsburg possessions as a descendant through the female line of Ferdinand I, and in virtue of old arrangements. Augustus III of Saxony and Poland put forward his claims as the husband of the eldest daughter of the Emperor Joseph I. The Bourbon courts of France and Spain seized the opportunity to make war upon Austria. England thereupon entered into an alliance with Maria Theresa. Charles Emmanuel III of Sardinia was also among the princes who sought to dismember the Austrian realm. Holland joined the Anglo-Austrian Alliance, and the Bourbon King of Naples joined the enemies of Maria Theresa. Some minor German princes engaged in the struggle, as allies of Prussia and France. On April 10, 1741, Frederick II defeated the Austrians at Mollwitz. The Bavarians, the French, under Belleisle, and the Saxons poured into the Austrian dominions. Maria Theresa appealed for support to her Hungarian subjects at the Diet assembled at Pressburg and they responded chivalrously to her call, but she was unable to save Prague, which surrendered to Belleisle Nov. 26, 1741; yet at the beginning of 1742 her forces entered upon a victorious campaign against Charles Albert. General Khevenhüller overran Bavaria, and on the day of the Elector Charles Albert's coronation as Emperor Charles VII took Munich (Feb. 12, 1742). On May 17, 1742, Frederick won a victory over the Austrians at Chotusitz, followed by the Treaty of Breslau (terminating the first Silesian War), which provided for the cession of most of Silesia to Prussia. The French General Belleisle retreated from Prague.

In May, 1743, Bavaria again fell into Austrian hands. In June the English, under George II, defeated the French at Dettingen. In the same year Saxony and Sardinia were won to the side of Austria. France and Spain now remained sole representatives of the coalition. Seeing the tide turn strongly in favor of Austria, Frederick became alarmed and renewed hostilities in 1744 by an invasion of Bohemia (second Silesian War). In January, 1745, Charles VII died and his son, Maximilian Joseph, made peace with Austria. On June 4, 1745, Frederick won a victory over the Austrians at Hohenfriedberg, and on December 15 the Prussians defeated the Saxons at Kesselsdorf. Frederick, displeased with the overbearing conduct of France, was willing to make terms with Austria, and the Peace of Dresden (Dec. 25, 1745) between Austria, Saxony, and Prussia terminated the second Silesian War. On Sept. 13, 1745, the husband of Maria Theresa had been elected Emperor as Francis I. Meanwhile the French were being led to victory in the Austrian Netherlands by Marshal Saxe, who, on May 11, 1745, defeated the English, Hanoverians, Dutch, and Austrians at Fontenoy. The principal towns of the region fell before his attacks, and on Oct. 11, 1746, he won a victory over the allies under Charles of Lorraine at Raucoux. In Italy the war was waged with varying fortune. In 1745 the French were successful. In 1746 the Austrians and Sardinians made a victorious advance, and Genoa, which had joined the enemies of Austria, was occupied. It was later evacuated, and an attempt to recapture it in 1747 was frustrated by the French. In 1747 Saxe routed the Duke of Cumberland at Laffeld, near Aix-la-Chapelle (July 2), while his chief of engineers, Count Löwendal, after a two months' siege, took Bergen-op-Zoom, a fortress believed by the Dutch to be impregnable. On the sea, however, the English gained victories in 1747 under Admirals Anson and Hawke. At this juncture the Empress Elizabeth of Russia came to the aid of Maria Theresa and sent forces into the field. France was now ready for peace. On Oct. 18, 1748, the Treaty of Aix-la-Chapelle ended the war. It left the Hapsburgs in possession of hereditary dominions, excepting Silesia. Parma and Piacenza (acquired in 1735) were ceded by Austria to Don Philip, brother of Ferdinand VI of Spain. The principal event of the contest waged by the British and French in America (King George's War) was the taking of Louisburg in 1745. The French held their ground in India. Consult: Deroy, *Beiträge zur Geschichte des oesterreichischen Erbfolgekriegs* (Munich, 1883); Franz Crousse, *La guerre de la succession dans les provinces belgiques* (Paris, 1885); Francis Parkman, "A Half Century of Conflict," in *France and England in North America*, part vi (2 vols., Boston, 1903); F. H. Shrine, *Fontenoy and the War of the Austrian Succession* (London, 1906); *Cambridge Modern History*, vol. vi (New York, 1909), containing a bibliography.

War of the Bavarian Succession. The Elector Maximilian Joseph of Bavaria died without issue on Dec. 30, 1777. The natural heir was Charles Theodore, Elector Palatine, head of the elder line of the house of Wittelsbach.

This prince had no legitimate heirs, and with a view to the interests of his illegitimate children, he had, in January, 1778, entered into a convention with the Emperor Joseph II (the son of Maria Theresa, sovereign of Austria and Queen of Hungary) by which he agreed to transfer Lower Bavaria to Austria, which put forward an old claim to a part of Bavaria. Frederick the Great would not consent to aggrandize Austria in south Germany, as he felt that it might interfere with the claim of Prussia to the succession in the principalities of Ansbach and Bayreuth. As Austria refused to withdraw her pretensions, Frederick proceeded to make war on her, and in 1778 invaded Bohemia. He was joined by the Elector of Saxony, who, as the husband of the only daughter of Maximilian Joseph, claimed part of the Bavarian inheritance. Maria Theresa and Joseph II were in no haste to go to war with Prussia, and the Austrian forces confronted the enemy without coming to an engagement. The hostile attitude of Catharine II of Russia towards Austria induced her to give way, and in the Treaty of Teschen, signed on May 13, 1779, she had to content herself with the acquisition of the Innviertel, a district on the east side of the Inn, with the exception of which the whole of the Bavarian inheritance passed to Charles Theodore. The Elector of Saxony received a money indemnity. Consult C. Reimann, *Geschichte des bayrischen Erbfolgekriegs* (Leipzig, 1869).

SUCCINIC (sŭk-sĭn′ĭk) **ACID** (from Lat. *succinum*, *sucinum*, amber), $COOH.CH_2.CH_2.COOH$. A dibasic organic acid found in amber, in unripe fruits, in brown coal, etc. Small quantities of it are invariably produced in the alcoholic fermentation of sugar by yeast, the protein of the yeast cells undergoing slight decomposition with formation of succinic acid. In the animal organism succinic acid occurs in the spleen, the hydrocephalic and hydrocele fluids, and, according to some authors, also in normal urine. It has been known to chemists since the sixteenth century, and its acid character was discovered by Lemery in 1679. It may be obtained by a variety of synthetic chemical methods. Usually, however, it is prepared by the fermentation of a solution of ammonium tartrate. It is a crystalline substance melting at 184° C. (263° F.) and boiling at 235° C. (455° F.), though when distilled it loses the elements of water and is partly converted into its anhydride. Succinic acid is almost insoluble in ether; it is moderately soluble in cold and very soluble in hot water and alcohol. See Malic Acid.

SUC′CORY. Another name for chicory (q.v.).

SUC′COTH (Heb. *sukkōth*, booths, thickets). The name of two places mentioned in the Bible. 1. In Josh. xiii. 27 a Succoth is described as situated in the territory of Gad, "in the valley," and within the ancient bounds of the territory ruled by Sihon, King of Heshbon. A location east of the Jordan is indicated here and also in Gen. xxxiii. 17 and Judg. viii. 5–16 (cf. Ps. lx. 6, cviii. 7). In 1 Kings vii. 46 (2 Chron. iv. 17) it is stated that the metal work for Solomon's temple was cast "in the plain of Jordan between Succoth and Zarethan." A site south of the Jabbok (Nahr el Zerka) seems to be demanded. 2. Succoth was also the name of the second station in the Exodus from Egypt (Ex. xii. 37, xiii. 20; Num. xxxiii. 5–6), which has been connected with *Thuku*, the Egyptian name of a district in the eastern delta and of a fortress in it. Consult G. F. Moore, *Judges* (New York, 1895), and B. Stade, *Die Entstehung des Volkes Israel* (Giessen, 1897).

SUC′COTH-BE′NOTH. According to 2 Kings xvii. 30, the name of a deity whose worship was carried on in the cities of Samaria by the colonists from Babylon settled there by the King of Assyria. No such god has been found in Babylonian inscriptions, and it is reasonable to conclude that the form is a corruption of Zarpanit, the wife of Marduk (q.v.).

SUC′CUBA. See Incubus.

SUCHER, *zōō′*kẽr, Josef (1844–1908). A prominent Austrian musical conductor, born at Döbör, Eisenburg County, Hungary. First instructed in music as a chorister in the Imperial chapel at Vienna, he afterward studied law at the university and composition under Sechter, became conductor of the Akademische Gesangverein and assistant conductor at the opera, and in 1876 went to Leipzig as kapellmeister at the Stadt Theater, where his rehearsals of Wagner's music dramas, especially of the *Ring of the Nibelung*, placed him in the front rank of modern conductors. In 1879 he was called to Hamburg and in 1888 to the Royal Opera in Berlin. He retired in 1899, and spent the remaining years of his life in the German capital. For his wife, see Sucher, Rosa.

SUCHER, Rosa (Hasselbeck) (1849–). A German dramatic soprano, born at Velburg, Upper Palatinate. She appeared first in Munich, was subsequently connected with the stages at Treves, Königsberg, and Danzig, then at Leipzig, where she was married to Josef Sucher (q.v.). With her husband she went to Hamburg and Berlin. She was one of the foremost interpreters of Wagner's heroines, frequently appearing at Bayreuth. In 1895 she was a member of Mr. Damrosch's German opera company in the United States. She retired from the stage in 1898.

SUCHET, sụ′shȧ′, Louis Gabriel, Duke of Albufera (1770–1826). A marshal of France and one of the best of Napoleon's generals, born at Lyons, March 2, 1770. He began his career by volunteering as a private in the Lyons National Guard in 1792. His intelligence and valor at Lodi, Rivoli, Castiglione, and Arcole laid the foundation of his military reputation. In 1797 he became a general of brigade and the next year general of division, serving in Switzerland and Italy. In 1880 he kept Melas in check, with a force less than the Austrians, and prevented the invasion of France. He took part in the campaigns against Austria (1805) and Prussia (1806–07), was sent to Spain in 1808, and in 1809 was appointed to the command of the French army in Aragon. He won the battle of Belchite (June 16–18, 1809) and took Lérida (May, 1810), and Tortosa and Tarragona (1811), earning the marshal's baton. In January, 1812, he conquered Valencia, and became Duke of Albufera. The misfortunes of the other French armies in Spain compelled Suchet gradually to relinquish his conquests. He was created a peer by Louis XVIII, but took service under Napoleon after Elba, and was charged with the defense of the southwestern frontier. Deprived of his peerage at the Second Restoration, he did not return to court till 1819. He died near Marseilles, Jan. 3, 1826. Consult Suchet, *Mé-*

moires sur ses campagnes en Espagne (Paris, 1829–34).

SUCHIER, sụ'shyȧ', Hermann (1848–1914). A German romance philologist, born at Karlshafen, on the Weser, of a family of French refugees. After studying at Marburg and Leipzig, he qualified as privatdocent at Marburg in 1873 and became successively assistant professor at Zurich (1875), and professor at Münster and Halle (1876). Of his publications in the field of French and Provençal philology may be noted: "Die französische und provenzalische Sprache und ihre Mundarten," in Gröber's *Grundriss der romanischen Philologie* (1888; 2d ed., 1906), also separate in French, *Le Français et le Provençal* (1891); *Altfranzösische Grammatik* (1893), also in French under the title *Les voyelles toniques du vieux français* (1906). He edited *Aucassin et Nicolette* (1878; 8th ed., 1913); *Bibliotheca Normannica* (8 vols., 1879–1911); *Denkmäler provenzalischer Litteratur und Sprache* (1883); *Œuvres poétiques de Beaumanoir* (2 vols., 1884–85); *Les Narbonnais* (2 vols., 1898); *La Chancune de Guillelme* (1911). In collaboration with Birch-Hirschfeld he wrote a *Geschichte der französischen Litteratur* (1900; 2d ed., 1913). In 1900 a *Festgabe* entitled *Forschungen zur romanischen Philologie* was presented to him by his pupils.

SUCHOW, sōō'chou', or **SOOCHOW**. A *fu* or departmental city of the Province of Kiangsu, China (Map: China, M 5); the residence of the provincial judge, the *chih-fu* or head of the department of the same name, and three district magistrates. It is situated on the Grand Canal, 80 miles west of Shanghai and 40 south of Yangtse. Its walls are 30 feet high, are pierced with 6 gates and 5 water gates, and have a circuit of 12 miles. Outside of five of these gates are large suburbs, the largest and busiest being that outside of the northwest gate or Ch'angmên, within which is the chief business quarter of the city. Suchow was founded about 500 B.C. It is the centre of a great silk and satin industry in which thousands of looms are employed, has also steam factories, two cotton mills, a flour mill, and thousands of workers in wood, gold, silver, brass, iron, tin, ivory, glass, lacquer, etc. It has long been noted for its wealth and luxury, and the gayety and elegance of its life and manners. In 1860 it was captured by the Taiping rebels and reduced almost to a heap of ruins. Among the buildings that escaped destruction is a pagoda 240 feet in height, said to be the highest in China. The streets of the city of Suchow are not wide enough for much traffic, but a great network of canals furnishes easy means of transportation between the city and the surrounding country. Pop. (est.), about 500,000.

In September, 1896, Suchow was opened by treaty as a place of foreign residence and trade. In 1912 imports amounted to 2,634,273 Hk. taels, and exports to 8,736,307 taels (Haikwan Tael = $0.726).

SUCKER (from *suck*, AS. *sūcan*, *sūgan*, OHG. *sūgan*, Ger. *saugen*, to suck; connected with Lat. *sugere*, to suck). A fresh-water fish of the catfish family and belonging to the genus *Catostomus* and its allies, characterized by having the mouth inferior, and the lips thick and fleshy, the lower usually deeply divided. There are many species, all of moderate size and natives of the United States, except one in Siberia. Their general form is shown in the Plate of Suckers; in color they are dull, and with little tendency to markings, except that breeding males in most species acquire a rosy or orange lateral band. They inhabit rivers, lakes, and bayous, and obtain their food mostly by sucking up the mud and soft organic matter from the bottom. The most widely distributed species is the northern or red sucker (*Catostomus catostomus*); the best known one, the common white sucker (*Catostomus commersonii*), which is abundant from Massachusetts to Kansas.

SUCKER STATE. Illinois. See States, Popular Names of.

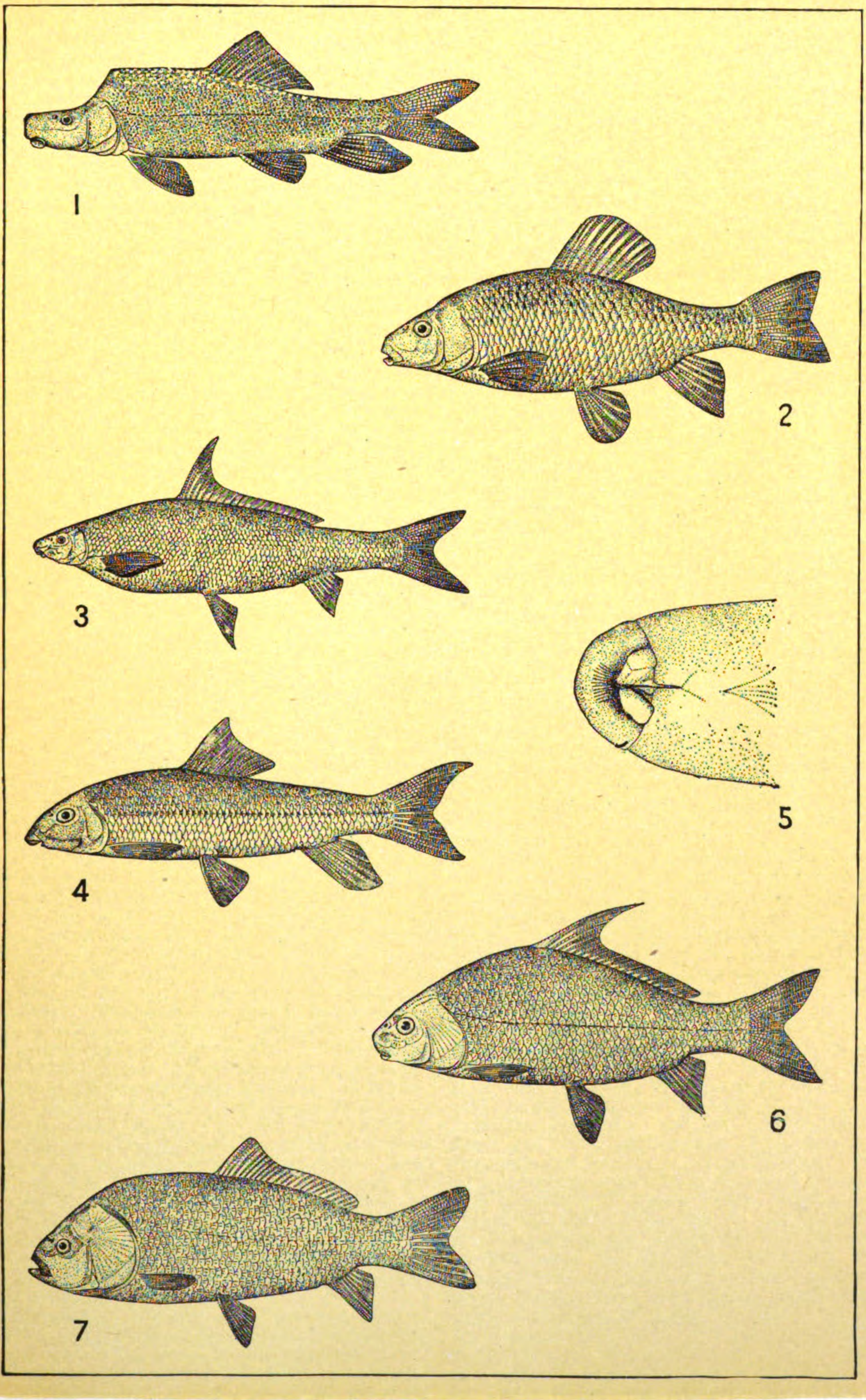
SUCKING FISH. See Remora.

SUCK'LING, Sir John (1609–42). An English poet, born at Whitton, in Middlesex, where he was baptized Feb. 10, 1609. His father, Sir John Suckling (knighted 1616), held high posts at the courts of King James and King Charles. In 1623 the poet entered Trinity College, Cambridge, but left without a degree. On the death of his father in 1627 he became heir to large estates. In 1628 he set out on extensive travels on the Continent and is said to have fought under Gustavus Adolphus. Returning to England in 1632, he soon became noted for wit, gallantry, and prodigality. Suckling took an active part in the plot to rescue Strafford from the Tower, and found it convenient to flee to the Continent. Impoverished and in despair, he seems to have poisoned himself in Paris in the summer of 1642. He was buried, says Aubrey, in the cemetery of the Protestant Church in Paris. Suckling's writings, few of which were published during his lifetime, were collected under the title *Fragmenta Aurea* (1646). The volume contains three plays, "Aglaura," "The Goblins," and "Brennoralt; Letters to Divers Eminent Personages"; a Socinian tract called "An Account of Religion by Reason"; and "Poems." In a later edition (1658) appeared an unfinished tragedy, "The Sad One." The fame of Suckling rests wholly upon his lyrics, inimitable for grace and gayety. Consult *Selections*, with a memoir, by A. I. Suckling (London, 1836; revised and enlarged by W. C. Hazlitt, under title of *Poems, Plays, and Other Remains*, 2d ed., 2 vols., ib., 1892), and *Works*, edited by A. Hamilton Thompson (New York, 1910); and see the articles on the group of cavalier or court poets to which Suckling belongs: Thomas Carew; Robert Herrick; Richard Lovelace.

SUCRE, sōō'krȧ. A department of Bolivia. See Chuquisaca.

SUCRE. The official capital of the Republic of Bolivia, known also as Chuquisaca (Map: Bolivia, E 7). It is 9328 feet above the sea on a plateau of the eastern Cordillera of the Andes, and is 318 miles southeast of La Paz. It has the Supreme Tribunal of Justice. The principal buildings are the cathedral and the president's palace. There is an ancient university with faculties of law, medicine, and theology. Its industries are mining and agriculture, the latter being the more important. Pop. (est.), 24,000. Sucre, founded in 1536 by Spaniards, and named La Plata from the rich silver mines of the vicinity, was later the seat of the *audiencia* of Charcas, serving as the capital of Upper Peru. The city was the scene of the declaration of Bolivian independence from Spain, Aug. 6, 1825, and later took the name of Sucre in honor of the republic's first president. Though it has continued to be the official capital of Bolivia,

SUCKERS



1. RAZOR-BACKED SUCKER (Xyrauchen cypho).
2. CHUB SUCKER (Erimyzon sucetta).
3. MISSOURI SUCKER (Cycleptus elongatus).
4. MAY SUCKER, or CUTLIPS (Lagochile lacera).
5. MOUTH OF CUTLIPS (No. 4).
6. CARP SUCKER (Carpiodes cyprinus).
7. BUFFALO FISH (ictiobus cyprinella).

the sessions of Congress, during the civil wars, have often been held at La Paz.

SUCRE, Antonio José de (1793–1830). A Venezuelan general, born at Cumaná, and educated at Carácas. He served in the various wars of independence in South America, from 1811 to 1824, was one of Bolívar's most valuable officers, and gained the victories of Pichincha (May 24, 1822), which freed Ecuador, and Ayacucho (Dec. 9, 1824), which drove the Spaniards from Peru. At the first election of the Republic of Bolivia, Sucre was chosen life president (1826). He failed in his effort to establish an orderly government, and resigned in 1828 at the demand of Peru. He returned to Colombia, entered the army and won from the Peruvians the decisive battle of Girón (Feb. 26, 1829). On his return to Quito from a session of the constituent Congress of Colombia, of which he was president, he was assassinated, supposedly by his political enemies (June 4, 1830).

SUCTION DREDGE. See Dredge.

SUDAN, so͞o′dăn′ *or* sû-dăn′, or **SOUDAN.** A term designating the vast region in north Africa lying between the Atlantic and the Red Sea, and between the Sahara Desert, on the north, and the Gulf of Guinea and the watersheds between Lake Chad and the Congo and between the Nile and the Congo, on the south. The northern line is about lat. 18° N., the southern about 4° N. The Sudan is the short form of Beled-es-Sudan, "Land of the Blacks." The name is sometimes limited to the grass belt lying between the Sahara on the north and the forest belt to the south. Except Portuguese Guinea, Togoland and Kamerun, and Liberia, all of the Sudan is now virtually divided up between Great Britain and France. To Great Britain belong Gambia, Sierra Leone, the Gold Coast, Lagos, and Nigeria (northern and southern); the government of the Egyptian Sudan is shared by England and Egypt; and Darfur is within the British sphere of influence. (See Sudan, Anglo-Egyptian.) Under French control are Senegal, French Guinea, the Ivory Coast, Dahomey, French Congo, Bagirmi, and Wadai. The French Sudan (q.v.) was formerly the name of the territory in West Africa lying between long. 12° W. and Lake Chad and between the Sahara on the north and the countries along the north coast of the Gulf of Guinea. By the decree of Oct. 17, 1899, French Sudan ceased to exist. The western portion fell to Senegal, French Guinea, the Ivory Coast, and Dahomey. The remainder was formed into the two territories of French West Africa (q.v.), Upper Senegal and Niger and the military territory of the Niger. All the above French possessions, except French Congo, Bagirmi, and Wadai, are included in the governor-generalship of French West Africa (q.v.) formed in 1895, which also embraces practically all of the Sahara (q.v.), in accordance with the decree above named; for Great Britain has recognized the claims of France to all the region west of the Nile basin, embracing substantially all of the Sahara Desert (excluding the Libyan Desert).

For particulars as to topography, climate, commerce, races, etc., see articles on the different countries mentioned.

Ethnology. Within this broadest belt of Africa lying south of the Sahara, the following races and peoples are to be discriminated:

1. Semites, consisting of Arabs, who under many names live in Kanem and Bornu about Lake Chad and eastward to Khartum and Kordofan.

2. Hamites, whose main divisions are the Tibus, in many subdivisions, about Lake Chad: the Tuaregs, within the Niger bend and on the left bank of the Senegal; and the Fulah, Futa-Toro, and Futa-Jallon, scattered from Senegambia to Darfur and south to Adamawa.

3. Negroes, who are best divided into three provisional geographical groups. The western Sudanese include the Wolof, Serer, Sarakole, Toucouleur, Mandingo, Felup, and innumerable other tribes from the Senegal River to Sierra Leone; the Sierra Leone negroes, comprising the Temne family and a multitude of pagan tribes; the Liberian negroes, or Colonials, Kru, and many pagan tribes; the Ivory Coast negroes, from Cape Palmas eastward, akin to the Kru; the Gold Coast negroes, composed of the Tshi group, including the Fanti, Ashanti, and others, and the Ga groups, all pagans; the Slave Coast negroes, making up the Ewe group, including the Dahomans (see Dahomey), and the Yoruba group. The central Sudanese comprise the Niger Basin negroes, including the Bambarra, Sonrhay, and Hausa (see Hausa States); the Benue negroes, composed of Moslem and pagan tribes in the region of the Benue River; the lower Niger negroes, or the Ibos (Niger delta), the Igbara (above the Benue confluence), and a multitude of pagan and Moslem tribes; the Chad Basin negroes, comprising the Kanuris, the Baghirmi, the Mosgu, and many thousands of others chiefly pagan and mixed with Semites and Hamites; the Wadai negroes, including the Maba and many other tribes all of more or less mixed blood, with a large percentage of Moslems; the Darfur and Kordofan negroes, or Furs (Moslems), and Nuba (pagans). The eastern Sudanese include the Nilotic or Dinka upper Nile negroes, extending from Lake Victoria northward, and including the Madi, the Mittu, Shilluk, and a host of others, nearly all pagan; the Welle negroes, comprising the Mangbettu, the Momfu, the Azande (Niam Niam), and a number of other tribes.

History. The Anglo-Egyptian Sudan is practically coincident with the ancient Nubia (q.v.). The eastern Sudan was brought under Egyptian control by Mehemet Ali (q.v.) in 1820–22 and so remained until in 1870 Ismail Pasha found it necessary to ask for assistance in restoring the waning authority of the khedival government in the interior. The Englishman Sir Samuel Baker was made Governor-General of the Sudanese provinces and began their reduction and the suppression of the slave trade. He established his capital at Gondokoro, which he renamed Ismailia. Supposing that his work was accomplished, Baker returned to England. After his departure the slave trade was immediately revived and the administration of the provinces was intrusted to Charles George Gordon (q.v.), who began the organization and development of this rich but little-known region. Gordon continued his work in the face of all manner of discouragements and difficulties until his recall in 1879 upon the deposition of Ismail, and, though Gordon's organization was continued under his successor, Rauf Pasha, there was a gradual reversion to earlier conditions. In 1882 the Sudanese tribesmen, for a long time restless under the greed and misgovernment of the Egyptian officials, took advantage of the difficulties in Lower Egypt and revolted. This, like the rising under Arabi Pasha (q.v.), with which it coincided in point of time, was primarily a revolt against foreign influence, but, unlike the latter, which was a political movement, it had its immediate origin in religious fanaticism. England had become so deeply involved in Egyptian affairs that she was compelled to take part in this struggle for the control of the upper Nile country. A force of 11,000 English and Egyptian troops was dispatched to the Sudan under Hicks Pasha. This force was annihilated in a battle with the tribesmen at El Obeid (Nov. 3–4, 1883). England then determined to abandon the Sudan, but several posts were held by British garrisons and it was necessary to withdraw these troops. For this difficult task and for the settlement of the troubled affairs of the country, Gordon, because of his former success and his knowledge of the tribesmen, was given a new commission as Governor-General, and on Feb. 18, 1884, he arrived at Khartum. In the meanwhile Osman Digna (q.v.) was making his power felt in the vicinity of Suakim, which became the scene of bloody fighting, Osman Digna being finally defeated (February–March, 1884). Gordon was surrounded at Khartum by the Mahdi's forces and cut off from all of his communications. After many delays, in part due to the fatal hesitation of the Gladstone government, a relief force was sent out under Lord Wolseley, which after severe fighting arrived at Khartum, Jan. 28, 1885. Two days previously the city had been captured and Gordon killed. The English then retired and until 1894 gave up the attempt to reconquer the revolted provinces; but the growing British interest in east and central Africa made it inevitable that England should seek to control a position of so great strategic importance. Upon the death of the Mahdi in 1885 his power passed to his chief lieutenant, the Khalifah Abdallah. In the interval of peace the Egyptian army was reorganized and brought to an admirable state of discipline under its English officers, and in 1894, under the Sirdar, Sir Herbert Kitchener (q.v.), the struggle for the possession of the Sudan was resumed. This movement was stimulated by the threatened movement of Osman Digna (q.v.), the ablest Dervish leader, upon the Italian post at Kassala, where a victory might throw the Dervishes again upon the Egyptian frontier. After slow and patient preparation the advance up the Nile was made and Dongola was captured, Sept. 23, 1896. Pushing forward his railway across the desert at the rate of about two miles a day, General Kitchener advanced steadily, always maintaining communication with his base on the Nile. The Khalifah was gradually hemmed in and on Sept. 2, 1898, at Omdurman, opposite Khartum, he was defeated, his army annihilated, and his power completely broken. He himself was killed near Gedid in November, 1899.

The French had sent out a tentative expedition under Major Marchand (q.v.) to Fashoda, with a view to entering a wedge of French influence in the eastern Sudan, but the French were themselves threatened by the tribesmen and were rescued by General Kitchener a few days after the victory at Omdurman. The aggressive attitude of England forced France to enter a diplomatic disclaimer. This led to the recognition by France in the supplementary treaty of 1899 of the English sphere of influence in the Sudan from Darfur and the Bahr el Ghazal eastward. By the Anglo-Egyptian convention signed Jan. 19, 1899, the government of the Sudanese provinces was to be intrusted to a governor general appointed by the Egyptian government with the approval of the British government, the slave trade was prohibited, as well as the importation of arms and ammunition, and the British and Egyptian flags were to be used conjointly.

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SUDAN, ANGLO-EGYPTIAN. That part of northeast Africa, under Anglo-Egyptian control, lying south of Egypt (Map: Africa, G, H 3). The total area is given as approximately 985,000 square miles. The distance from the Egyptian boundary to Lake Albert is 1400 miles. In the north lies the Nubian Desert, and across the central section and in the extreme south are found mountains. In the flat part of the southern region are pestilential swamps. In this section the rainfall is enormous, being from 80 to 100 inches a year. There are only two dry months—November and December. The precipitation gradually diminishes northward, and represents about an average fall at the northern boundary of the country. The Nile, with its important head streams, courses through the entire land from Lake Albert to Egypt. All the tributaries of the Nile enter it in Egyptian Sudan. (See NILE.) The Atbara is heavily charged with volcanic débris from the Abyssinian highlands, and supplies the greater part of the mud which gives fertility to Lower Egypt. Egyptian Sudan is largely underlain by igneous and metamorphic rocks. Of these materials are composed most of the ranges and ridges traversing this region. To the northwestward the formations become successively younger in geologic age. The country is not only well watered, but the extremes of temperature are not excessive, though the mean temperature is high. But agriculture suffered greatly after the revolt of the Mahdi in 1883, and trade was largely abandoned. In December, 1889, the Territory was reopened for trade, and the important traffic of former times in ivory, ostrich feathers, gold dust, gums, and skins is being revived. The opening in January, 1906, of the Berber-Suakin railway, a distance of over 200 miles, is of the utmost advantage to the Sudan, as it gives it a short route to the sea. In the south particularly there are great natural resources. The soil along the White Nile is rich, and millet, durra, and sesame are raised. The forests are extensive, and possess numerous valuable varieties of wood.

The region is divided into 13 provinces—Khartum, Dongola, Berber, Kassala, Sennar, Kordofan, Blue Nile, White Nile, Bahr el Ghazal, Halfa, Red Sea, Mongalla, and Upper Nile. For 1912 the receipts were estimated at £E1,375,600, the expenditures £E1,568,600. Population was given as 10,000,000 before 1882, but fully four-fifths of the inhabitants are thought to have perished during the Dervish rule. Pop., 1914 (est.), 3,000,000. Khartum (q.v.) is the capital, and is connected with Cairo by rail and telegraph. Other chief towns are Omdurman, Dongola, Wadi Halfa, Berber, Kassala, El Obeid, and Suakin. Population of Khartum, with suburbs, 70,000 in 1910; of Omdurman in 1912 approximately 48,000. See SUDAN and bibliography there given.

SUDAN, MILITARY TERRITORIES OF FRENCH. See MILITARY TERRITORIES OF FRENCH SUDAN.

SUDAN GRASS (*Andropogon sorghum sudanensis*). This promising hay grass was introduced into the United States in 1909 from Khartum, where it appears it was cultivated under the name garawi. It is closely related to Johnson grass (q.v.) but unlike that species it has no perennial rootstock and, as a consequence, it is not liable to become a pest. It has been given trial over a large part of the country and for the semiarid portions of the United States it has been found a valuable acquisition. As generally grown in the United States it is treated as an annual but in frostless regions it becomes perennial in its habit of growth. Sudan grass ratoons well and several cuttings may be had in a season. In Hawaii it is considered one of the most valuable grass introductions ever made. Tunis grass, another form of *Andropogon* without underground root stocks, is less leafy and not so vigorous in habit of growth as Sudan grass. See ANDROPOGON.

SUD′BURY. A town and the capital of Sudbury District, Ontario, Canada, on the Canadian Pacific, Canadian Northern, and the Algoma Eastern railways (Map: Ontario, E 1). It is the centre of a famous nickel district. A Jesuit College and government school of mines are located here. Pop., 1901, 2027; 1911, 4150.

SUDEB′NIK. A Russian code of laws. The first sudebnik was compiled in 1497 under the direction of Ivan III and was the first attempt to systematize the rules of court procedure that had grown up during the preceding centuries. The first sudebnik was necessarily fragmentary. During the years 1550–51 a second sudebnik was prepared under the supervision of Ivan IV, which has remained the authoritative source of Russian law for that period.

SÜDENHORST, HANS ZWIEDINECK VON. See ZWIEDINECK VON SÜDENHORST, HANS.

SUDERMANN, zōō′dĕr-măn, HERMANN (1857–). A German dramatist and novelist, born at Matzicken, East Prussia, Sept. 30, 1857. He studied history, philology, and literature at Königsberg and Berlin. After some obscure years as tutor and journalist he published the small collection of stories *Im Zwielicht* (1887), but won European fame and assured literary position by a drama *Die Ehre* (1888), and the novel *Frau Sorge* (1888; trans. as *Dame Care,* 1892). He followed these up with the novel *Der Katzensteg* (1889; trans. as *Regina,* 1898); the sensational drama, *Sodoms Ende* (1890); the humorous short story *Iolanthes Hochzeit* (1893); and his greatest drama, *Heimat* (1893; trans. as *Magda,* 1895); a fine novel of moral psychology, *Es war* (1894); an inferior drama, *Die Schmetterlingsschlacht* (1894); and *Das Glück im Winkel* (1896), a strong but unpleasant play. Then came three one-act dramatic scenes in verse collected under the appropriate title *Morituri* (1896); *Johannes* (1897), a realistic dramatic presentation of the story of John the Baptist; *Die drei Reiherfedern* (1898), an ethical and literary mystery in dramatic form; *Johannisfeuer* (1901); *Es lebe das Leben* (1902; trans. *The Joy of Living,* 1902), a powerful drama of the struggle between soul affinity and marital obligation; *Der Sturmgeselle Sokrates* (1903); *Stein unter Steinen* (1905); *Das Blumenboot* (1905); *Rosen* (1907), four one-act dramas; *Strandkinder* (1909); *Der Bettler von Syrakus* (1911); and *Der gute Ruf* (1912). Sudermann's work with the dramas of Hauptmann is the most significant in contemporary Germany, powerful in conception, admirable in technique, virile in its grasp of humanity in the more sombre aspects, and with occasional touches of delicate humor, though Sudermann is more skilled with the sterner weapons of satire. *Frau Sorge* is a pathetic Odyssey of duty with some romantic aberrations; *Katzensteg* is a declaration of "naturalism"; *Iolanthes Hochzeit* breathes the serener realism of common life; *Es war* is a protest against the fruitlessness of brooding repentance. The dramas *Die Ehre, Sodoms Ende,* and *Heimat* are all social satires and militant democratic protests. By comparison the later dramas are increasingly out of touch with modern life. In *Die drei Reiherfedern* the evolution has become complete transformation. To some it seems a deepening, to others a sinking of his dramatic power.

Sudermann made a wide appeal both at home and abroad. Many of his books ran into scores of editions; in the case of *Frau Sorge* the 125th edition was reached in 1912. His greater works have appeared in English translation.

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SUDET′IC MOUNTAINS (Ger. *Sudeten*).

A mountain system on the south border of Silesia, Germany, which some of its ranges separate from Bohemia and Moravia (Map: Germany, G 3). It extends in a southeast direction from the water gap of the Elbe to the "Moravian Gate," a gap through which the Oder passes, and which separates the system from the Carpathian Mountains. The system is composed of a number of short, broken, more or less isolated and partly parallel ranges, consisting chiefly of crystalline slate, serpentine, and granite. These ranges inclose a number of large valleys. The best defined as well as the highest of the ranges, the Reisengebirge, lies near the centre of the system, and attains an average altitude of 4250 feet, culminating in the Schneekoppe, 5255 feet above the sea. The higher ridges have an alpine flora appearing above the large pine forests which cover the slopes. Many of the slopes afford fine pasturage for sheep and the foothills are well cultivated. The Sudetic Mountains are very rich in minerals, especially iron, zinc, lead, and copper, and in the southeastern portion there are large coal deposits.

SUDHAUS, zōōt′hous, Siegfried (1863–1914). A German classical scholar, born at Treptow. He studied at Bonn and Berlin, and taught at Bonn from 1888 till 1901, when he became professor at Kiel. In 1912 he was rector of the university. He was killed in battle in Russian Poland in November, 1914. His publications include: *Philodemi Volumina Rhetorica* (1892–96); *Aetna* (1898); *Der Aufbau der Plautinischen Cantica* (1909); *Menandri Reliquiæ* (1909).

SUDHOFF, zōōt′hōf, Karl (1853–). A German physician and medical historian, born at Frankfort-on-the-Main. He studied medicine at Erlangen, Tübingen (M.D., 1875), Berlin, and Vienna, and practiced at Bergen and later at Hochdahl. In 1905 he was called to the University of Leipzig to be professor of the history of medicine, a chair created for him through the Theodor Puschmann (q.v.) foundation. Sudhoff wrote many important essays on the history of medicine, especially on Paracelsus and Paracelsian manuscripts, on the iatromathematicians of the fifteenth and sixteenth centuries, on German medical incunabula, on the Greek medical papyri of the Alexandrinian period, and on the early history of syphilis. He published the *Klassiker der Medizin* (1910 et seq.), a collection of reprints of classical medical works, and became editor of *Studien zur Geschichte der Medizin.*

SU′DORIF′ICS. See Diaphoretics.

ŚUDRA, shōō′drȧ. See Caste.

ŚŪDRAKA, shōō′drȧ-kȧ. A Hindu king to whom tradition attributes the Sanskrit drama *Mricchakatikā* (q.v.), more probably composed by Dandin (q.v.). He seems to have been altogether mythical, for the only Śūdraka found in the history of India is a king of Gaya who probably lived in the twelfth century. According to different legends he reigned either at Vidiśa, or Śobhavati, or Vardhamana. He is said to have recovered his eyesight through Siva's (q.v.) favor and to have lived more than 100 years. Consult Sylvain Lévi, *Théâtre Indien* (Paris, 1890); Montgomery Schuyler, *Bibliography of the Sanskrit Drama* (New York, 1906).

SUE, sụ, Marie Joseph (known as Eugène) (1804–57). A French novelist, born in Paris. He studied medicine, became an army surgeon, was transferred to the navy, cruised in the East, resigned in 1829, having inherited wealth, and gave himself successively to literature, dissipation, and socialistic agitation, writing *feuilletons* that rivaled those of Dumas in rapidity of production, fertility of imagination, and carelessness of execution. In 1831 he published *Plick et Plock*, the success of which led to *Atar-Gull* (1831), a novel of the sea, suggested by his own experience and by the American novels of Cooper. It revealed a gift of story-telling, but showed a reckless mingling of tragic and comic, pathetic and grotesque. Debts and disgust at his equivocal social position turned him into a socialist and convert to the propagandism of Fourier and Proudhon. His work in this spirit consists of long novels printed in cheap newspapers, but winning such hold on the masses that the government sought to check his activity. Sue entered on an unexplored path when he began the *Mystères de Paris* (1842). He was undertaking to paint the sufferings, the needs, the possibilities of the working class with the intent of influencing their political action, and he won for the novel a new audience and a new interest. He entered on the task with an enthusiasm that fired his genius to the creation of types of character that still have power to horrify or charm. Both the *Mystères de Paris* and *Le Juif errant*, "The Wandering Jew" (1844–45), were dramatized by Sue, and both have attained world-wide circulation. He wrote an *Histoire de la marine française* (1835–37) and two historical novels, *Latréaumont* (1837) and *Jean Cavalier* (1840). The later work of Sue is vast. He was elected to the Assembly in 1850, and was exiled in December, 1851. He died at Annecy in Savoy. Consult Eugène de Mirecourt, *Eugène Sue* (4th ed., Paris, 1870).

SUECA, swā′kȧ. A town of Spain, in the Province of Valencia, 23 miles south of the city of that name, on the left bank of the Júcar (Map: Spain, E 3). It is in a fertile valley. Pop., 1900, 14,422; 1910, 17,178.

SUERA, swā′rȧ. A seaport of Morocco. See Mogador.

SUESS, zụs, Eduard (1831–1914). An Austrian geologist. He was born in London, studied the natural sciences at Prague and Vienna, and from 1857 to 1891 was professor of geology at the University of Vienna. From 1873 to 1896 he was a member of the Austrian Lower House. From 1897 to 1911 he was president of the Imperial Academy of Sciences. His more important contributions to geology, which have opened up a new path in geological inquiry, and laid the foundation for what is now frequently termed the "new geology," deal with the construction and relations of continents and mountain ranges, the dynamics of volcanoes and earthquakes, and the general movements of the earth's crust. His *Antlitz der Erde* (1883–1901; Eng. trans., *Face of the Earth*, 1904–09) is a masterly exposition of the relation of the dominant features of the earth's surface, and the first luminous effort to correlate their multiform aspects and give to them their true geographic expression. Among his other works are *Ueber den Löss* (1860) and *Die Entstehung der Alpen* (1875).

SUETO′NIUS TRANQUIL′LUS, Gaius. A Roman historian, born probably a few years after the death of Nero. Pliny procured for him the dignity of military tribune, which, by

Suetonius's desire, was transferred to another. He was afterward secretary of the Emperor Hadrian. His death occurred about 160 A.D. All his works (among which, as we learn from Suidas, there were several on topics usually treated by grammarians) have been lost, except his *Lives of the Cæsars*, part of his *Lives of Eminent Grammarians*, and part of his *Lives of Eminent Rhetoricians*. The *Lives of the Cæsars* contains information about the 12 Cæsars, from Julius Cæsar to Domitian, which is to be had nowhere else, and abounds with anecdotes which, while they too often prove the profligacy of his heroes, or the pruriency of Suetonius's own mind, testify to the impartiality of their chronicler. The best editions are by Baumgarten-Crusius (Leipzig, 1816–18), Reifferscheid (ib., 1860), Roth (ib., 1886); and of parts, by Peck (New York, 1891), Schuckburgh (Cambridge, 1896), Ihm (Leipzig, 1907), and Pike (Boston, 1903). There is an English version by Thomson and Forrester (ib., 1855), and another by J. C. Rolfe (2 vols., New York, 1914). Consult the introduction in Schuckburgh's edition; Martin Schanz, *Geschichte der römischen Litteratur*, vol. iii (2d ed., Munich, 1905); W. S. Teuffel, *Geschichte der römischen Literatur*, vol. iii (6th ed., Leipzig, 1913); M. S. Dimsdale, *A History of Latin Literature* (New York, 1915).

SUE′VI. The collective designation of a great number of Germanic peoples (Cæsar, *De Bello Gallico*, iv, 1). They occupied a district of indefinite extent on the eastern side of the Rhine, and may have been the same tribes as those subsequently known as Chatti, Longobardi, etc. Cæsar states that their territory comprised 100 cantons, and was densely wooded, that they had towns (*oppida*), but no strongholds, and that every year a part of the population left their homes to seek employment in war. The Suevi of whom Tacitus speaks (*Germania*, 38, etc.) seem to have dwelt north and east of the country of the Suevi of Cæsar, extending as far as the Elbe and the Baltic, which Tacitus calls the "Suevic sea." The peoples united under the rule of Maroboduus, the Marcomannic chief, were Suevic, and hence the Marcomanni (q.v.) and the Quadi (q.v.) who figure in the reigns of Marcus Aurelius and Aurelian are often called Suevi. After the name had fallen into disuse as a collective designation, it reappeared in Ammianus Marcellinus (q.v.) as the name of a people occupying the same territory as the Suevi of Cæsar. We find them in alliance with the Burgundians, Alemanni, Alani, Vandals, etc. They are among the most notable of the barbaric peoples that broke up the Roman Empire in the northwest and west. Bursting through the passes of the Pyrenees (409 A.D.), they, along with the Vandals, overran and wasted Spain (q.v.). Those who remained at home in Germany seem to have spread during the fifth century east of the Neckar and the Rauhe Alb, and south as far as Switzerland. The mediæval Swabians were their direct descendants. Consult the article "Sueben," in Friedrich Lübker, *Reallexikon des klassischen Altertums*, vol. ii (8th ed., Leipzig, 1914).

SUEZ, sōō-ĕz′. A town of Egypt, situated on the south coast of the Isthmus of Suez, at the north extremity of the gulf of that name, and near the southern terminus of the Suez Canal (Map: Egypt, C 1). It is built on a desert peninsula, and consists chiefly of unpretentious-looking houses. The European quarter, however, is regularly laid out, and contains the large warehouses of the Peninsular and Oriental Steamship Company. There are also a large English and a French hospital, and the town is supplied with water from the Nile at Cairo through a fresh-water canal. To the south a large stone causeway, carrying a railroad, runs to the immense harbor of Port Ibrahim, at the entrance to the canal, 2 miles south of the town. Suez has railroad connection with Cairo and Ismailia, but its commerce is not very large, as only a small portion of the transit trade passing through the canal affects the town. Pop., 1907, 18,347.

SUEZ, Gulf of. An arm of the Red Sea between the Sinai Peninsula and the main portion of Egypt (Map: Egypt, C 2). It has a length of 187 miles with a breadth of from 14 to 39 miles. At its north end, which is the extreme north end of the Red Sea, it is artificially connected with the Mediterranean Sea by the Suez Canal (q.v.).

SUEZ, Isthmus of. The neck of land connecting the Sinai Peninsula with the main land of Egypt, and separating the Mediterranean from the Red Sea (Map: Egypt, C 1, 2). The shortest straight-line distance across it, between the site of the ancient Pelusium and the head of the Gulf of Suez, is 72 miles. The isthmus consists of a low, sandy, and stony desert, the lowest depressions being occupied by salt lakes and marshes, and it is almost wholly destitute of fresh water. A series of such depressions extends across the isthmus from the great coast lagoon in the north to the Gulf of Suez, and affords the route for the Suez Canal (q.v.).

SUEZ CANAL. A canal about 100 miles in length, which crosses the Isthmus of Suez and connects Port Said on the Mediterranean Sea with Port Thewfik on the Red Sea. In 1854 Ferdinand de Lesseps (q.v.) obtained permission from Said Pasha to form a company to construct a waterway from sea to sea without locks, and in 1855 an "International Consultative Commission" selected from among the most celebrated civil engineers of Europe was appointed to report upon the scheme. The final report of this commission was submitted to and accepted by the Viceroy in June, 1856. Its conclusions were in effect as follows: A direct route through the isthmus from Suez to the Mediterranean was adopted. The dimensions of the channel were to be as follows: from the Red Sea to the Bitter lakes, depth 26¼ feet, bottom width 210 feet, top width 320 feet; from the Bitter lakes to the Mediterranean Sea, depth 26¼ feet, bottom width 144 feet, top width 262 feet. At Port Said the plan of extending jetties directly seaward to protect the entrance was adopted. (See Jetty.) Basing his efforts on these conclusions, M. de Lesseps succeeded, in 1858, in forming a company, with a capital stock of £8,000,000, to build the canal.

Topography. The construction of the canal was greatly facilitated by the existence along the route of four dried-up depressions which were formerly and have again become lakes of considerable area, viz., the two Bullah lakes, the Great and Small Bitter lakes, and Lake Timsah. (See Map of Egypt.) These low-lying basins have an aggregate length of 27 miles. Excavation was required, however, through the Bullah lakes, Lake Timsah, and the Small Bitter Lake, and also through a portion of the

Great Bitter Lake. Consequently it was only for a length of 8 miles of the Great Bitter Lake, where the natural depth exceeded that of the canal, that no excavation was necessary. The total distance from Port Said to Suez, Port Thewfik, is 88 nautical miles, or about 100 English miles. The only serious obstacles to be overcome in the line of the canal were at El Gisr, the summit of the work, situated between the Bullah lakes and Lake Timsah, where the hills crossing the canal vary from 30 to 60 feet above sea level over a length of 6 miles, and at the deep cutting of Serapeum, between Lake Timsah and the Great Bitter Lake. From Port Said to Kantara, a distance of 24 miles, the canal passes through Lake Manzaleh, a shallow lagoon which covers an area of nearly 1000 square miles. The soil encountered along the route was sand, sandy clay, and hard clay, with rare stretches of rock, and thus favorable to rapid and easy excavation. No serious engineering difficulties were presented by the harbor works at Port Said and Suez, and unlike the Panama Canal no locks were required. In short, the canal works in general were of a very simple nature, but of vast magnitude, involving, as originally proposed, the removal of 60,000,000 cubic meters of dry earth and 56,000,000 cubic meters of earth under water; and as they were situated in a country destitute of fresh water, a well-conceived organization was required to bring the colossal work to a successful issue.

Progress of the Work. Work on the canal was begun on April 25, 1859. The work progressed slowly at first, but the installation of a large fleet of dredges by means of which the dredged material carried by long and high projecting chutes was rapidly delivered on either bank of the canal at some distance from the slopes of the cuttings without the intervention of barges, and other mechanical appliances, had the effect of reducing by three-fourths the number of workmen needed to open the canal by the time originally estimated. More important than these, however, was the completion, in 1863, of a fresh-water canal and pipe line from Cairo by the way of Ismailia to Port Said. Financial difficulties were overcome, first, by decreasing the width of the bottom of the canal to 72 feet and the depth to 26 feet, 2 inches, its dimensions when opened, and, second, by virtually increasing the capital of the company to £17,100,000. To compensate for the greatly reduced width of the canal, sidings were provided at every 5 or 6 miles between Port Said and Lake Timsah to allow vessels to bring up either for the purpose of passing each other or to moor for the night. In April, 1867, water from the Mediterranean was let into the marshy bed of Lake Timsah, and in March, 1869, it was allowed to flow into a near-by dry salt-incrusted basin of the Bitter lakes. After five days of great pomp and ceremony (Nov. 16–20, 1869) the canal was opened to traffic and was available for ships drawing not more than 24.4 feet. The canal had cost up to Dec. 31, 1869, £16,632,953.

Enlargement of the Canal. In 1883 it became evident that, owing to the great increase of traffic, a radical plan of improvement was demanded. In 1884, therefore, a second International Consultative Commission was appointed to consider the whole question and to report plans. This commission made its report in 1885, and shortly thereafter the enlargement works were begun according to the general plan recommended by the commission. In 1890 ships drawing 25.4 feet were allowed. Another enlargement was completed in 1898; it consisted in an increase of the bottom width of the canal to 121⅓ feet, and an increase of the navigable depth to 27 feet, 10 inches. The increase in depth was at the rate of about one foot every six years, so that on Jan. 21, 1915, the maximum draft permitted was 30 feet. In addition to this uniform enlargement of section there were completed in 1899 nine new sidings, each 49 feet wide and 2460 feet long. A depth of 40 feet throughout the canal was being aimed at, and the company had power to raise bonds up to $30,000,000 for the work, which would have been completed by 1919 had it not been for the war. Although Sydney, Australia, was the only Australasian port with a depth of harbor greater than that of the Suez Canal, yet the depth of the Panama Canal, 40 feet, and that of many Atlantic ports, made such increased depth desirable. In 1914 the average time of passage was 16 hours and 11 minutes for vessels navigating by night as well as day. The maximum speed permitted was 5⅓ nautical miles per hour.

Night Navigation. In 1885 it was decided to make use of electric light in such a manner as to insure a safe passage by night through the canal, the company hoping in this way to diminish the traffic by day and thus to render the navigation less difficult until the full enlargement of the waterway was accomplished. A vessel passing by night carries four lights, one astern, one on each side, and a strong searchlight ahead capable of sending light 4000 feet ahead of the vessel. The effect of this system of lighting so as to permit night navigation virtually doubles the carrying capacity of the canal.

Traffic and Revenue. The toll charged for the passage of the canal was 10 francs per ton and 10 francs per passenger when the canal was first opened. From time to time there have been discussions as to the transit dues, and recent reductions in charges have led to smaller revenues. From the time of opening various changes were made in succeeding years, and in 1903 the toll was 8½ francs per net ton for loaded vessels, 7 francs for empty ships, and 10 francs per passenger. On Jan. 1, 1913, a reduction to 6¼ francs per ton was made. The reduction of toll rates naturally affected the receipts. The accompanying table shows the traffic of the canal from 1869 to 1914, inclusive:

YEAR	Vessels	Gross tonnage	Net tonnage	Transit receipts
				Francs
1869......	10	10,558	6,576	54,460
1870......	486	654,915	436,609	5,159,327
1875......	1,494	2,940,708	2,009,984	28,886,302
1880......	2,026	4,344,520	3,057,422	39,840,484
1885......	3,624	8,985,412	6,335,753	62,207,439
1890......	3,389	9,749,129	6,890,094	66,984,000
1900......	3,441	13,699,238	9,738,157	90,623,608
1905......	4,116	18,310,442	13,134,105	113,866,796
1910......	4,533	23,054,901	16,581,898	130,436,547
1911......	4,969	25,417,853	18,324,794	134,762,199
1912......	5,373	28,008,945	20,275,120	136,423,831
1913......	5,085	27,737,180	20,033,884	126,650,934
1914......	4,802	26,866,340	19,409,495	122,248,853

In 1914 Great Britain led in the number of vessels passing through the canal with 3078 of 17,756,322 gross tons and 12,910,278 net tons. Germany was second with 481 of 2,961,755 gross tons and 2,118,946 net tons, and was followed by Holland with 347 vessels, 1,925,036 gross tons, 1,389,390 net tons, and France with 228 vessels of 1,217,406 gross tons and 799,624 net tons. Flying the United States flag were 3 vessels of 5264 gross tons and 2562 net tons.

During the first six months of 1915, 1750 ships passed through the Suez Canal, paying tolls to the amount of about $8,750,000, as compared with 2571 ships for the corresponding six months of 1914, or previous to the outbreak of the Great War. In these six months the amount of toll paid was approximately $13,000,000. Deducting the number of German, Austrian, and Turkish ships which naturally were unable to use the canal in 1915, it would appear that the amount of traffic and receipts therefrom was little below the ordinary.

History. The plan of a water connection between the Mediterranean and the Red Sea goes back to early Egyptian history. Such a canal seems to have been constructed in the reigns of Seti I and Rameses II (about 1350–1300 B.C.), extending from the Nile to Lake Timsah and thence to the Red Sea. When this had been choked up by the sands in the course of ages, a new canal was begun by Necho, a son of Psammetichus I (about 600 B.C.), between Bubastis on the Nile and the Red Sea, but was left unfinished till the time of Darius Hystaspis (521–486 B.C.), who completed the work. About the beginning of the Christian era the canal was no longer navigable, but it was probably restored under Trajan. The last restoration was made in the seventh century by Amru, the Mohammedan conqueror of Egypt, who connected Cairo with the Red Sea. During Napoleon's invasion of Egypt (1798–99) the project of piercing the isthmus was carried to the extent of preliminary surveys being made, but, owing to a miscalculation on the part of the engineers which seemed greatly to enhance the difficulties of the work, the execution of the plan was delayed till the French were forced to abandon Egypt. An international commission of engineers made a preliminary survey in 1846 to ascertain the practicability of a level-water canal. The English engineer on the commission, George Stephenson, strongly opposed a canal and recommended to his government a railroad from Cairo to Suez, and this was constructed by British capital in 1858. By the terms of the De Lesseps concession (see above) the canal was to be constructed without expense to Egypt, which was to receive 15 per cent of the gross receipts for 99 years, at the expiration of which period the canal was to revert to the Egyptian government. When, however, De Lesseps found it impossible to enlist the large amount of capital necessary, he turned to Said Pasha, secured from him a large loan for preliminary work and promoting, and later a subscription for nearly half of the stock, which was about £17,000,000. Said was not able to pay his subscription and his warrants had to be cashed in London. The Egyptian government had agreed to furnish labor at a nominal price, the fellaheen to be well treated and their health to be cared for. The violation of the latter condition on the part of the canal company aroused a protest in the name of humanity, especially from England, which had never looked with favor on the canal and suggested to the Sultan that the work be stopped. His approval of the concession, as suzerain, which had been provided for in the original contract with Egypt, had never been obtained. He now approved the concession, but decided that the fellaheen must not be forced to do the work. The company complained of the Egyptian government's compliance with this order from Constantinople as a breach of contract, made heavy claims for damages, induced the Khedive to accept Napoleon III as arbitrator, and on this and a later claim wrung from the exhausted resources of Egypt over 80,000,000 francs. The direct and indirect cost of the canal to Egypt is estimated at about $85,000,000. In 1875 Ismail Pasha (q.v.) appealed to Europe for aid in his financial difficulties. Among other measures that were taken was the sale of his canal stock to England, 176,602 shares, for £4,000,000 effected through the foresight of Lord Beaconsfield, who outwitted a French syndicate by asking the Khedive outright if the shares were for sale. (See DISRAELI.) This made England, which had originally opposed the canal project, the heaviest owner in it, and combined with the general financial assistance rendered to Egypt gave that power a direct interest in Egyptian affairs. A very short time sufficed to show that the canal was of the utmost value as the passageway between England and her Oriental possessions. Under the control of British and French capitalists the commercial development of the canal followed unchecked until the Great War. There was no preferential treatment in its use, and ships of all nations employed it on equal terms.

England and France at first exercised together that tutelage over Egypt which the financial situation rendered necessary. Later events led England to assume this responsibility alone. The Suez Canal was the key to this political development, as it became in part to the complicated situation in the Near East previous to and during the Great War of 1914. In fact its protection against Teutonic and Turkish attacks was an important consideration that bulked large in the strategy of the war and for that reason it was well guarded by British troops. Rumors of the closing of the canal in 1915 severely affected freight rates and commerce. See EASTERN QUESTION; EGYPT; WAR IN EUROPE.

Bibliography. Ferdinand de Lesseps, *The Isthmus of Suez Question* (Eng. trans., London, 1855); Jules Barthélemy-Saint-Hilaire, *Egypt and the Great Suez Canal* (Eng. trans., ib., 1857); Ferdinand de Lesseps, *Suez Canal: Letters and Documents Descriptive of its Rise and Progress* (ib., 1876); P. H. Fitzgerald, *The Great Canal at Suez: Its Political, Engineering, and Financial History* (2 vols., ib., 1876); J. E. Nourse, *The Maritime Canal of Suez* (Washington, 1884); J. Charles-Roux, *L'Isthme et le canal de Suez: historique, état actuel* (2 vols., Paris, 1901), contains reprints of official documents and a bibliography; United States Bureau of Statistics, *Traffic, Finances, Shipping, and Tonnage, and Receipts and Expenditures of the Suez Canal* (Washington, 1903); Charles Freycinet, *La question d'Egypte* (2d ed., Paris, 1905); E. R. Johnson, *Panama Canal Traffic and Tolls* (Washington, 1912), including notes on finance, traffic, etc., of the Suez Canal.

SUFFERN. A village in Rockland Co., N. Y., 32 miles north by west of New York City, on the Ramapo River and on the Erie Railroad (Map: New York, Insert, A 1). It has the convent of the Holy Child and a fine high-school building. There are ironworks, a foundry, perfume factory, etc. Pop., 1900, 1619; 1910, 2663; 1915 (State census), 2781.

SUF'FIELD. A town in Hartford Co., Conn., 16 miles north of Hartford, on the New York, New Haven, and Hartford Railroad (Map: Connecticut, E 2). It has manufactures of tobacco and cigars. Pop., 1900, 3521; 1910, 3841.

SUFFOCATION. See Asphyxia.

SUFFOLK, sŭf'ok. A maritime county of southeast England (Map: England, G 4). Area, 1489 square miles. Pop., 1901, 384,198; 1911, 408,054. The surface is for the most part flat, falling away into marshes on the northwestern and northeastern borders. The tributaries of the Waveney and of the Stour, together with the river Lark, an affluent of the Great Ouse, and the Gipping, with its estuary, the Orwell, are the chief streams. The soil is of various kinds, some of which are very productive for the ordinary crops. Capital, Ipswich. Consult *Victoria History of the County of Suffolk*, vols. i–ii (London, 1907–11).

SUFFOLK. A city and the county seat of Nansemond Co., Va., 22 miles southwest of Norfolk, on the Nansemond River, and on the Norfolk and Western, the Seaboard Air Line, the Southern, the Atlantic Coast Line, the Norfolk Southern, and the Virginian railroads (Map: Virginia, H 5). It is an important railroad centre, and one of the largest peanut-cleaning markets in the State. There are car works, a stove foundry, various woodworking and lumber mills, ironworks, hosiery mills, and brick plants. Pop., 1900, 3827; 1910, 7008.

SUFFOLK, Earls and Dukes of. Dignities held by several noted English families.—The title Earl of Suffolk was conferred on Robert de Ufford (1298–1369), who held high office under Edward III. He was made admiral of the northern fleet in 1344, fought at Crécy and Poitiers, and was intrusted with diplomatic missions.—He was succeeded by his son William de Ufford, one of the most popular statesmen of the later part of Edward III's reign, who took a share in the suppression of the peasant revolt in 1381, and died in 1382, leaving no male heirs.—A new line of Suffolk was founded by Michael de la Pole (?1335–89), who fought in the French wars, became in 1376 admiral of the northern fleet, negotiated the marriage of the young Richard II with Anne of Bohemia, and in 1383 was made Chancellor. By marriage he acquired extensive possessions in Suffolk, enlarged by royal grants. In 1385 he was created Earl of Suffolk. His rapid elevation and the influence which he exercised over the King aroused the nobles, and in 1386 he was dismissed from office on the demand of Parliament, which proceeded to impeach him of treason and malfeasance. The King's favor could not protect him and in 1387 he fled. In his absence he was condemned to be hanged. He died at Paris.—His son Michael de la Pole (1361–1415) was restored to his father's dignities in 1397 and fell at Harfleur in 1415. He was followed by his eldest son, who was killed soon after at Agincourt, being succeeded by his younger brother William de la Pole (1396–1450), best known of all that have borne the title. He served in the French wars under Henry V, the Duke of Bedford, and the Earl of Salisbury, upon whose death in 1428 he became head of the English forces in France. He failed to capture Orléans, which was relieved by Joan of Arc in 1429, and in the same year was taken prisoner. Ransomed at a heavy cost he took little military part, but for 20 years had an important rôle in the government. The death of the Duke of Bedford in 1435 left him one of the two most powerful men in the Kingdom, his great rival being Humphrey, Duke of Gloucester, uncle of the young Henry VI. In 1448 Suffolk was at the head of an embassy which arranged a truce with France and brought about the marriage of Henry VI with Margaret of Anjou. This alliance gained him great popularity. The government fell entirely into his hands, and after the death of Gloucester, in 1447, he was master in the Kingdom. He became successively chamberlain, lord warden of the Cinque Ports, admiral, Governor of Calais, and Duke of Suffolk. He was hated by a large faction of the nobility headed by Richard, Duke of York. He lost popularity owing to the surrender of Anjou and Maine, to which he had assented as one of the conditions of the King's marriage, and hostility was intensified by the renewal of war with France in 1449, when Normandy was lost to the English. People thought he had encompassed the death of the "good Duke Humphrey." In 1450 the Commons accused him of having betrayed the King to the French and brought articles of impeachment against him. The King, whose favor he never lost, sentenced Suffolk to five years' exile. On May 1, 1450, the Duke set sail for France, but his ship was intercepted by a royal man-of-war, Suffolk was forced on board, and later was taken into a small boat and beheaded. His body was cast upon the beach at Dover. The deed was probably due to Richard of York, his mortal enemy. Consult C. W. C. Oman, *The History of England from the Accession of Richard II to the Death of Richard III* (New York, 1906).—John de la Pole (1442–91), second Duke of Suffolk, only son of the preceding, regained the ducal title in 1455. He joined the York party, married a sister of Edward IV, and was in favor under that family and under Henry VII. His eldest son, John, took part in Lambert Simnel's rebellion and fell at Stoke in 1487. He was attainted, and the greater portion of the family estates was lost.—Edmund de la Pole, a younger brother, received a part of the confiscated estates with the title of Earl. He plotted to seize the throne with the aid of German troops, but the plan miscarried, and he fell into the hands of Henry VII, who, however, spared his life and sent him to the Tower. He was beheaded with his brother Richard in 1513 and left no male issue.—The title Duke of Suffolk was subsequently borne by Charles Brandon (died 1545), the favorite of Henry VIII and husband of his sister Mary Tudor. He was succeeded by his two young sons, who died in 1551, on the same day.—Henry Grey, third Marquis of Dorset, who had married a daughter of Charles Brandon, was next made Duke of Suffolk. He was the father of the unhappy Lady Jane Grey (q.v.). In 1553 he attempted to raise the north, was betrayed and beheaded. Consult Richard Davey, *The Sisters of Lady Jane Grey* (New York, 1912).—In 1603 Thomas Howard, second son of Thomas, fourth Duke of Norfolk, was created Earl of Suffolk. His second son was created Earl of Berkshire in 1626, and in 1645 the two titles merged.

SUF'FRAGAN (ML. *suffraganus*, from Lat. *suffragari*, to assist, to vote for). The name given to a bishop to express his relation in a province to the archbishop or metropolitan (q.v.). The name is also applied to coadjutor or assistant bishops, especially in the Church of England. The Protestant Episcopal church in the United States provided in 1910 for suffragan bishops, without right of succession, but eligible to election as bishops or bishop coadjutors. In the Roman Catholic church similar assistant bishops are usually designated by the titles of extinct sees. See TITULAR BISHOPS.

SUF'FRAGE (Lat. *suffragium*, vote). In a representative government, the act of a qualified voter in participating in the choice of government officials or in voting on laws or constitutions submitted to the electorate. There are two views as to the basis of suffrage. One holds that it is a privilege bestowed by the state upon such citizens as are capable of exercising it intelligently and for the public welfare. The other view regards it as the natural right of all adult citizens. By most states suffrage has been restricted to some of the following bases: sex, ownership of property, payment of taxes, educational attainments, moral character, residence, religious profession, etc. An almost universal rule has been to exclude children, lunatics, idiots, convicted criminals, and aliens from the exercise of the suffrage, although there are still exceptions.

In the American Colonies qualifications for suffrage varied greatly. In Virginia the suffrage was restricted to "freeholders and housekeepers," in Massachusetts until 1664 it was restricted to church members; in the New Haven Colony it was the same; under the Massachusetts charter of 1692 it was restricted to freeholders of a certain amount of property. The religious tests were first to be abolished, the last survival of the kind existing in South Carolina from 1778 to 1790. The right of each State to regulate the suffrage within its limits was recognized by the Federal Constitution, and in hardly any two States were the requirements the same. During the early part of the nineteenth century a freeholder qualification was required in Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Virginia, Maryland, North Carolina, and South Carolina, the amount ranging from £20 in New York to £60 in Massachusetts or from 25 acres of improved land in Virginia to 50 acres in Maryland and South Carolina. The payment of taxes alone was required in Pennsylvania, Delaware, and Georgia. Early in the nineteenth century the freehold requirement was abolished in nearly every State. The tax and ownership of personalty qualifications disappeared in most States, so that adult male suffrage became the general rule long before the outbreak of the Civil War. Free negroes were almost everywhere excluded.

A readjustment of the suffrage followed the Civil War. The Reconstruction Acts of 1867 conferred the right of suffrage on the freedmen. In the States that had rebelled the negroes voted for the first time in 1867, in the elections for delegates to the reconstruction constitutional conventions, and in the following year on the question of adopting or rejecting the new constitutions. The States having once been readmitted to the Union, however, there was nothing to prevent them from withdrawing the right temporarily bestowed on the freedmen by Congress. The Fourteenth Amendment was intended to guard against such action on the part of the reconstructed States. On account of the difficulty of enforcing this amendment and the inadequacy of protection which it afforded the negro population, the reconstructionists advanced another step. In the first place, it was made a condition precedent to the readmission to the Union of the remaining unreconstructed States that they adopt constitutions with unamendable provisions guaranteeing the right of suffrage to negroes. At the same time the Fifteenth Amendment to the Federal Constitution was carried. But the Constitution confers the right of suffrage directly on no one, so that there are no United States voters. This is a prerogative of the individual States, and they may exclude any number of persons on other grounds than race or color, such as illiteracy, lack of citizenship, nonpayment of taxes, etc., subject to the penalty of a reduction of representation in Congress.

Grandfather Clause. In the effort of the Southern States to restrict the negro vote many of them had enacted so-called "grandfather clauses." The usual method was to limit the right to vote by some educational or property qualification, but to exempt from such qualification those who could vote prior to 1866 and their descendants. Such clauses were declared null and void by the United States Supreme Court in June, 1915, in two cases based on the Oklahoma constitution and the Maryland statute. All such clauses were declared by the court to be subterfuges designed to defeat the express intent of the Fifteenth Amendment. Moreover the court upheld the criminal conviction of Oklahoma officials and the fining of Maryland officials for refusing suffrage privileges to negroes.

The attainment of the twenty-first year of age is a qualification in every State. To the beginning of 1916 the States of Wyoming, Colorado, Utah, Idaho, Washington, California, Arizona, Kansas, Oregon, Nevada, and Montana, and the Territory of Alaska had granted women equal suffrage rights with man; in Illinois women had gained the right of voting in the filling of all offices not created by the State constitution; 19 States had granted to women the right of suffrage in school elections, and Iowa in municipal elections on proposals to vote bonds or increase tax levies. The States may and generally do require voters to register within certain periods as a means of preventing frauds at the election, and this requirement indirectly excludes some. Residence within the State and district for a certain period previous to the election is an almost universal requirement. Educational tests have long existed in Massachusetts and Connecticut and have been introduced in a number of Southern States, as a result of which the suffrage has been practically restricted to the whites in Mississippi, South Carolina, Louisiana, North Carolina, Alabama, and Virginia. See the sections on government of the various countries and States for suffrage requirements. See WOMAN SUFFRAGE.

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SUFFREN DE SAINT-TROPÈZ, sụ'frăN' *de* săN'trô'pĕz', PIERRE ANDRÉ DE (1726–88). A French naval hero, born at Saint-Cannat, near Lambesc. He was captured by Hawke in 1747 and after his exchange served for several years in the vessels of the Knights Hospitalers of Malta (q.v.). He was again with the French navy in the Seven Years' War, in 1767 returned to the service of the Knights of Malta, and in 1772 was commissioned as a captain in the French navy. In 1778–79 he served with distinction in the squadron of D'Estaing (q.v.) which operated on the American coast and in the West Indies. In 1781 he was given command of a squadron of five ships, sent out against a British fleet under Commodore George Johnstone. He found Johnstone's fleet in Porto Praya, Cape Verde Islands, and inflicted so much damage that the British expedition failed in its purpose of conquering the Dutch South African settlements. He then proceeded to the East Indies, where his four principal actions against the superior forces of the British Admiral Sir Edward Hughes, taken together, were the most brilliant operations ever performed by a French naval commander. The strategic results of his campaign were most important, and if proper use of them had been made by the French land forces, the British hold upon India would have been seriously menaced. Suffren was made a vice admiral; he had long been known as the Baillie de Suffren from a high office he held in the Knights of Malta.

SUFIISM, sōō'fê-ĭz'm (from Ar. *sūfī*, clad in woolen, from *sūf*, wool). A system of Mohammedan mysticism, having its home chiefly in Persia.

Mohammedanism is not a mystical religion, but it contained from the first elements which could be used by mystics. Not till its second century did mysticism become organized in it. The word "Sufiism" seems to have been first adopted by Abu Hashim, a Syrian (A.D. 780), who founded a mystic community at Ramleh in Palestine. Abul Said Abul Khair (about 820) is mentioned as founder, while Al-Ushairi (1073) states that the name was in common use about 815. Mythical tales give the origin to Rabia al Adawiyya (752), a pious woman much spoken of in Sufiism. There seems to be historic evidence to prove the Sufi claim that, in spite of Mohammed's precautions against mysticism, his favorite Ali was not free from its influence. Sufiism is radically theistic and is led by its theism to consider God as absorbing the universe. The Vedanta is pantheistic with occasional theistic phraseology. The Sufis are so strongly devoted to the Beloved (viz., God) that they look for Divinity everywhere and see Divinity anywhere. It became easy, even for the Persians, to interpret this in a pantheistic way. The intellectual forms given to most of the Sufi doctrines in Persia are from foreign sources, among which must be mentioned Buddhism, the Peripatetic philosophy, and Neo-Platonism.

A few really great Sufis lived before the close of the second century of the Hejira (815). Among them and those immediately after are to be mentioned the Egyptian Dhun-Nun (859), who introduced the doctrine of ecstasy and mystical stages; Sirri Sagvati (867), who introduced unification; Junaid (910), who reduced Sufiism to writing; and Al-Nallaj, who became famous because he went about crying "I am the true One," for which he was put to death by torture (921). The *Fihrist* (987) represents him as a "wily conjurer," but Sufis consider his death the result of the workings of the occult law which brings death upon him who divulges divine secrets. Ghazali (q.v.) (died 1111) and Jalal ud din Rumi (q.v.) (died 1273) were the two most famous doctors in Sufiism. The most brilliant Persian poetry is Sufi. Aside from Rumi, the Sufi poets are Nizami (q.v.), Farid ud din Attar (q.v.), Sadi (q.v.), Shamsi, Hafiz (q.v.), Anvari, Jami (q.v.), and Hatifi (q.v.). It may be added that Omar Khayyam (died 1123), known to the West through FitzGerald's translations, is not a Sufi. Jami (died 1492) has been called the last Sufi, and with some justice. After him Sufiism slowly declined, but the nineteenth century saw its powerful revival in Turkey, though its Turkish representative names are almost unknown outside of Turkey. From Turkey and Egypt comes what may be called a Neo-Sufiism.

Primitive Sufiism is not doctrinal; it is an "experience," a "feeling of God," a "mystery of godliness," and does not primarily have anything to do with the notions of the intellect. Within 200 years from its origin, however, it assumed doctrinal forms. The two chief doctrines of Sufiism are that of the One (*Ahad*) and that of "the Way to the One" (*tariqat*). A Sufi first of all endeavors to realize that "the One" is the only existence, that there is not only "no god but God," but that there is nothing but God. Next, he enters upon "the journey to the rose garden of Union." The Sufi's belief is not pantheism in the Greek sense; he does not "make everything God except God himself"; on the contrary, everything is naught except Divinity and it is Divinity that gives life to the dead Nonbeing. The world is a phantasmagoria, and the time will come when it shall pass away. God's reason for creating the world is found in this saying: "I was a Hidden Treasure and I wished to be known, so I created Creation that I might be known." The form of creation is not only truth and goodness, but also and essentially beauty. Sufis lay more stress upon the conception of Divinity as beauty than other mystics or religions.

The Sufi "way to God" is similar to the well-known ideas on that subject among Western mystics. With the help of a guide, "the traveler" ascends step by step to union with God or through awakening to regeneration and sanctification to union. The "Way" is ascetic and full of occult practices, such as dances, silences, etc., and leads to the mystic trance of perfect union with God, when man loses all sense of independent individuality. All men may reach union.

Sufi symbolism permeates the entire system of Sufiism. A symbol to a Sufi is not merely an object which stands for some other object or idea. For him every object has besides its own immediate signification also an ideal content, and it is this latter which is the real object of the Sufi's search. He finds it by means of love (*isq*). Objects are therefore veils, not veils that hide, but veils that reveal the One.

All Sufi poetry is written with a double sense and the initiates can read five other senses besides. The now comparatively well-known ghazels of Hafiz, Sadi, Jami, and others abound in veils, which the Occidental calls voluptuous and bacchanalian, but to the Sufi they are descriptive of emotions or soul life. As such they suggest to him deeper and more universal states of life.

There are many sects among the Sufis, but their differences are not strictly Sufiistic; they have arisen on external and unessential ground and are of little interest outside of Sufiism. Sufiism has exerted a powerful influence in Arabia, Persia, and Egypt, and it is flourishing to-day in Turkey. India also has a large number of Sufis. Persian literature, more than any other, bears strong impress of it.

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SUGAR, MANUFACTURE OF. Cane sugar is found in varying quantities in many plants, but sugar cane (*Saccharum officinarum*), the sugar beet (*Beta vulgaris*), the sugar maple (*Acer saccharinum*), and various species of palms are its only commercially important sources. At one time the United States Department of Agriculture and several of the States experimented with sorghum (*Sorghum vulgare*), which seemed a promising source of cane sugar, but though several varieties containing from 10 to 20 per cent of cane sugar were produced by seed selection, sorghum has not been found a favorable plant for sugar manufacture because of the great difficulty in purifying the juice. Several sorghum sugar factories were erected in Kansas and elsewhere about 1890, but development failed to pass the experimental stage. The plants are, however, used quite extensively for making sirup. (See SORGHUM.) Owing to the presence of impurities, including saccharine substances other than cane sugar, raw sugars obtained from various plants differ greatly in flavor, but, contrary to popular belief, the granulated or refined sugar derived from them differs not at all in sweetening power, since it consists of more than 99 per cent of sucrose and less than 1 per cent of impurities including mineral matter, water, etc. The world's sugar supply is about equally divided between cane and beet. Practically all of the European consumption is beet sugar produced chiefly in Germany, Austria, Russia, and France. The chief cane-sugar-producing areas are Cuba, Java, Hawaii, Porto Rico, the Philippines, and India.

Cane Sugar. Sugar cane (q.v.) is the oldest sugar-producing plant. During the middle of the eighteenth century it was introduced from southern Europe into Louisiana, where the successful manufacture of sugar began during the last decade of that century. Until it had to compete with beet sugar manufactured under the most scientific conditions, raw sugar was generally produced from the cane by very crude methods. The proportion of the juice of the cane extracted by pressure was comparatively small, and was subjected to little purification before being evaporated in open pans (kettles), and the molasses allowed to drain off.

The modern sugar factory is a highly efficient plant operated in accordance with the most advanced findings of science. The juice of the cane is extracted in mills consisting mainly of a system of rollers, often nine or twelve in number, arranged in sets of three, through which the cane successively passes. The process is called grinding. The cane delivered by carriers first passes through two huge corrugated rollers, which break and prepare it for the heavier pressures applied by the succeeding sets of three rolls each. The hydraulic pressure upon the rollers is increased at each successive set to remove more and more of the juice. Between the sets of rollers the crushed cane is sprayed with water, or macerated, to facilitate the removal of sugar. This process removes from 90 to 95 per cent of the sugar, according to the efficiency of the apparatus and the care with which it is operated. The crushed cane, called bagasse, is used for fuel to furnish steam for the engines and pumps, and for the evaporation of the juice.

Lime is added to the raw juice drawn from the mill, which is then heated to boiling, and the insoluble compounds of lime formed with the organic and phosphoric acids, the albuminous bodies and other impurities, rise to the surface and are removed by skimming and by allowing the juice to settle. Often the juice is passed through filter presses. In some factories it is treated with gaseous sulphur dioxide to bleach it and to aid in removing the impurities. The next step is evaporation. Under primitive conditions this was done over a fire in open pans or kettles. Caramelization is unavoidable by the open-kettle method, and the sugar is characterized by a dark color and aromatic taste. In some countries, as the Philippines, the juice is evaporated to a thick mass and allowed to solidify, this being known as concrete sugar. In some South American countries the evaporated mass is run into hogsheads having a finely perforated bottom, allowing the molasses to drain off. The residue is sold as muscovado sugar.

In the modern sugar factory evaporation is carried on under vacuum, to avoid loss of sugar.

Vacuum evaporators are arranged usually in series of two, three, four, or even more. In the first vessel of a series a lower vacuum is maintained than in the second, and so on, the temperature of boiling for each succeeding vessel being thus reduced. Steam is applied to the first pan and the vapor from the boiling juice is used to heat the second pan, and so on. The juice passes continuously through the pans, from the last of which it issues as a sirup.

The sirup is then admitted to the strike pan, a cylindrical cast-iron vessel provided with a vacuum pump, condenser, and a set of copper coils, to which steam may be admitted as desired. After further condensation, and when one-fourth to one-third full of thick liquor, the sugar will begin to crystallize in small grains. When enough of these have appeared so that it is known from experience that they will have grown to a desired size by the time the pan is full, more sirup is drawn in, thinning the contents to such an extent that the formation of new crystals will be stopped. In like manner more sirup is gradually added, its contained sugar attaching itself to the crystals already formed. Care is necessary that the mass be at no time thickened to such an extent that new crystals, false grain, are formed, as these will cause great trouble in the after working. The handling of the vacuum pan requires more skill than any other operation in the sugar house. The process is controlled by drawing out samples from time to time, which are tested upon glass to see the consistency and size of the crystals. When the vacuum pan is filled with crystallized sugar the pan is emptied, the dense mass of sugar crystals and sirup, massecuite, being conveyed to cylindrical metal vessels (centrifugal machines) with perforated walls and supported upon vertical shafts making from 1000 to 1500 revolutions per minute, the force throwing the sirup out through the walls. After spraying with water to further remove the molasses, the raw sugar is removed and packed.

This is known as first sugar and the molasses as first molasses. The latter contains a large amount of sucrose, for the recovery of which there are various processes. The first molasses is sometimes boiled down again in the vacuum pan and a second crystallization, called the second sugar, is now obtained. This may be repeated until a third sugar is obtained. The tendency in modern methods, however, is against repeated boiling of the molasses. The aim is to get as much sugar as possible from one operation. One method is to draw the molasses from the first strike of sugar into the pan with the sirup for the succeeding strike and boil the two down together. The massecuite from the mixture is drawn while hot into large tanks, where it is kept in slow motion by revolving arms until all the sugar is crystallized out that can be recovered.

Latterly the manufacture of white sugar directly from the juice without resorting to a refining process has greatly increased. This is accomplished by various modifications in the details of manufacture, especially in the clarification process and the rapid handling of the juice.

Beet Sugar. The manufacture of sugar from beet roots is a comparatively modern industry, having its inception in the investigations of Margraff, who in 1747 announced to the Berlin Academy of Sciences the analysis of several sugar-containing plants, and predicted that the sugar beet (q.v.), being the most saccharine of the plants examined, would become the basis of a great industry. Nearly half a century later the problem was solved by a pupil of Margraff, Achard, who made a considerable quantity of beet sugar and announced his methods to the Berlin Academy of Sciences and to the Institute of France in 1797 and 1799, respectively. In Germany several beet-sugar factories were built within the next decade, and beginning with 1810 the industry, being stimulated by governmental aid in both countries, developed steadily.

In the manufacture of beet sugar the beets, delivered from the storage sheds by water power after being thoroughly washed, are cut into thin slices or chips and conveyed to a diffusion battery, consisting of a series of tall boiler-shaped cylinders called cells. A series of 12 to 14 of these cells constitute a diffusion battery, so called because the sugar is removed from the chips by water at about 85° C. into which the sugar diffuses, and which passes through all the charged cells of the series. Heaters are placed between the cells to maintain the temperature. The exhausted chips are pressed, dried by the heat from the flue gases, and used as stock feed.

The diffusion juice, containing from 12 to 15 per cent of sugar, is treated with a considerable excess of lime to purify it, and the dissolved lime is precipitated by carbon dioxide, together with certain impurities, after the removal of which the operations of liming, carbonization, and filtering are repeated. The juice is then evaporated, crystallized, and centrifuged, as in making sugar from cane juice. The raw beet sugar is not suitable for food until it is refined. Many processes have been devised for recovering the sugar in the low-grade beet molasses, in one of which, the Steffens, it is diluted and treated with very finely powdered lime, the insoluble trisaccharate of lime formed being removed by filter presses. It is then added to the diffusion juice, the carbonation liberating the sucrose. In 1914 there were 60 beet-sugar factories in the United States as compared with 32 in 1900. These 60 factories were located as follows: California 10, Colorado 13, Idaho 4, Michigan 15, Ohio 3, Utah 7, and other States 8. The development of the beet-sugar industry in the United States in recent years indicates that the entire sugar requirements of the country could be thus supplied. The production grew from 5,000,000 pounds in 1890 to 163,000,000 in 1900 and 1,500,000,000 pounds in 1915.

Maple Sugar. The manufacture of maple sugar is carried on more or less wherever sugar-maple trees are abundant, especially in the northern Atlantic and northern Central States, the leading producers, according to census returns, being Vermont and New York. The total production in the United States as given by the thirteenth census was 14,000,000 pounds of maple sugar and 4,106,418 gallons of maple sirup. In some cases the natural groves have been extended by planting. The busy period depends upon the locality and the season, sometimes beginning in February, sometimes lasting until the middle of May, the best flow of sap coming with daily alternation of thawing and slight freezing. See MAPLE.

The most popular modern method of tapping the trees is to bore a half-inch hole not more than 1½ inches into the tree near the ground and to drive in a metal or wooden spile. This conducts the sap and also serves to support the bucket, from which the sap is collected each day and boiled as soon as possible, to avoid deterioration. All sorts of apparatus, including culinary utensils, are used for boiling the sap; the most approved is a steam-heated evaporator, of which there are several makes. In these the sap flows through a winding channel, emerging as the finished product, which, owing to its freedom from molasses, quickly solidifies if evaporated.

The sap contains about 3 per cent of sugar, but occasionally exceeds 6 per cent; and at this average a yield of three pounds a year is considered profitable. Large trees and trees with rich sap often yield more. Impurities rarely exceed 5 per cent. There is, however, a small amount of insoluble material removed by skimming. Reliance is placed on quick boiling and skimming without clarifier to produce a light-colored and otherwise satisfactory sugar. The only impurity that causes trouble is the so-called sugar sand, composed mainly of acid malate of lime, which collects on the bottom of the pans, interferes with the boiling, and makes the sirup cloudy and the sugar gritty.

Palm-Tree Sugar. The jaggery, made principally in the East Indies from various species of palms (Phœnix, Borassus, Cocos, and other genera), is a dark-colored raw sugar made in a crude way by methods not essentially different from those described, except that a little lime is added as a clarifying agent. It plays a minor part in the world's markets.

Sugar Refining. The process usually consists in dissolving the raw sugar in water, filtering through cloth to remove suspended matter, decolorizing by filtration through bone black (bone charcoal), and granulating in a vacuum pan as above described. By modern methods the raw sugar is liquefied with sirup, which is then removed with centrifugal machines, taking a large part of the liquor originally adhering to the sugar crystals with it, and forming a sirup which can be used for further liquefaction. The sirup not required for this follows the dissolved sugar through the various processes, and is boiled in on top of the white strikes. The centrifugal sirups, when too poor to be returned to the white pans, are boiled alone, the product being sold as soft sugar or remelted. Boiling to grain before placing in crystallizers or tanks is generally practiced. If such additions are not made, and the entire strike is boiled from washed and thoroughly cured raw sugar, bluing is rarely required.

Statistics. The total production of cane sugar in 1914–15 was 9,956,523 long tons, of which the United States and its dependencies produced 1,343,196 (exclusive of that produced and consumed in the Philippine Islands). The production of beet sugar amounted to 8,288,499 long tons, divided as follows: Europe, 7,629,740; United States, 646,257; Canada 12,502. The per capita consumption (1910) ranged from 86.3 pounds for England (United States 81.6) to 14.2 for Spain.

Molasses. Molasses is an uncrystallizable liquid which seeps from the massecuite or is thrown out by the centrifugal machine. These seepings may be reboiled if they contain considerable sugar, but are quite valuable as molasses owing to their flavor and sweetness. Since the introduction of the vacuum pan and centrifugal machine molasses has become less plentiful, the small quantities made being used where cane sugar is manufactured. No table molasses is made from the sugar beet, because the impurities cannot be removed by any known process. Normally, cane molasses made by the open-kettle process contains about 30 per cent cane sugar, 23 per cent reducing sugar, and 47 per cent water, ash, and impurities; that made in a large modern factory, 20 per cent cane sugar, 25 per cent reducing sugar, and 51 per cent water, etc. Beet molasses contains 47 per cent cane sugar, 5 per cent reducing sugar, 20 per cent water, 22 per cent organic matter other than sugars, and 6 per cent ash, etc. In sugar-manufacturing regions molasses is mixed with such bulky materials as cottonseed meal, dried beet pulp, etc., to be easily handled and fed to stock as a cheap source of carbohydrate food.

Milk Sugar or Lactose. Sugar of milk, occurring only in the milk of mammals, is found to the extent of 4 or 5 per cent in the milk of herbivorous animals. It is obtained by first curdling the milk with rennet or other agent to remove the casein and the fat, and then drawing off and evaporating the clear whey to a sirup in which, when cold and still, the milk sugar crystallizes and sinks. The deposit is recrystallized after being dissolved in hot water, sometimes as hard cylindrical masses on strings. See MILK; FOOD.

Food Value of Sugar. Since milk sugar and dextrose are used for human food to a far less extent than cane sugar, which they resemble somewhat closely in action, the statements in the following paragraphs are confined to cane sugar. In its food value sugar resembles starch, being considered a fat former and a source of energy with a fuel value of 1860 calories a pound. Thus it is ranked as a more readily available heat producer and force conserver than starch (q.v.). The wholesomeness and utilization of sweetened foods is largely a matter of quantity or concentration, a simple dish flavored with sugar being considered easy to digest, but a heavily sweetened one eaten singly, more or less difficult because of its concentration.

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SUGAR BEET (*Beta vulgaris*). A field crop of the natural order Chenopodiaceæ, botanically the same species as the garden beet, important commercially as the source of about one-half of the world's supply of sugar. (See SUGAR, *Beet Sugar.*) The sugar beet flourishes upon a rich, deep, loamy soil in a climate having a mean temperature of about 70° during the growing season. The seed is planted and the crop cultivated and harvested generally by means of implements and machinery. The rotation of the crop with others is carefully planned and the proper fertilization of the fields has been a subject of much study. In commercial beet-seed production beets with about 15 per cent of sugar are selected, placed in pits during the winter and set out again in the spring to produce the seed crop. This is necessary as the plant is a biennial, and in the regions where most of the seed is produced in France, Germany, and Austria-Hungary, the winters are sufficiently severe to injure the beet if simply left in the ground. Some beet seed is produced in the United States, but the practice is hardly beyond the experimental stage. (See SUGAR.) The average cost of growing an acre of sugar beets in the United States is estimated at about $30. The average yield in the best districts is about 12 tons, with an average sugar content of 14.5 per cent. This represents a yield of about 3900 pounds of sugar per acre, though yields up to 4800 pounds have been reported. In some cases the percentage of sugar in the beet runs up to 18 or even 20 per cent. Consult: Department of Agriculture, Bureau of Chemistry, *Bulletin No. 27* (Washington, 1890); H. Briem, *Der praktische Rübenbau* (Vienna, 1895); Barnett, *References to Literature of Sugar Beet* (Washington, 1897); also bibliography under SUGAR.

SUGAR-BEET DISEASES. The sugar beet is subject to the same diseases as the common beet (q.v.), but a few diseases are especially troublesome on account of the reduction in stand and the lowering of the sugar content due to their attack. The seedlings may be destroyed by a number of damping off fungi. In Europe the crown rot (*Phoma betæ*) is probably the most destructive disease of the sugar beet, while in the United States crown gall and curly leaf cause most injury to the growing crop. Two forms of crown gall are recognized, both of them due to bacteria (*Bacterium tumefaciens* and *Bacterium beticolum*). Both reduce the sugar content of the beets and may be followed by various rots, otherwise they do not reduce the tonnage of the crop. The curly top, which is characterized by dwarfed and curled foliage, reduces both the yield and sugar content. This disease is especially severe in the western beet fields. There seems to be some relation between the presence of leaf hoppers as carriers and the occurrence of curly top but the connection has not yet been fully worked out.

SUGAR-BEET GUM. See GUMS.

SUGAR-BEET INSECTS. The recent introduction and rapid spread of the sugar beet have resulted in the attacks of several insects not before known as injurious and have given a new food to others. A leaf miner (*Pegomyia vicina*), 30 or 40 larvæ of which may be found in a single leaf, has produced serious damage in California. Many leaf hoppers (q.v.) feed upon the leaves; also several plant and leaf bugs, and plant lice, notably the common melon aphis (*Aphis gossipii*). Various cutworms (q.v.) are troublesome while the beets are young. Considerable damage has been done by the greenhouse leaf roller (*Phlyctænia ferrugalis*). The so-called garden webworms, however, especially in the West, have done the greatest damage of all. Certain leaf beetles injure the leaves, and the larvæ of some of them feed upon the roots. Much damage has been done by grasshoppers, nonmigratory locusts, and blister beetles (q.v.), the imbricated snout beetle, and the army worm (q.v.). Towards the close of the last century the so-called beet army worm (*Laphygma flavimaculata*) defoliated thousands of acres of sugar beets in Colorado. The purslane caterpillar (*Copidryas gloveri*), the purslane sphinx (*Deilephila lineata*), and several of the wooly-bear caterpillars also feed upon the leaves. Great damage has been done in the State of Washington by a root louse known as the beet aphis (*Phemphigus betæ*), and a root mealy bug has been found on the crown of the plant in Colorado. Several of the wireworms (q.v.) and white grubs (q.v.) also damage the roots.

Consult Forbes, in *Twenty-first Annual Report of the State Entomologist of Illinois* (Chicago, 1900), and Forbes and Hart, *Illinois Agricultural Experiment Station, Bulletin No. 60* (Urbana, 1900).

SUGAR BERRY. See HACKBERRY.

SUGAR CANE (*Saccharum officinarum*). A tropical and subtropical grass, originally a native of the East Indies. It was brought to Europe by the Crusaders, and in the fifteenth and sixteenth centuries found its way into all the European colonies in the tropics. In Europe the cultivation of the sugar cane has always been limited almost wholly to Sicily and Andalusia. In China it extends to latitude 30° N., and in North America to 32°; in the Southern Hemisphere only to latitude 22° S.

The plant is a perennial with creeping roots, sending up a number of many-jointed diversely colored stems, generally 8 to 12 feet high, 1 to 2 inches thick, and filled for about two-thirds of their length with a loose, sweet, juicy pith. The leaves are ribbon shaped, 4 to 5 feet long, with a strong midrib. The flowers are in long and diffuse pyramidal panicles. Until quite recently the flowers were considered infertile and were regarded as unimportant. Use of the flowers and the seeds is now made in the development of new varieties and strains according to modern plant-breeding methods. In subtropical regions as the southern United States the plant rarely produces seed. Even under the most favorable conditions the plant yields a relatively small number of fertile seeds and these retain their germinative power for only a comparatively short time.

SUGAR CANE.

Sugar cane requires a deep rich soil and abundant moisture during the growing season. Low alluvial soils near the sea are preferable. The land is prepared with large deep-going plows. The plants are propagated by cuttings. For this purpose the top joints are planted in rows 5 to 7 feet apart. Usually two continuous lines of cane cuttings are planted in the row. The largest varieties, in rich, moist soils, attain a height of 20 feet; but in dry, poor soils the height is sometimes scarcely more than 6 feet. The cane ground is kept clean by shallow cultivation. The best varieties are ready for cutting in about eight or ten months from the time of planting, but other varieties require from 12 to 20 months. When the canes are fully ripe they are cut a little above the ground, stripped of their leaves, and tied in bundles. Fresh canes, called ratoons, spring from the root, so that the plantation does not require to be renewed for several years; but the canes of the first crop are the largest, and a gradual decrease of size takes place. The ordinary practice on sugar estates is to renew a part of the plantation every year. The sugar content of the cane ordinarily grown averages from 10 to 12 per cent. Sugar-cane production is usually carried on by large plantations. It is a business of great risks, but large profits. It requires a large and sure source of labor, especially at harvest. The yield of sugar varies greatly. In regions with a fertile soil, irrigation, and improved methods of culture about five tons of sugar per acre is produced. Yields of over ten tons per acre are authenticated. In Hawaii, where sugar-cane production has reached a high degree of perfection, yields of even 14 tons of sugar per acre are known. This is obtained only by frequent plantings and scientific fertilization and irrigation of the crop. The leaves are sometimes used for feeding cattle. Efforts made by the Louisiana Experiment Station to make silage from sugar-cane refuse were unsuccessful, owing to the alcoholic and acetic fermentation induced by the residual sugar. The pressed residue from the mill, known as *bagasse*, is used for fuel. It is also employed as a fertilizer. Consult: W. C. Stubbs, *Sugar Cane* (Baton Rouge, 1897); Noel Deerr, *Sugar and Sugar Cane* (Manchester, 1905); Léon Colson, *Culture et industrie de la canne à sucre* (Paris, 1905); Jones and Scard, *Manufacture of Cane Sugar* (New York, 1911); and bibliography of SUGAR. See SUGAR, MANUFACTURE OF and Plate of MONOCOTYLEDONS.

SUGAR-CANE DISEASES. No part of the sugar-cane plant is free from some kind of parasitic attack. Some diseases occur in practically every cane-growing region, while others are less widely distributed. The sugar content of the cane is lowered by some diseases but by others the chief injury is shown in the imperfect stand and dwarfed character of the growth. Leaf spot (*Cercospora longipes*), ring spot (*Leptosphæria sacchari*), and a leaf-splitting disease caused by *Mycosphærella* (sp.) are the principal parasitic diseases of the foliage. The more important stem diseases and their causes are: red rot (*Colletotrichum falcatum*), gummosis (*Bacillus vascularum*), smut (*Ustilago sacchari*), sereh, a very serious disease in Java, the cause of which is unknown, rind disease (*Trichosphæria sacchari*), pineapple disease (*Thielaviopsis etthaceticus*), black rot (*Sphæronema adiposum*), and a disease known in Hawaii as iliau (*Gnomonia iliau*). Among the root diseases, that caused by *Marasmius sacchari* and related fungi is perhaps the most widely spread and serious in its effects. Selection of seed cane, treating it with fungicides, and rotation of crops give some degree of relief from these diseases. On account of the possibility of the introduction of some of these parasites the importation of sugar cane into the United States is prohibited.

SUGAR-CANE INSECTS. The principal enemies of the sugar cane in the United States are the sugar-cane beetle (*Ligyrus rugiceps*) and the sugar-cane borer (*Diatræa saccharalis*). The former belongs to the family Scarabæidæ, and breeds in the ground. The adult beetles make their appearance in early spring, bore into the stubble or into the young cane, and also work into the seed cane; the top leaves wither and the stalk is finally destroyed. The borer is the larva of a crambid moth which lays its eggs upon the leaves of the young cane near the axils, and the young borer, hatching in the course of a few days, penetrates the stalk at or near the joint and tunnels, usually upward, through the soft pith. It matures in 30 days or less, and there are several generations each year. It hibernates in the larval state in the lower part of the stalk or in the tap root. Burning the tops and volunteer cane, and laying down the seed cane in trenches beneath the surface of the ground, keep this insect in check.

In Hawaii there is a weevil borer (*Sphenophorus obscurus*) which does considerable damage. Stalks of the cane are frequently riddled with the galleries of the larvæ, and the galleries are filled with macerated fibre, which the larva apparently pushes behind itself. When ready to pupate the tunnel is somewhat enlarged and a cocoon is formed of coarse fibre in which transformation takes place. In Australia there is a noctuid larva which bores downward from the tips of the plants. Certain scarabæid larvæ feed upon the roots, and the young plants are destroyed by wireworms. In the West Indies a bark-boring beetle (*Xyleborus piceus*) sometimes riddles the canes by its minute burrows, the larva working into the young sprouts from the stumps of previously cut canes. In Java there are three lepidopterous borers and a mealy bug which do some damage, and in Mauritius a somewhat troublesome scale insect known as *Icerya sacchari*. Consult: *Insect Life* (Washington, 1888 to 1895), passim; Comstock, *Report on Insects Injurious to Sugar-Cane* (ib., 1881); Morgan, "Sugar-Cane Borer," in *Bulletin 9, Louisiana Agricultural Experiment Station* (Baton Rouge, 1891).

SUGAR CORN. See Maize.

SUGAR GUM. See Eucalyptus.

SUGAR HOUSE, The. A brick building on Liberty Street, New York, used by the British as a military prison during the Revolution. When it was demolished, one of its barred windows was erected in Van Cortlandt Park.

SUGAR OF GELATINE. See Glycine.

SUGAR OF LEAD. The common name for acetate of lead. See Lead.

SUGARS (OF., Fr. *sucre*, from ML. *succarum*, *saccharum*, from Gk. σάκχαρ, *sakchar*, σάκχαρον, *sakcharon*, sugar). A term applied to various substances composed of carbon, hydrogen, and oxygen (see Carbohydrates), which are more or less sweet, readily soluble in water, colorless and odorless, and usually crystallizable. They are widely distributed in nature as original products of vital processes in plants, and are important in the organic world. In green plants they are formed from carbon dioxide and water by the chloroplasts (see Photosynthesis), and are transferred by diffusion to all parts of the plant body to be used directly in the metabolism of the plant for the manufacture of proteid substances, or to be stored for future use, sometimes as glucose (in the onion bulb), sometimes as sucrose (in the beet), and sometimes as other widely different substances into which they have been converted. (See Storage.) If formed more rapidly than they can diffuse away, sugars may be condensed into starch in the chloroplasts themselves. At times of renewed growth, as in the germination of seeds and the sprouting of tubers and bulbs, the plant draws upon these stores of carbohydrate. If the storage has been in the form of cellulose, starch, inulin, or cane sugar, the stored food must be converted by means of enzymes into a hexose sugar before it can be utilized. The stored sugars of plant tissues form one of the most valuable sources of animal food. Sugars found in the bodies of animals or in the excreta therefrom are believed to be derived from substances of vegetable origin.

All the monosaccharides (see below) and certain of the disaccharides possess the property of reducing compounds of copper, silver, and other easily reducible metals in alkaline solution, the reduction being generally more rapid at the boiling point of the liquid. In some cases the compounds are reduced to lower oxides, which are precipitated; in other cases the reduction is complete, the free metal being precipitated. An alkaline solution of copper (see Fehling's Solution) is the one usually employed for testing the reducing power of sugars. Reduction of Fehling's solution is further used for the quantitative determination of reducing sugars. Among the important nonreducing sugars may be mentioned: sucrose (cane sugar), raffinose, melicitose, and stachyose.

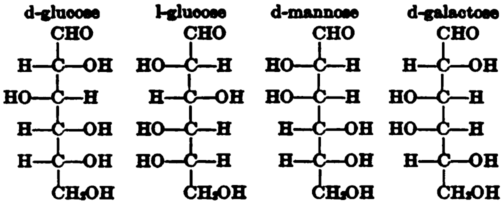
All the sugars possess the property of rotating the plane of polarized light. Those that turn the plane of polarization to the right are called dextrorotatory; those to the left, lævorotatory. In some cases, notably that of ordinary cane sugar, the amount of rotation is proportional to the amount of the sugar in a given volume of the solution, and this is taken advantage of for the quantitative determination of sugars. A special form of the polariscope (q.v.), called a saccharimeter, is in common use for this purpose. For the polarimetric determination of sucrose (cane sugar), a weighed quantity of the sugar, syrup, or other material is dissolved in water; the solution is treated with lead acetate or other clarifying agent, diluted to 100 cubic centimeters, filtered, and placed in the observation tube of the polariscope. The observer then ascertains the percentage of sugar contained in the material under investigation by simply looking into the instrument, and adjusting it to compensate for the change in the field of vision caused by the presence of the sugar solution. This simple method is applicable even in those cases in which the observed rotation is not proportional to the concentration of the sugar solution. Thus, the percentage of glucose in a given solution is often determined polarimetrically.

Since 1880 the sugars have formed the subject of numerous brilliant researches, notably those of H. Kiliani and Emil Fischer. In the early eighties Kiliani demonstrated conclusively the constitution of the simple sugars; he showed that d-glucose (dextrose or grape sugar) and d-frutose (lævulose or fruit sugar) are aldehyde and ketone derivatives, respectively, of hexahydric alcohols, the former containing one aldehyde group and the latter one ketone group. (See Alcohols; Aldehydes; Ketones.) He also showed that arabinose is an aldehyde of the pentahydric alcohol, arabite, and has the formula $C_5H_{10}O_5$. The molecules of all carbohydrates had been believed to contain six carbon atoms or some multiple thereof. But sugars containing three, four, five, six, seven, eight, and nine atoms of carbon in their molecules are now known; these are designated respectively by the class names trioses, tetroses, pentoses, hexoses, heptoses, octoses, and nonoses. According as the individual members of each of these classes contain aldehyde or ketone groups (see Aldehydes; Ketones), they are designated as aldoses or ketoses; e.g., aldohexoses and ketohexoses. These classes together constitute the group of carbohydrates known as *monosaccharides*. Their molecules contain as many atoms of oxygen as atoms of carbon, except in the case of certain of their synthetic derivatives.

There are other groups of sugars, in the molecules of which there are fewer atoms of oxygen than of carbon. When the latter are treated with acids or enzymes they are hydrolyzed, i.e., each one of their molecules combines with one or more molecules of water and simultaneously splits up into two or more monosaccharide molecules. These more complex sugars are called disaccharides when each of their molecules yields two monosaccharide molecules; trisaccharides when one molecule yields three monosaccharide molecules; or, in general, polysaccharides (see CARBOHYDRATES). For example see descriptions of individual sugars below.

Emil Fischer prepared a number of hitherto unknown sugars by purely synthetic processes. He showed that the monosaccharides furnish excellent examples of the necessity for the chemist to consider the space relations of the atoms in the molecule. (See STEREOCHEMISTRY.) According to stereochemical theory sixteen isomeric aldohexoses are possible, since their molecules contain each four asymmetric carbon atoms. Three of these occur in nature or are obtainable from natural carbohydrates by hydrolysis. Practically all the other aldohexoses foreseen by the theory have now been produced in the laboratory—mostly by Fischer, partly by Levene at the Rockefeller Institute for Medical Research.

The character of the differences between the aldohexoses is illustrated by the following stereochemical formulæ:



Formic aldehyde and glycerin, both of which have been produced synthetically, are substances from which certain sugars have been synthesized by Fischer and others. Formic aldehyde, CH_2O or H.CHO, may be regarded as the simplest of the monosaccharides and be designated as monose. Baeyer (1870) suggested that this substance is the first product of the reduction of carbon dioxide in the green parts of plants, and that starch and other carbohydrates are formed by its polymerization. It is known readily to undergo polymerization or condensation to form paraformaldehyde $(CH_2O)_2$, and trioxymethylene $(CH_2O)_3$. In 1861 Butleroff obtained by condensation of trioxymethylene a sweet, sugar-like body which he called "methylenitan." Loew (1885) obtained in a similar manner "formose" from oxymethylene, and later "methose." The last named is more sugar-like than "formose" in that it is fermented with yeast. Fischer regards these substances as mixtures of different hexoses, including among others α-acrose, which he also obtained from glycerose, a mixture of glyceraldehyde and dioxyacetone, obtained by the careful oxidation of glycerol (glycerin). From α-acrose [(d + 1) fructose] Fischer prepared d-fructose, d-glucose, d-mannose, and the l-modifications, or optical antipodes of each of these bodies. The synthesis of each of these bodies was accomplished by a series of complicated reactions. Fischer's work was greatly facilitated by the use of phenylhydrazine, which, in the presence of acetic acid, forms readily crystallizable compounds with the hexoses, called osazones. These compounds are insoluble in water and eminently suited for the separation and identification of the different sugars. By means of Kiliani's method known as the cyanhydrine reaction, he changed hexose sugars into heptoses, and these in turn into octoses and nonoses.

The combination of monosaccharides to form a naturally occurring disaccharide has probably been accomplished by Fischer in at least one case. Fischer calls his synthetic disaccharide *galactosidoglucose* (because it is made by the union of one molecule of d-galactose with one molecule of d-glucose). The substance closely resembles the natural sugar melibiose, and Fischer announced that if further investigations confirm his conclusion that the two sugars are identical, "melibiose is the first natural disaccharide to be produced synthetically."

The more important sugars are mentioned in the following table with brief descriptions of those of commercial importance:

I. MONOSACCHARIDES

1. Monose, CH_2O.	Formic aldehyde.
2. Biose, $C_2H_4O_2$.	Glycollic aldehyde.
3. Triose, $C_3H_6O_3$.	Glycerose, obtained by oxidation of glycerin.
4. Tetrose, $C_4H_8O_4$.	Erythrose, obtained by oxidation of erythrin, a tetrahydric alcohol found in lichens and algæ.
5. Pentoses, $C_5H_{10}O_5$. A. Aldopentoses.	l-arabinose (arabinose, arabose, pectinose, pectin sugar) and xylose (wood sugar), obtained alone or mixed with other sugars by hydrolysis of gums and other vegetable substances. d-arabinose, l-xylose, and ribose, obtained synthetically.
B. Ketopentoses.	None known with certainty.
C. Methyl pentoses, $CH_3C_5H_9O_5$.	Fucose, from seaweed; rhamnose, widely distributed in the vegetable kingdom in the form of glucosides: chinovose, obtained by the decomposition of chinovite, a constituent of cinchona bark.
6. Hexoses, $C_6H_{12}O_6$. A. Aldohexoses.	d-glucose (dextrose, grape sugar or starch sugar); see GLUCOSE; d-mannose (mannose, isomannose or seminose), obtained by the oxidation of mannite and by the hydrolysis of various vegetable materials; d-galactose (see below). l-glucose, l-mannose, l-galactose, d-gulose, l-gulose, d-idose, l-idose, d-talose, and l-talose, obtained synthetically.
B. Ketohexoses.	d-fructose (levulose or fruit sugar; see below); sorbinose, from mountain-ash berries. l-fructose, obtained synthetically.
C. Hexoses of natural origin and of unknown nature.	Chondroglucose, crocose, eucalyn, hederose, indiglucin, locaose, paraglucose, phlorose, scammonose, skimminose, solanose, tewfikose (forms 5 to 6 per cent of the milk of the Egyptian buffalo), and wine sugar.
D. Methyl hexoses, $CH_3C_6H_{11}O_6$.	α-rhamno-hexose and β-rhamno-hexose, obtained synthetically.
7. Heptoses, $C_7H_{14}O_7$.	Six heptoses and a methyl derivative have been prepared synthetically.
8. Octoses, $C_8H_{16}O_8$.	Four octoses and a methyl derivative have been prepared in the laboratory.
9. Nonoses, $C_9H_{18}O_9$.	Two have been produced artificially.

II. DISACCHARIDES

1. Derivatives of pentoses, $C_{10}H_{18}O_9$.	Di-arabinose or arabinon, obtained from arabinic acid (metapectic acid).

2. Derivatives of hexoses, $C_{12}H_{22}O_{11}$.	Sucrose (cane sugar, saccharose, saccharon, or saccharobiose), lactose (milk sugar, lactobiose, or lacton), and maltose (maltobiose, malt sugar, amylon, diglucon, ptyalose, or cerealose; see below). Trehalose (mycose, trehabiose) from ergot and other fungi; isomaltose from malted grain; melibiose, formed together with d-fructose by careful hydrolysis of raffinose; turanose, formed together with d-glucose by hydrolysis of melecitose; cyclamose, from cyclamen tubers; agavose, from the juice of the agava; and several produced synthetically by Fischer.
	III. TRISACCHARIDES
All are derivatives of the hexoses, $C_{18}H_{32}O_{16}$.	Raffinose (melitriose, melitose, and gossypose, or cotton sugar; see below); melecitose (melecitriose), from the manna of *Pinus larix;* stachyose, from the tubers of *Stachys tuberifera;* gentianose, from the roots of *Gentiana lutea;* lactosinose (lactosin), from the roots of certain plants of the order Caryophyllaceæ; and secalose, from unripe rye.

Sucrose, Cane Sugar, or Saccharose. This is commercially the most valuable sugar. It and the products of its hydrolysis, "invert sugar" (d-glucose and d-fructose), are the most important sugars, considered from the point of their wide distribution in fruits and vegetables used for food by man and the lower animals. (For the commercial sources of cane sugar, see SUGAR, MANUFACTURE OF.) White granulated sugar, whether made from sugar cane or beetroots, contains between 99 and 100 per cent of pure sucrose or cane sugar. In many plants it is found associated with "invert sugar," which seems to be changed to cane sugar during the process of ripening. When cane sugar is hydrolyzed by the action of acids or enzymes, each molecule yields one molecule of d-glucose and one molecule of d-fructose, a mixture called "invert sugar."

Cane sugar is readily crystallized in the form of monoclinic hemihedral tables which contain no water of crystallization. These crystals are well exemplified in loaf sugar, rock candy, and granulated sugar, the coarseness of which depends upon the size of the crystals. It dissolves in about one-half of its weight of water and is even more soluble in hot water; it dissolves with difficulty in strong alcohol. Its specific gravity is about 1.6. It melts at 160° C. (320° F.), and with care may be cooled to a colorless glasslike mass; if the temperature is somewhat higher the solidified mass is colored and constitutes the so-called "barley sugar." At 200° C. (392° F.), decomposition and marked discoloration set in, caramel is formed, and as the heat is continued gases are evolved and finally only a black char remains. Sucrose unites with the oxides of calcium and other metals to form saccharates, which are of importance as a means of separating sugar from beetroot molasses. While cane and other sugars in dilute solutions are very prone to undergo fermentation and change, they possess considerable antiseptic power in concentrated solution, which is utilized in keeping dried fruits, preserves, etc.

Levulose, d-Fructose, or Fruit Sugar. This occurs in almost all sweet fruits with d-glucose. It is crystallized with difficulty, and melts at 95° C. (203° F.). It is readily obtained by hydrolysis of inulin, a polysaccharide which occurs in many plants. It is less soluble than d-glucose, and is as sweet as cane sugar. Levulose is used as a substitute for sugar in the food of diabetic patients. Some of the commercial forms of levulose for this purpose are called "diabetine."

Raffinose, Melitriose, Melitose, or Cotton Sugar. This occurs in rather large quantity in Australian manna (from varieties of *Eucalyptus*), in cottonseed meal, and in small quantities in sugar beets, the manufactured sugar from which sometimes contains small amounts, but the molasses much the greater proportion. It forms characteristic crystals and is strongly dextrorotatory. When hydrolyzed by acids each molecule yields one molecule of d-glucose, one of d-fructose, and one of d-galactose.

Maltose, Maltobiose, or Malt Sugar. This is formed, together with dextrin and dextrose, when starch is hydrolyzed with enzymes or acids. It is present in malted grain, in commercial glucose, and in the mash of beer and whisky. It is usually obtained in the form of crystalline crusts. When hydrolyzed it is converted into d-glucose.

Milk Sugar, or Lactose. This occurs in the milk of mammals. It crystallizes in white hard rhombic prisms, with one molecule of water of crystallization, which is dissipated at 140° C. (284° F.); at 205 C. (400° F.), it melts with decomposition. It dissolves in six parts of water at the ordinary temperature and in 2½ parts of hot water, is insoluble in alcohol, and has a faint, sweet taste. When hydrolyzed by the action of acids it is converted into equal parts of d-glucose and d-galactose. See SUGAR, MANUFACTURE OF.

Galactose. This is of interest as one of the inversion or hydrolysis products of raffinose and milk sugar. It is also obtained by the hydrolysis of a number of polysaccharides occurring in vegetable substances and called "galactans."

Consult: B. Tollens, *Kurzes Handbuch der Kohlenhydrate* (Breslau, 1895); E. O. von Lippmann, *Die Chemie der Zuckeraten* (2d ed., Brunswick, 1895); F. W. Pavy, *Physiology of the Carbohydrates* (London, 1895); L. G. M. Maquenne, *Les sucres et leurs principaux dérivés* (Paris, 1900); J. E. Mackenzie, *Sugars and their Simple Derivatives* (Philadelphia, 1914).

SUG′DEN, EDWARD BURTENSHAW. A celebrated English jurist and author. See SAINT LEONARDS, EDWARD BURTENSHAW SUGDEN, BARON.

SUGER, sụ′zhâ′, ABBÉ DE SAINT-DENIS (1081–1151). A French churchman, statesman, and historian. He spent a large part of his youth in the abbey of Saint-Denis and was for a time a student with Prince Louis, afterward Louis the Fat, with whom he always remained on terms of close friendship. In 1122 he became abbé of Saint-Denis, and he carried out many reforms and greatly increased the prosperity of his charge. He was frequently engaged in affairs of state, and when Louis VII went on the Second Crusade, Suger acted as Regent in his absence and administered the affairs of the Kingdom with great ability. Shortly afterward, although he had opposed the previous one, Suger preached another crusade, but died in 1151 before it could be carried out. He wrote in Latin a *Life of Louis VI* (c.1140), which is one of the chief sources upon the history of the period. His complete works were published at Paris in 1867.

SUGGESTION (Lat. *suggestio,* intimation, suggestion, from *suggerere*, to suggest, supply, from *sub*, under + *gerere*, to carry). Any stimulus which sets in function a determining tendency (q.v.). Less technically, a prompting, other than a direct impression, which conditions an organic movement or a change in the content or meaning of consciousness. Thus a yawn may suggest going to bed, a shiver suggest cold, or a sound in a lonely house suggest ghosts.

The arousal of sensation by suggestion is doubtful. In the laboratory an observer whose finger has been introduced into a box in which he has seen a burning candle may report warmth, even when the flame has (without his knowledge) been extinguished. In such cases, however, there are several possibilities. The sensation may be imagined; or attention may be directed by the suggestion to previously unnoticed sensations of the suggested quality; or other sensations may be falsely interpreted as of that quality. Finally, the suggestion may lead directly to report, or to other action indicative of the quality, without the basis either of sensation or of image. Experimental work upon sensory suggestion tends to show that all of these possibilities are at times realized. There is evidence in support of the suggestive arousal of sensations proper; though, in view of the similarity of sensation to image (q.v.), the point is difficult to determine.

The use of the term "suggestion" to indicate the fact of association (see Association of Ideas) is psychologically out of date. It is now seen that in both "free" and "constrained" association the organism is set or instructed, so that the ideas always arise under determination. Attention and action (qq.v.) are also essentially determined consciousnesses. It follows, therefore, that suggestion is natural and necessary throughout the normal mental life, and is not the mysterious and sporadic phenomenon that common usage makes it. In abnormal states, such as hypnosis and hysteria, the nature of suggestion remains precisely the same, only that its effects are enormously magnified by the weakness or absence of contradictory ideas, and by the extreme vividness of the suggestions themselves.

In general, suggestion is to be explained in terms of inhibition and facilitation of certain nervous excitations, with consequent restriction of the scope and definition of the direction of nervous function; but nothing further can be stated with assurance. See Determining Tendency; Hypnotism; and references there given.

SUHL, zōōl. A town of the Prussian Province of Saxony, Germany, on the Lauter, 12½ miles north by east of Meiningen (Map: Germany, D 3). Important for its manufactures of swords and firearms since the fifteenth century, Suhl has been called the "armory of Germany." Pop., 1900, 12,617; 1910, 14,468.

SUICIDE (from Lat. *sui*, of one's self + *-cidium*, a killing, from *cædere*, to kill). The intentional taking of one's own life. Among uncivilized peoples suicide is by no means unknown, though generally regarded as uncommon. It is favored by the teaching of some Oriental religions, but expressly forbidden by the Koran. Aristotle condemned suicide as unmanly, and early Greek custom accorded dishonorable burial to the perpetrator; but later practice, especially under the influence of the Stoics, was much less severe. The Romans, also affected by Stoic doctrine, recognized many legitimate reasons for suicide and punished with confiscation of property only suicides committed to escape punishment for a grave crime. Under Christianity the spirit of law and custom was radically modified. To St. Augustine suicide was essentially a sin, and several Church councils, from the fifth century, deprived the corpse of the ordinary rites of the Church. Mediæval law usually provided confiscation of the suicide's property, while custom decreed indignities to the corpse, such as dragging by the heels face downward, as in France, or burying at the crossroads with a stake through the body, as in England. Later English law compelled forfeiture of lands and goods in all cases of suicide, but the requirement came to be frequently evaded through the granting of a coroner's verdict of insanity, and the law itself was abolished in 1870. A statute of 1823 made it legal to bury suicides in consecrated ground, but it was not till 1882 that religious services were expressly permitted. In France at the present time neither suicide nor attempt at suicide is punishable. In the United States suicide is unlawful, and an unintentional killing of another during an attempt at self-destruction is homicide. An attempt at suicide is a common-law misdemeanor, and in some States a felony by statute. Thus in New York, aiding a suicide is manslaughter in the first degree, aiding an attempt at suicide is felony, and the attempt itself by a sane person is felony, punishable by not over two years in State prison, or a fine of not over $1000, or by both.

The statistics of suicide are by no means satisfactory, as motives always exist for concealment of causes, and published figures are usually too low. This trouble is partly overcome with comparative figures, as below, showing the average annual number of suicides per million of population in various countries during the nineteenth century:

COUNTRY	1851–55	1861–65	1871–75	1887–91	1901–10
England and Wales	64	66	66	81	†90
Prussia	130	122	134	197	202
Saxony	248	264	299	322	326
France	100	124	150	218	224
Belgium	...	*55	68	120	137
Italy	...	28	35	52	71
Denmark	272	288	258	253	96
Sweden	71	76	81	119	151
Norway	107	85	73	66	51

* 1856–65. † United Kingdom.

The differences which appear between countries are due rather to race and national characteristics than to climate. This is well shown by suicide rates in the United States. In 1900 in the registration area persons with mothers born in France had a suicide rate (per million) of 220; Germany, 193; England and Wales, 104; Ireland, 61; Russia and Poland, 58; Italy, 51. In the registration area as a whole the rate was 103 in 1890 and 118 in 1900, being very much higher for white persons than for colored. In 1913 it was 158 for the registration area, 162 for whites, and 86 for colored. The most notable difference of rate is that occasioned by sex, males usually constituting from three-quarters to four-fifths of the total suicides. In 1913 male suicides in the registration area of the United States numbered 7709; female, 2279. Statistics indicate that the preponderance of males has been increasing. When age is considered together with sex, it appears that, while suicide in general increases with age, the ages at which women most tend to self-destruction are much under the corresponding ones for men. Thus in the United States (1913) female suicides exceed male up to age 19. Up to age 39 the female suicide rate diminishes from half to one-third of the male rate, and beyond age 40 declines to one-sixth, at ages 80–84. Married people show a lower suicide rate than single, and single than widowed or divorced persons. Large cities have an unfavorable influence. The rate in Dresden is more than 500 per 1,000,000; in Paris, more than 400; in London, about 230; in Berlin, 260; in St. Petersburg and Rome, less than 100. In New York City the rate for 1914 was 176; in Chicago, 242; in Philadelphia, 165; in St. Louis, 366; in Boston, 181.

Suicides among the young are prevalent in the great centres. Professional and commercial classes are more prone to suicide than others; artisans evince higher rates than laborers; among soldiers and criminals the rates are extremely high. The rates for summer or late spring are much above those for the other seasons, the maximum usually between April and July, the minimum in January or December. The early part of each month and the early days of the week show a relative preponderance. Other interesting correlations appear in the methods by which suicide is accomplished. In the aggregate the order of preference in method is: hanging, drowning, shooting, cutting or stabbing, falling from a height, and asphyxiation or poison. In cold countries drowning is naturally less favored than in the south; the use of firearms is specially prominent in Italy; of cutting or stabbing in Prussia; of poison in England. As would be expected, female suicides employ firearms less than male. In England drowning is the recorded means for more than a quarter of the women committing suicide, and poison for about a seventh; but only 15 per cent of male suicides drown themselves, and only a twelfth use poison.

Definite mental disorders usually appear as the direct cause of a third of all suicides, but a much larger proportion of cases show evidence of mental or physical abnormality. Suicidal tendency, like insanity, has been observed to be inherited. Alcoholism is a frequent cause. Emphasis upon biological influences has led some writers to regard suicide as always being, like certain diseases, a specific tendency of the individual. But the social causes of suicide are not to be underestimated. Imitation and the desire for notoriety undoubtedly affect suicides, and the stress and strain of modern business.

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SU'IDÆ. The swine family. See SWINE.

SU'IDAS (Lat., from Gk. Σουίδας, *Souidas*). The author of a great Greek lexicon, compiled probably in the middle of the tenth century. The work current under his name is a compilation giving the result of grammatical, lexicographical, historical, and literary studies. It is valuable for articles touching the latter field, and the information they contain is indispensable for knowledge of the writers of antiquity. It is clear that the lexicographical portions were drawn from the lexica of Harpocration and Helladius, and from certain other lexica and grammatical works which cannot be absolutely determined. He further employed excellent scholia to Aristophanes, scholia to Sophocles similar to those now found in the *Codex Laurentianus*, Homeric scholia similar to those found in the *Codex Venetus B*, and the older scholia to Thucydides. In his historical and theological articles it is more difficult to determine his sources, but his chief authority seems to have been the work of Constantinus Porphyrogenitus and the chronicle of Georgius Monachos. His literary articles were probably drawn in large measure from the Onomatologos of Hesychius Milesius, which he possessed in an abridged form. He employed also the notices of the comic poets preserved in Athenæus; but he added much from his independent reading. The work is best edited by Bernhardy (1834–53). The edition by Bekker (1854) is far inferior. Consult Adam Daub, *De Suidæ Biographicorum Origine et Fide* (Heidelberg, 1880); id., *Studien zu den Biographika des Suidas* (Freiburg, 1882); J. E. Sandys, *A History of Classical Scholarship*, vol. i (2d ed., Cambridge, 1906).

SUI JURIS, sōō'ī jōō'rĭs (Lat., of his own right). A Latin phrase employed to describe a person competent to perform legal acts. (See CIVIL LAW; PATRIA POTESTAS.) The meaning of the phrase has been extended in modern times to denote a person who is capable of taking care of himself. Thus a minor or an insane person is designated in law as a person non sui juris.

SUIR, shōōr. A river of Ireland. Rising in County Tipperary, it forms, in part, the boundary between that county and County Waterford and then the boundary between Waterford and County Kilkenny (Map: Ireland, D 7). It unites with the Barrow to form Waterford Harbor, after a course of about 100 miles.

SUISSE, swēs, JULES FRANÇOIS SIMON. See SIMON, JULES.

SUIT. In law, any proceeding in a court of justice brought for the purpose of obtaining a specific remedy by way of damages or other relief. All such proceedings are now generally designated as civil actions rather than as actions at law and suits in equity. Thus it has been held that the words "action" and "suit" in statutes of limitation are synonymous. See ACTION; EQUITY.

SUITE, swēt (Fr., succession, following), or PARTITA. In music one of the oldest of cyclical forms. It had its origin in the sixteenth century, when the Stadtpfeifer began to perform several national dances in succession, which were of contrasting tempi, but all in the same key. During the seventeenth century German composers for the pianoforte applied the name partita to their doubles (a series of variations). (See VARIATION.) The form reached its culmination in the suites of J. S. Bach. The style of the suite is not so much contrapuntal as elegant. The four obligatory movements are: (1) allemande, (2) courante, (3) sarabande, (4) gigue. As a rule, however, there were more movements, which were inserted after the sarabande. Such additional movements were known as intermezzo (q.v.). In modern times composers have also written suites for orchestra, which, however, but slightly resemble their prototypes. Some of the movements are not dance forms, and the principle of contrasting keys is also introduced. See DANCING, *Modern Dances;* SONATA.

SUK, zụk, JOSEF (1874–   ). A Bohemian violinist and composer, born at Křečovic. He began his musical studies with his father and later entered the Prague Conservatory, where he studied violin with Bennewitz and composition with Knittl, Strecker, and Dvořák, whose daughter he subsequently married. In 1892 he became a member (second violin) of the famous Bohemian Quartet. Later he also appeared frequently as a concert conductor. His works include two symphonies (E flat and E minor); *Serenade* for strings; *Scherzo Phantastique;* a symphonic poem, *Praga;* incidental music to Zapor's *Ráduz und Mahulena* and Zeyer's *Pod jabloni* (Under the Apple Tree); some noteworthy chamber music; and the opera *Lesur pán* (The Master of the Forests), produced at Prague in 1903.

ŚUKASAPTATI, shōō′kȧ-săp′tȧ-tē̇ (Skt., 70 [stories] of a parrot). A collection of Sanskrit prose stories, 70 in number, told by a parrot to the wife of a merchant who is away on his travels. She is inclined to be adulterous, and consults the parrot regarding her plans. The bird pretends to approve of her intentions, but points out to her the dangers of detection, and induces her to promise not to meet any lover unless she can extricate herself as so-and-so did. This rouses her curiosity, and the parrot tells the story as far as the dilemma, when he asks her what, in her opinion, the person involved ought to do. Unable to make a suitable guess, she promises to remain at home that night on condition that the parrot will tell her the answer the following evening. In this way 70 days pass until her husband returns. The story is very popular in India and has been translated into Persian as the *Tūṭīnāmah*. The Sukasaptati exists in two recensions. The shorter one was edited (Leipzig, 1893) and translated (Kiel, 1894) by R. Schmidt, who also edited (Munich, 1896) and translated (Stuttgart, 1899) the longer version. Consult: Schmidt, *Ueber die Śukasaptati* (Halle, 1898); Victor Henry, *Les littératures de l'Inde: sanscrit-pâli-prâcrit* (Paris, 1904); A. A. Macdonell, *History of Sanskrit Literature* (London, 1913). A selection from this collection of stories has also been published under the title *The Enchanted Parrot* by Wortham (London, 1911).

SUKHĀVATĪ, sōōk-hä′vȧ-tē̆′ (Skt., blissful). The Land of Bliss into which those Buddhists are reborn who believe in Amitabha Buddha, the Buddha of boundless light, life, and mercy, invented by the founders of the Northern or Mahayana (q.v.) School. It is situated in some far distant world separated from this world by tens of millions of Buddha worlds, and is presided over by Amitabha. Here there is no difference between gods and men. There is no sin, no hunger, nor pain of any kind, and neither summer nor winter, no day, no night. To attain to this paradise good deeds in this life are not necessary. Simple trust in the mercy of Amitabha is sufficient. Among the common people this doctrine has superseded the doctrine of Nirvana (q.v.). Consult D. T. Suzuki, *Outlines of Mahâyâna Buddhism* (London, 1907).

SUKHOMLINOV, sōō′kôm′lyė̂-nôf, VLADIMIR ALEXANDROVITCH (1852–   ). A Russian general. During the Russo-Japanese War he commanded the forces guarding Russia's western frontier, and afterward held various military positions in Russian Poland and on the Prussian frontier. As Governor of Kiev, he became notorious for his inflictions of the death penalty. He succeeded General Rudiger as Minister of War in 1909, resigning this post in 1915, during the European War. As head of the Officers' Cavalry School Sukhomlinov provided thoroughly practical training and by throwing open the Academy of the General Staff to a larger body of military students, he promoted efficient military training. During his ministry he was permitted to expend about $300,000,000 annually on the service, which he raised to extraordinary efficiency. Among the specific achievements to his credit were the organization of a first-class school of military aviation, the opening of a school for railroad engineers, and the development of an effective corps of army automobilists. Sukhomlinov became known as "the Russian Kitchener." Consult V. D. Doumbadze, *Russia's War Minister* (Eng. trans., London, 1915).

SULEIMAN, sōō′lȧ̂-män′. A Turkish sultan. See SOLYMAN II.

SULEIMANIEH, sụ-lā′mȧ-nē̆′ye. A town of the Vilayet of Mosul, Turkey in Asia, 130 miles southeast of Mosul. It commands several trade routes between Mesopotamia and Persia and is an important military station. Population, about 10,000.

SULEIMAN PASHA, sōō′lȧ̂-män′ pȧ-shä′ (c.1840–92). A Turkish general, born at Constantinople. He was trained at the military school in Constantinople, entered the army, becoming major in 1867, when he served in Crete. In 1873 he was a colonel and instructor in the military school, of which he later became subdirector, with the rank of general of brigade, in 1874. He took part in the deposition of Abdul Aziz, May 30, 1876, and was made general of division by Amurath V. In 1877 he was made marshal. In the early part of the Russo-Turkish War (q.v.) he fought against General Gurko, whom he defeated at Eski-Zaghra (July 31–Aug. 1, 1877) and forced to retreat into the Balkans, failing in his attempts to command the Shipka Pass. From October to December he commanded the Turkish army of the Danube and was then intrusted with the command of the Turkish forces south of the Balkans. At Philippopolis, Jan. 15–17, 1878, he met defeat. This led to a sentence of imprisonment, but he was afterward pardoned.

SUL′FONAL. See SULPHONAL.

SULIMAN (sōō′lė̂-män′) **MOUNTAINS**. A range of mountains in India, separating the provinces of Baluchistan and Punjab (Map: India, A 2). It forms part of the east boundary of the great Iranian Plateau, towards which it sends numerous spurs, while on the east it falls steeply into the Indus valley. Its highest point, the Kaisargarh, has an altitude of 11,300 feet.

SULINA, sōō-lē'nȧ. The central arm of the delta of the Danube (Map: Balkan Peninsula, G 2). Though not the largest in volume, it is the principal channel for navigation and has been made navigable for the largest vessels by means of large jetties and other engineering works. The European Commission of the Danube has deepened and corrected it so that at Sulina the depth has been increased from 9 to 24 feet, and below Braĭla the maximum depth from 8 to 18½ feet, while by canalization the navigation has been shortened from 45½ to 33¾ nautical miles.

SULIOTES, sōō'lē-ōts. A tribe of Turkish subjects of mixed Greek and Albanian blood, who derived their name from the Suli Mountains, near Parga, in Epirus, to which they fled from the Turks in the seventeenth century. Their persistent opposition to Turkish rule brought them into constant trouble and won for them a reputation for bravery and patriotism. Overcome in 1803 by Ali Pasha of Janina, they left their mountains and fled to the islands off their native shore. From here the Suliotes were driven by the Sultan to their old mountain retreats and to the island of Cephalonia. Later they are found warring on the side of Greek independence, their most celebrated leader being Marco Bozzaris (q.v.). Many of them have migrated into Greece. Consult Perrhaebos, *History of Suli and Parga* (London, 1823), and Lüdemann, *Der Suliotenkrieg* (Leipzig, 1825).

SULKY. See CART.

SUL'LA (*Hedysarum coronarium*). A perennial leguminous fodder plant, native of southern Italy and similar Mediterranean regions, where it has been in cultivation since about 1766. It is a leafy plant four to six feet tall, bearing numerous clusters of showy flowers. Because it is susceptible to frost it is adapted to few regions of the United States.

SUL'LA, LUCIUS CORNELIUS (surnamed FELIX) (138–78 B.C.). A Roman general and statesman, born at Rome of a family belonging to the Gens Cornelia. In 107 B.C. he was elected quæstor, and sent to Africa with cavalry that the consul Marius (q.v.) required for prosecuting the war with Jugurtha (q.v.). He induced Bocchus, the Mauretanian King, to surrender Jugurtha (106 B.C.). In the campaigns that followed (104–101 B.C.) against the Cimbri and the Teutones, Sulla's reputation continued to rise. For several years after the destruction of the barbarians Sulla lived quietly, taking no part in public affairs; but in 93 B.C. he won the prætorship by a liberal distribution of money among the people. Next year he was sent to Cilicia as proprætor, to put Ariobarzanes back on the throne of Cappadocia, from which he had been driven by Mithridates. In the Social War (q.v.) the successes of Sulla threw those of Marius into the shade, and the mortification of the latter was bitter. In 88 B.C. Sulla was elected consul with Q. Pompeius Rufus, and the Senate conferred on him the command of the Mithridatic War. Allying himself with the tribune P. Sulpicius Rufus, a political adventurer in difficulties, Marius placed himself at the head of the new Italian party, on whom the rights of Roman citizenship had been conferred, and Sulla was compelled to flee to his camp at Nola in Campania. There, finding the soldiers full of enthusiasm, he resolved to lead them against the pseudo-government at Rome. The Marian party was overthrown and Marius fled to Africa. Sulla was in the East, 87–83 B.C., and finally forced Mithridates to sue for peace, and returned to Italy 83 B.C. Marius was now dead, but his party was strong and again in revolt; yet before the close of 82 B.C. the Marian party in Italy was utterly crushed. In Spain, however, it held out under Sertorius (q.v.). Sulla caused himself to be appointed dictator, an office which he held until 79 B.C. In 81 came the fearful period of the proscriptions, the object of which was to extirpate the Marian party. His dictatorship was signalized by the framing of a series of laws the design of which was to restore the ancient power of the senate and the aristocracy. Consult: Plutarch, *Life of Sulla*, edited by H. A. Holden (New York, 1886); A. H. Beesly, *The Gracchi, Marius, and Sulla* (ib., 1878); C. W. Oman, *Seven Roman Statesmen* (London, 1902); and the article "Cornelius III," in Friedrich Lübker, *Reallexikon des klassischen Altertums*, vol. i (8th ed., Leipzig, 1914).

SUL'LIVAN. A city and the county seat of Moultrie Co., Ill., 25 miles southeast of Decatur, on the Wabash, the Chicago and Eastern Illinois, and the Illinois Central railroads (Map: Illinois, G 6). It contains the Illinois Masonic Home and Hospital, and has grain elevators, a flour mill, machine shops, and a planing mill. Pop., 1900, 2399; 1910, 2621.

SULLIVAN. A city and the county seat of Sullivan Co., Ind., 26 miles south of Terre Haute, on the Chicago and Eastern Illinois, the Illinois Central, and the Chicago, Terre Haute, and Southeastern railroads (Map: Indiana, C 6). It is a shipping point for coal, grain, and live stock; and manufactures woolen goods and brushes. The town has a Carnegie library, an Elks home, and a city hospital. Pop., 1900, 3118; 1910, 4115.

SULLIVAN, SIR ARTHUR SEYMOUR (1842–1900). A distinguished English composer. He was born in London of Irish parents, May 13, 1842. In 1856, at the age of 14, Sullivan won the Mendelssohn scholarship, then recently established. In 1858 he went to Leipzig, where he studied at the conservatory. His incidental music to Shakespeare's *Tempest* was his last work at the conservatory, and was first heard in England in 1862, a few days after his arrival in the country. After holding organ appointments at St. Michael's and St. Peter's he was appointed professor of the pianoforte and ballad singing at the Crystal Palace School of Art. In 1876–81 he was director of the National Training School for Music. Cambridge (1876) and Oxford (1879) honored him with the degree of Mus. Doc., and in 1883 he was knighted. He died in London, Nov. 22, 1900. His first great success in composition was his "Orpheus with His Lute," which was soon followed by "The Lost Chord." He was meanwhile engaged on more serious work, and in 1864 the cantata *Kenilworth* was produced. Then came the *Symphony in E* (1866), the overture *In Memoriam* (1866), *The Prodigal Son* (1869), *Light of the World* (1873), *The Martyr of Antioch* (1880), *The Golden Legend* (1886), and the grand opera *Ivanhoe* (1891). He is held in greatest repute, however, for his light operas, several of which are veritable gems. But it should be said that their perennial success is the tribute paid no less to Sullivan's music than to the inimitable librettos of his collaborator W. S. Gilbert (q.v.). The principal works are: *Trial by Jury* (1875); *The Sorcerer* (1877); *H. M. S. Pinafore* (1878); *Pirates of Penzance* (1880); *Patience* (1881); *Iolanthe* (1882); *The Mikado* (1885); *The Yeomen of the Guard* (1888); *The Gondoliers* (1889); *Utopia* (1893); *The Beauty Stone* (1898); *The Rose of Persia* (1899); and *The Emerald Isle* (posthumous, completed by E. German, 1901). Sullivan's music is essentially lyric in quality, and he was exceptionally fluent in melody as well as a master of dainty orchestration. His early training in the school of English church music left its imprint on all his sacred compositions, and, indeed, on his operettas also. Consult: Arthur Lawrence, *Sir A. Sullivan, Life-story, Letters, and Reminiscences* (London, 1900); B. W. Findon, *Sir A. Sullivan, His Life and Music* (ib., 1903); H. S. Wyndham, *Arthur Sullivan* (ib., 1904); Cellier and Bridgman, *Gilbert and Sullivan and their Operas* (Boston, 1914).

SULLIVAN, Edward (1832–1902). A Canadian Anglican bishop. He was born at Lurgan, Ireland, and graduated at Trinity College, Dublin, in 1857. Going to Canada in 1858, he was ordained a priest of the Church of England in Canada in 1859, and in 1862 became assistant rector of St. George's Church, Montreal. In 1868–78 he was rector of Trinity Church, Chicago, and in 1878–82 rector of St. George's, Montreal. In the latter year he was appointed Bishop of Algoma, but in 1896 resigned the bishopric and became rector of St. James' Cathedral, Toronto. He belonged to the evangelical school, and attained a wide reputation as a pulpit orator.

SULLIVAN, James (1744–1808). An American jurist and politician, born at Berwick, Me. He was admitted to the bar, and in 1770 was appointed king's attorney. In 1775 he was a member of the Massachusetts Provincial Congress, and was one of three commissioners dispatched on a secret mission to Ticonderoga. From 1776 to 1782 he was a judge of the Superior Court, and in 1784–85 a Massachusetts delegate to the Continental Congress. For many terms he was a member of the State Legislature, in 1787 was a member of the executive council and a probate judge, and from 1790 to 1807 was Attorney-General. In 1807 and 1808 he was Democratic-Republican Governor of Massachusetts. He published *Observations on the Government of the United States* (1791); *The Altar of Baal Thrown Down* (1795); *Impartial Review of the Causes of the French Revolution* (1795). Consult T. C. Amory, *Life of James Sullivan* (Boston, 1859).

SULLIVAN, James Edward (1860–1914). An American athletic official and publisher, born in New York City. In 1877–84 he won a long series of victories in walking and running contests. Of the Amateur Athletic Union of the United States, which he organized in 1889, he was president in 1907–09, and for 25 years he officiated at American track meets and field games. He was prominently identified with the Olympic games (See Olympic Games, *Modern Olympic Games*), in the revival of which he had an important part, and with the athletics at all the great American expositions from 1893. He founded the *Athletic News*, one of the first papers of the sort in the United States, and for many years was editor, and later president, of the *New York Sporting Times*. In addition, Sullivan published *Spalding's Athletic Library*, edited *Spalding's Official Athletic Almanac*, and wrote *The Olympic Games, Stockholm, 1912* (1912). He was called the "father" of American amateur athletics.

SULLIVAN, John (1740–95). An American soldier, born at Berwick, Me. In June, 1775, he was appointed brigadier general by Congress. During the siege of Boston, with General Greene, he commanded the left wing under Gen. Charles Lee, and on June 4, 1776, took command of the army in Canada, whence, after being defeated at Three Rivers, he retreated to New York. On August 10 he became a major general, and on the 27th served with distinction at the battle of Long Island (q.v.), but was taken prisoner. He was exchanged and served at Trenton, Princeton, Brandywine, and Germantown. In 1778 he acted with D'Estaing against Newport, and decisively defeated the English at Butt's Hill on August 29. In 1779 he marched into western New York and effectually subdued the Iroquois. Resigning from active duty late in 1779, he served in the Continental Congress in 1780–81, was Attorney-General of New Hampshire from 1782 to 1786, was President of the State from 1786 to 1789, and was United States District Judge from 1789 to 1795. Consult his *Life* by Peabody in Sparks, *American Biography*, vol. iii (new ed., New York, 1902); Amory, *Military Services and Public Life of General John Sullivan* (Boston, 1868); and *Journals of the Military Expedition Against the Six Nations* (Auburn, N. Y., 1887).

SULLIVAN, John L(awrence) (1858–). An American prize fighter, born in Boston, Mass. In 1880 he defeated George Rooke, and two years afterward he beat Ryan in nine rounds. In 1887 he fought a draw with Cardiff; in 1888 fought a draw with Mitchell at Chantilly, near Paris; and in the next year, in Mississippi, in a 75-round fight, defeated Kilrain, winning the American championship and a diamond belt offered by a sporting paper. In 1892 he met Corbett at New Orleans and was defeated in the twenty-first round, thereby losing the championship title. Later he became an advocate of prohibition, asserting that his use of liquor had been responsible for his defeat in the ring. Consult his *Life and Reminiscences of a Nineteenth Century Gladiator* (Boston, 1892).

SULLIVAN, Robert Baldwin (1802–53). A Canadian statesman and jurist. He was born at Bandon, Ireland, went to Canada with his father in 1819, and settled at York (Toronto). He was called to the bar in 1828, practiced law in Vittoria and later in Toronto. Bred a Liberal, Sullivan at his entrance upon public life had been led to modify his political views, and soon came to identify himself with the Conservatives. He was elected Mayor of Toronto in 1835, and in 1836 was appointed a member of the provincial executive council by the Lieutenant Governor, Sir Francis Bond Head, of whom he became a trusted political adviser. He served in the militia during the rebellion of 1837–38, and was appointed a member of the Legislative Council of Upper Canada in 1839. The real test of his ability and character came with the larger issues involved in the Act of Union in 1841 (see CANADA, *History*). Sullivan was a member of the first administration after this; but because he was a Conservative his presence, with that of others, was objected to by Robert Baldwin, the Premier, who resigned. Sullivan remained in office, and in the first Lafontaine-Baldwin administration (1841–43) was president of the council, by accepting which position he apparently repudiated his former political faith. Nevertheless he soon became more in sympathy with Liberal members of the cabinet and resigned with them upon a serious difference of opinion with the Governor-General, Sir Charles Metcalfe. Canada was now virtually without a responsible administration, the country being divided into two parties, those who favored and those who opposed the autocratic Toryism of Sir Charles Metcalfe. Sullivan at this time did the most noteworthy service of his career by a brilliant defense of parliamentary government in a series of letters contributed to the Toronto *Examiner* under the signature "Legion." In the second Lafontaine-Baldwin government (1848–51) he was Provincial Secretary for Upper Canada till 1848 and thereafter was a puisne judge of the Court of Queen's Bench for Upper Canada. He was described by authoritative writers as probably the most brilliant man known to the Canadian history of his time. As an orator he was without a rival, but the effect of his eloquence and debating power was somewhat weakened by a lack of steadfast conviction. Consult J. C. Dent, *The Last Forty Years* (Toronto, 1881).

SULLIVAN, THOMAS BARRY (1824–91). A British tragedian, born in Birmingham. He was brought up in Cork, where he made his appearance on the stage before 1840. He joined the company of the Theatre Royal, Edinburgh, and remained there several seasons, advancing rapidly in his profession. In 1852 he appeared at the Haymarket Theatre, London, in Hamlet, the part in which he was on the whole most successful, though his Beverley in *The Gamester* was very highly praised. Consult Arthur Lawrence, *Barry Sullivan: A Biographical Sketch* (London, 1893).

SULLIVAN, THOMAS RUSSELL (1849–). An American novelist and dramatist, born in Boston. He was educated at the Boston Latin School, passed the years 1870–73 in Europe, was then for 15 years connected with a firm of Boston bankers as clerk and cashier, and after 1888 devoted himself to literature. The National Institute of Arts and Letters elected him to membership. He wrote, notably: *Roses of Shadow* (1885); *Day and Night Stories* (two series, 1890 and 1893); *Tom Sylvester* (1893); *Ars et Vita* (1898); *The Courage of Conviction* (1902); *Boston Old and New* (1912); *The Hand of Petrarch* (1913); and several plays, of which the more noteworthy are *The Catspaw* (1881), a dramatization of *Dr. Jekyll and Mr. Hyde* (1886), and *Merely Players* (1886).

SULLIVAN, TIMOTHY DANIEL (1827–1914). An Irish journalist and legislator. He was born at Bantry, County Cork. He early wrote for the Dublin newspapers, vigorously advocating Irish Home Rule. Later he became identified with the Land League (q.v.). In 1880, with Charles Stewart Parnell (q.v.) and others, he was arrested and tried in Dublin for his League activities, but was freed by the disagreement of the jury in January, 1881. He became prominent in the Home Rule propaganda, delivering many speeches in Ireland and Great Britain. Between 1880 and 1900 he was a Nationalist member of the House of Commons successively for Westmeath, Dublin City, and West Donegal. He was elected Lord Mayor of Dublin in 1886 and 1887. In 1888 he was imprisoned for two months in Tullamore jail for publishing reports of branches of the Land League which had been suppressed under the Coercion Act; and in 1889 he was examined before the Parnell Commission. His publications include: *Songs and Poems* (new ed., 1901); *Recollections of Troubled Times in Irish Politics* (1905); *Bantry, Berehaven and the O'Sullivan Sept* (1908).

SULLIVAN, SIR WILLIAM WILFRID (1843–). A Canadian statesman. He was born at New London, Prince Edward Island, was educated at St. Dunstan's College, and was called to the bar in 1867. He was elected a Conservative member of the Provincial Legislature and sat therein until 1889; was Premier and Attorney-General in 1879–89, and in 1889 became chief justice of the Province and local judge in Admiralty. In 1914 he was knighted.

SULLIVAN'S ISLAND. An island at the entrance to Charleston harbor, the site of Fort Moultrie (q.v.).

SUL'LIVANT, WILLIAM STARLING (1803–73). An American botanist, the founder of American bryology. He was born at Franklinton, Ohio, studied at Ohio University, and in 1823 graduated at Yale. In 1840 he published a *Catalogue of Plants in the Vicinity of Columbus, Ohio*, and thereafter specialized in the cryptogamous plants. *Musci Alleghanienses* (1845) was followed in 1846 and 1849 by contributions to the *Memoirs* of the American Academy of Sciences "On the Bryology and Hepaticology of North America," and by a valuable addition to Gray's *Manual* on the mosses of the northern United States, published separately in 1856 as *The Musci and Hepaticæ of the United States East of the Mississippi River*. In the same year, with the help of Lesquereux, he published *Musci Boreali-Americani Exsiccati*. *Icones Muscorum* (2 vols., 1864–74), containing 129 valuable copper plates, is probably Sullivant's greatest work.

SUL'LY, JAMES (1842–). An English psychologist, born at Bridgwater, Somersetshire. He was educated at the Independent College in Taunton, at Regent's Park College, London, and at Göttingen and Berlin. Until 1892 he served as lecturer in the College of Preceptors, London, and in that year became professor of the philosophy of mind and logic in University College, London. He retired in 1903. Sully published both general treatises and special studies in psychology, the most important being: *Sensation and Intuition* (1874); *Illusions* (1881); *Outlines of Psychology* (1884; 4th ed., under the title *Teachers' Handbook of Psychology*, 1903; 5th ed., 1909); *The Human Mind: A Text-Book of Psychology* (1892); *Studies of Childhood* (1895); *Essay on Laughter: Its Forms, its Causes, its Development, and its Value* (1902). He also wrote *Italian Travel Sketches* (1912). Sully became known as one of the most eminent of modern English psychologists; his work carries on the best traditions of the English school, but is characterized by its breadth and by careful recognition of the development of psychological science on the Continent.

SULLY, Jean Mounet-. See Mounet-Sully, Jean.

SULLY, sụ'lé', Maximilien de Béthune, Baron de Rosny, Duke de (1560–1641). The great Minister of Henry IV of France. He was born at Rosny, near Mantes, the second son of François, Baron de Rosny. He belonged to a Protestant family and was educated with the young Henry at the court of Navarre. This was the beginning of a friendship and a loyal service that continued until Henry's death. He escaped the Massacre of St. Bartholomew, accompanied Henry in his flight from the French court (1576), shared in the campaigns against the Catholic League, distinguishing himself especially at Coutras (1587), and became Henry's best adviser. He urged Henry's acceptance of Catholicism to save the crown. Sully, made Minister of Finance in 1597 and Chief Intendant in 1599, set himself thoroughly to reform the administration. He made a tour through the chief provincial districts, armed with absolute authority, examined the accounts, dealt with delinquents, and replenished the treasury with the wealth he recovered. Sully brought the affairs of the country into order. From 1597 to 1609 he trebled the income of the state. His indefatigable activity was not confined to finance; he practically was in supreme charge of the various other branches of the administration, promoted agriculture, encouraged exports, and constructed roads and bridges. He was made Grand Master of Artillery in 1601, and in 1606 was created Duke de Sully. His service for the King made him disliked by the people for supposed severity. The Catholics hated him for his religion; the Protestants for his refusals to sacrifice the smallest jot of his master's interest for their sake. At Henry's death he was forced to resign his offices and lived in comparative retirement. Sully wrote *Mémoires des sages et royales économies d'état, domestiques, politiques et militaires, de Henri le Grand*, a wearisome work in the form of a narrative addressed to himself by his secretaries. It is through these volumes that we are made acquainted with the great design of Henry for the federation of Europe. The edition in Michaud and Poujoulat, *Nouvelle collection des mémoires pour servir à l'histoire de France*, is from the original. Consult Lavisse, *Sully* (Paris, 1880), and Jean Gauthereau, *Un précurseur financier "Sully"* (Toulouse, 1912), containing a bibliography.

SUL'LY, Thomas (1783–1872). A portrait painter of the early American school. Born at Horncastle, Lincolnshire, England, he was brought by his parents, who were actors, to Charleston, S. C., in 1792. After a desultory training under a French miniature painter, he removed to New York in 1806, and in 1809 after severe financial difficulties he went to London, where he completed his studies under Benjamin West. After nine months he was compelled through lack of funds to return to America and settled in Philadelphia. In 1837 he again visited England, painting the portrait of Queen Victoria for St. George's Society, Philadelphia. He was one of the best painters of his day, and his portraits display skillful handling and warm mellow color, although they are careless in drawing and often niggling in execution. Among his best-known portraits are those of Commodore Decatur in the City Hall, New York; General Lafayette at Independence Hall, and George Frederick Cooke at the Pennsylvania Academy of Fine Arts, Philadelphia; Thomas Jefferson (1821) at the Military Academy, West Point; and portraits of Charles Kemble, Frances Anne Kemble, and Rembrandt Peale, James Madison, Andrew Jackson, and John Marshall, in the Corcoran Gallery, Washington. He is well represented in the Metropolitan Museum, New York, by nine portraits, including those of his wife, daughter, and himself, a charming original sketch of Queen Victoria, and of "Mother and Son." Consult C. H. Hart (ed.), *Register of Portraits Painted by Thomas Sully* (Philadelphia, 1909).

SULLY-PRUDHOMME, sụ'lé'-prụ'dôm', René François Armand (1839–1907). A French poet, born in Paris. He was educated for the law and was a student of science and philosophy. In 1865 he published *Stances et poèmes*, which won praise from Sainte-Beuve for their elegiac sentiment. Encouraged by this he devoted himself to poetry. In 1866 appeared *Les épreuves*, in which the sadness of unbelief is poignantly expressed. *Les solitudes* (1869) and a rhymed translation of the first book of Lucretius (1869) foreshadow by their depth his great philosophical poems *La justice* (1878) and *Le bonheur* (1888). These two poems are among the greatest efforts of French poetry since Victor Hugo and Lamartine. *Impressions de guerre* (1870) deal with some phases of the Franco-German War. *Les destins* (1872), *Vaines tendresses* (1875), and *Le prisme* (1886) are less philosophic and more personal. In 1905 he published *La vraie religion selon Pascal*. Sully-Prudhomme entered the Academy in 1881, and in 1901 received one of the Nobel prizes in recognition of the lofty qualities of his poetry. He devoted a portion of this to establishing an annual award for excellence among the younger French poets. His verses are thoughtful and often melancholy. Open to all impressions, he is reserved in expression.

Consult: Ferdinand Brunetière, *Poésie lyrique*, vol. ii (Paris, 1894); Jules Lemaître, *Les contemporains*, vols. i, iv (ib., 1896); Gaston Paris, *Penseurs et poètes* (ib., 1897); Ernest Zyromski, *Sully-Prudhomme* (ib., 1897); Camille Hémon, *La philosophie de Sully-Prudhomme* (ib., 1907); also G. Walch, *Anthologie des poètes français contemporains* (ib., 1906).

SUL'LYS HILL NATIONAL PARK. See Park, National.

SULMONA. See Solmona.

SUL'PHOCYAN'IC ACID, or Thiocyanic Acid, HCNS. A powerful organic acid analogous in its composition to the well-known cyanic acid (q.v.), HCNO, from which it differs in containing sulphur instead of oxygen. Sulphocyanates, i.e., salts of sulphocyanic acid, may be obtained by the direct action of sulphur on cyanides (i.e., salts of hydrocyanic acid); just as cyanates may be obtained by the direct union of cyanides with oxygen. Thus, potassium sulphocyanate may be obtained by boiling a solution of potassium cyanide with sulphur. Free sulphocyanic acid may be prepared by decomposing barium sulphocyanate with sulphuric acid, and distilling the aqueous acid thus obtained over warm anhydrous chloride of calcium. The acid is thus obtained in the form of a volatile liquid with a characteristic pungent odor. Pure sulphocyanic acid may be preserved for some time if kept cold. At ordinary temperatures it rapidly polymerizes, forming an amorphous yellow substance.

Several sulphocyanates are extensively used as mordants in certain dyeing processes. The principal commercial source of the salts is found in the manufacture of coal gas. The products formed during the destructive distillation of coal include ammonia, cyanogen, a certain amount of ammonium cyanide, and certain compounds of sulphur. In course of the purification of the gas, these by-products are brought into contact with moist ferric oxide to free the gas from sulphur compounds. The sulphur is thus retained partly in the free state, partly as iron sulphide, and by combination with the ammonium cyanide present yields ammonium sulphocyanate, which may be dissolved out of the reacting mixture with water. Ammonium sulphocyanate is usually transformed into the sulphocyanate of copper, from which, in turn, the useful sulphocyanate of barium is obtained by the action of baryta. The sulphocyanate of aluminium, another useful salt of sulphocyanic acid, may be obtained by the action of aluminium sulphate on the sulphocyanate of barium. Most of the sulphocyanates are soluble in water. Sulphocyanate of mercury may be obtained by the action of mercuric nitrate on the sulphocyanate of ammonium. It decomposes on moderate heating, the resulting mass, externally yellow, but black within, assuming a large size and often a fantastic shape. This sulphocyanate is the principal ingredient of the toy known as Pharaoh's serpents. Each serpent consists of a little cone of tinfoil, filled with the salt. On lighting the cone at the apex there begins to issue a thick serpent-like coil, which continues twisting and lengthening to an extraordinary degree. In 1906 Rosanoff and Hill succeeded in working out a reliable method for the quantitative determination of sulphocyanates in the presence of chlorides and bromides.

Like cyanic acid (q.v.), sulphocyanic acid furnishes a simple example of the phenomenon known as tautomerism. The two constitutional formulas corresponding to the acid, as deduced from a study of its two different series of derivatives, are as follows:

$$N = C - S - H \quad \text{and} \quad H - N = C = S$$

The two imaginary compounds corresponding to these formulas, but in reality represented by only one acid, are called, respectively, sulphocyanic acid and isosulphocyanic acid (or thiocyanic acid and isothiocyanic acid).

SUL'PHONAL $(CH_3)_2C(SO_2C_2H_5)_2$. A white crystalline compound used as a hypnotic. It is prepared by the action of acetone on mercaptan (q.v.) and the oxidation of the resulting product by permanganate of potassium. Pure sulphonal is a colorless crystalline substance that melts at 125.5° C. (257.9° F.). It is sparingly soluble in water, alcohol, and ether and is best administered with hot milk. It is employed as a substitute for chloral, over which it has the advantage of exercising no depressing action on the heart. It is, however, a poisonous substance and has been known to produce serious functional disturbances and eruptions on the skin. It is sometimes administered in conjunction with trional.

SUL'PHOVIN'IC ACID. Same as ethyl hydrogen sulphate, or ethyl sulphuric acid. $C_2H_5.H.SO_4$. See ALCOHOL.

SUL'PHUR (Lat. *sulphur*, *sulfur*, sulphur; possibly connected with Ger. *Schwefel*, AS. *swefl*, sulphur). A nonmetallic element, known since ancient times. From the fact that it burns readily, it was called brennestone or brimstone, and was regarded by the alchemists as the principle of combustibility, representing the alterability of metals by fire. It occurs in the uncombined state, though usually contaminated with clay, bitumen, and other impurities, and sometimes with traces of arsenic, selenium, tellurium, etc., usually in the vicinity of volcanoes and hot springs. The principal localities in which sulphur is mined include the provinces of Caltanisetta and Girgenti in Sicily; Romagna in Italy; the coastal plains of Louisiana and Texas and the Mexican Gulf states; Central Hokkaido in Japan; Caucasus; Upper Egypt; White Island in New Zealand; Iceland, and others. Compounds of sulphur, especially metallic sulphides, are of common occurrence, and include chalcopyrite or copper-iron sulphide, cinnabar or mercury sulphide, galena or lead sulphide, pyrite or iron sulphide, the arsenic sulphides or realgar and orpiment, sphalerite or zinc sulphide, stibnite or antimony sulphide. In combination with metals and oxygen (sulphates), sulphur occurs in such minerals as anglesite or lead sulphate, barite or barium sulphate, celestite or strontium sulphate, chalcanthite or copper sulphate, gypsum or calcium sulphate, and kieserite or magnesium sulphate. Volcanic gases generally contain sulphur in the forms of sulphur dioxide and sulphureted hydrogen, and compounds containing it are found in certain organic materials, as the volatile oils of mustard and garlic, hair, wool, bile, and albuminous substances. It is believed that native sulphur has been formed by the action of sulphur dioxide on hydrogen disulphide. Sulphur may also be obtained by decomposing certain mineral sulphides, as pyrite. The commercial article is usually obtained by purifying native sulphur by fusion, or by distillation, and until the close of the nineteenth century was produced largely in Sicily, where it occurs mixed with celestite, gypsum, limestone, and marl, and whence about 16,000,000 tons (probably one-third of the total deposit) have been obtained in the last 300 years. The ore, after being carefully hand-picked, was formerly heated in heaps beneath which the liquid sulphur collected in a trough, whence it was ladled out; but as this process was wasteful, kilns came into use, in which sulphur ore was piled and ignited at the bottom; the heat penetrated it slowly, and as the sulphur gradually melted it ran to the bottom, where it was collected and cast into molds. The crude sulphur obtained in this manner usually contains about 3 per cent of earthy impurities, which may be removed by distillation, in which case the sulphur is first melted and then heated to the boiling point, the vapor of sulphur then passing into a large chamber, where it condenses and falls to the floor in the form of a light yellow crystalline powder commonly known as flowers of sulphur. This is cast into slightly conical wooden molds, when it is known as roll sulphur or brimstone, and sometimes it is allowed to cool in the chamber, when it is obtained in large crystalline masses called block sulphur.

In recent years the sales of Sicilian sulphur, which formerly supplied nearly the entire demand of the world, have been enormously reduced by American competition. In 1902, after several years of ingenious research, Herman Frasch succeeded in developing a most remarkable process for extracting sulphur from deposits like those of Louisiana and Texas, where the sulphur is covered by many feet of quicksands and ordinary shaft mining is inapplicable. The Frasch process, which has been generally recognized as a veritable triumph of modern industrial research, consists in introducing superheated water into the sulphur bed; the sulphur melts and is driven to the surface by compressed air. While the principle of Frasch's process is thus quite simple, the engineering difficulties encountered seemed almost insuperable. In present practice, a well, 17 inches in diameter, is bored to a depth of 50 feet; a wrought-iron pipe 13 inches in diameter is sunk within the well, but to a depth often of 250 feet (the top of the sulphur bed); within this a second pipe, 8 inches in diameter and with perforated sides, is sunk to a depth near the bottom of the sulphur bed; within this a third pipe, 6 inches in diameter but with unperforated sides, is sunk to the same depth; through the 8-inch and 6-inch pipes the superheated water is pumped into the sulphur bed; a fourth pipe, 3 inches in diameter and again unperforated, serves to convey the molten sulphur to the surface; finally, a fifth pipe, 1 inch in diameter, unperforated, conveys the compressed air required for driving the molten sulphur upward through the 3-inch pipe. The sulphur thus obtained is 99.95 per cent pure, and the cost of production is exceedingly small.

Sulphur (symbol, S; atomic weight, 32.07) occurs in several allotropic modifications. The commonest, and under ordinary conditions the stablest, of these is a brittle solid that crystallizes in the rhombic system, but that on heating passes into transparent yellowish-brown needles of the monoclinic system. Both of these forms are soluble in carbon disulphide. The modifications of sulphur that are insoluble in carbon disulphide include plastic, amorphous, yellow, and black sulphur. There is a variety of sulphur that is soluble in water. This is known as colloidal sulphur, and is obtained by passing hydrogen disulphide into an aqueous solution of sulphur dioxide. Rhombic sulphur melts at 114.5° C.; monoclinic sulphur melts at 120° C. At 95.6° C. rhombic sulphur begins to change (slowly) into the monoclinic form. Sulphur is a poor conductor of heat and electricity. The element itself is now extensively used in the manufacture of paper from wood pulp and for the prevention of the growth of oidium fungus on grapevines.

Sulphur combines with oxygen to form a dioxide (SO_2) and a trioxide (SO_3), which in turn combine with water to form sulphurous and sulphuric acids (H_2SO_3 and H_2SO_4 respectively). It also forms a sesquioxide (S_2O_3) and a heptoxide (S_2O_7); but these are unimportant. Sulphur dioxide, or sulphurous anhydride, was known to the ancients, and Homer mentions its fumes. It is readily formed by burning sulphur in the air, and also by the action of certain metals, such as copper, on sulphuric acid. It is a colorless gas with a suffocating odor and is freely soluble in water, forming sulphurous acid. Large amounts of it also dissolve in acetone. The gas is used as a bleaching agent, as a disinfectant, and as an antiseptic, serving to prevent the putrefaction of meat and to stop fermentation. It is also used in the sulphuring of wine. Its compound with water, known as sulphurous acid (H_2SO_3), combines with bases to form a series of salts which are known as sulphites. Sulphur trioxide, or sulphuric anhydride, is formed when a mixture of sulphur dioxide and oxygen is passed over platinum sponge, or by the distillation of fuming sulphuric acid. It is a colorless mobile liquid that solidifies in the form of long transparent prismatic crystals which melt at 14.8° C. The liquid boils at 46° C. It is very acrid and chars paper, wood, and organic matter generally. When thrown into water it dissolves with a hissing sound and evolves a large amount of heat, forming sulphuric acid (q.v.). Under the name of crystallizable sulphuric acid, it is used in the manufacture of coal-tar colors, such as alizarin, and in the purification of ozokerite. With hydrogen and oxygen sulphur forms a series of acids including, besides those already mentioned, the following: thiosulphuric or hyposulphurous acid ($H_2S_2O_3$), which is described elsewhere; hydrosulphurous acid (H_2SO_2), a powerful reducing agent discovered by Schutzenberger and prepared by the action of metallic zinc on acid sodium sulphite; persulphuric acid (HSO_4), obtained in a combined form by the electrolysis of a strong solution of acid potassium sulphate; pyrosulphurous acid ($H_2S_2O_5$), whose potassium salt is formed when sulphur dioxide gas is passed into a hot aqueous solution of potassium carbonate; pyrosulphuric acid ($H_2S_2O_7$), formed by the direct union of sulphur trioxide and sulphuric acid; dithionic acid ($H_2S_2O_6$), whose manganese salt is formed by the action of sulphur dioxide on manganese dioxide; trithionic acid ($H_2S_3O_6$), whose potassium salt is formed by the action of flowers of sulphur on a warm solution of acid potassium sulphite; tetrathionic acid ($H_2S_4O_6$), whose sodium salt is formed by the action of iodine on sodium hyposulphite; pentathionic acid ($H_2S_5O_6$), formed, along with free sulphur, by the action of sulphur dioxide on aqueous sulphureted hydrogen.

Sulphur combines with hydrogen to form a disulphide (sulphureted hydrogen, q.v.) and a persulphide, of which the former is well known. The persulphide (probably H_2S_5) is an oily yellow liquid prepared by pouring an aqueous solution of an alkaline polysulphide into excess of a solution of about equal parts of concentrated hydrochloric acid and water. It has the property of bleaching organic coloring matters, and reduces the oxides of gold and silver with great rapidity. With carbon sulphur combines to form a disulphide (CS_2), which is described in a special article. (See CARBON DISULPHIDE.) With chlorine sulphur combines to form a monochloride (S_2Cl_2), a dichloride (SCl_2), and a tetrachloride (SCl_4), of which the most important is the monochloride. This is prepared by passing dry chlorine gas over melted sulphur and distilling off the chloride from the excess of sulphur. It is an amber-colored liquid that fumes strongly in the air and possesses a penetrating odor. A saturated solution of sulphur in a commercial mixture of the monochloride and the tetrachloride is used in vulcanizing rubber goods. Consult Lucas, "Geology of the Sulphur and Sulphur Oil Deposits of the Coastal Plain," and Pough, "Sulphur Mines of the Union Sulphur Company in Louisiana," in *Journal of Industrial and Engineering Chemistry* (Easton, 1912).

SULPHUR, MEDICAL USES OF. Sulphur is used in medicine both internally and externally. It is prepared from crude sulphur by sublimation, washing, and precipitation. Taken by the mouth sulphur in medicinal doses is a mild laxative, producing a soft stool, which slips by strictures of the rectum, piles, and fissures with little discomfort. It is, therefore, used in these conditions. Sulphur is indicated in chronic rheumatism, either taken in the form of mineral waters containing this element, or externally by means of sulphur baths. The latter are employed in various chronic skin diseases, of obstinate type, such as psoriasis, lichen, and eczema. (See BATH; MINERAL WATERS.) Calcium sulphide is of value in all cases where pus is about to form, as when successive crops of boils appear, and in acne pustulosa.

The external uses of sulphur are mostly confined to affections of the skin and as a parasiticide. It is only active when used in the form of an ointment. For the itch (q.v.) sulphur ointment is a specific. It is also a favorite remedy for ringworm (tinea, q.v.).

SUL'PHURET'ED ANTIMONY. See KERMES MINERAL.

SULPHURETED HYDROGEN, HYDROGEN SULPHIDE, or HYDROSULPHURIC ACID, H_2S. A foul-smelling gaseous acid compound of sulphur and hydrogen, known since the sixteenth century, but first carefully investigated by Scheele in 1777. It occurs uncombined in certain mineral waters and in volcano gases, and is formed in the decomposition of albuminous substances containing sulphur. It also occurs as a product of transformation of gypsum (calcium sulphate) and other metallic sulphates and is a constituent of volcanic exhalations. But whatever its origin, it does not long remain unchanged in the air, being oxidized with great ease. The usual method of preparing the gas consists in causing sulphuric, or preferably hydrochloric, acid to act on ferrous sulphide. The following rule usually holds good: Sulphureted hydrogen is formed by the action of acids on the sulphides of those metals (e.g., iron, zinc, manganese, calcium, magnesium, sodium, potassium, etc.) which can directly decompose the acids with liberation of hydrogen. Larger quantities of the gas may be prepared by heating sulphur with moistened charcoal or with paraffin, vaseline, or similar substances. Sulphureted hydrogen is a colorless gas, somewhat heavier than air, soluble in water and more so in alcohol, the solutions reddening blue litmus paper. Mixed with 1½ volumes of oxygen and ignited, it explodes, the products of the reaction being water vapor and sulphur dioxide (SO_2). With water it forms a hydrate having the formula $H_2S.7H_2O$. Under the influence of cold and pressure sulphureted hydrogen condenses to a colorless mobile liquid. When heated, it dissociates into its component elements, which recombine when the temperature is lowered. Sulphureted hydrogen is very poisonous, and even small proportions of it in the air are dangerous. The presence of free sulphureted hydrogen may be demonstrated by means of a strip of filter paper soaked with a solution of lead acetate, the paper turning brown or black, owing to the formation of lead sulphide. Chlorine and iodine decompose sulphureted hydrogen, and this is why the odor of the latter is readily destroyed by bleaching powder. Sulphureted hydrogen is used in the manufacture of certain metallic sulphides, for the purification of sulphuric acid, and extensively in analytical chemistry. The sulphureted hydrogen produced in certain industrial processes is utilized by burning it and transforming the resulting sulphur dioxide either into sulphuric acid or into free sulphur.

SULPHU'RIC ACID, H_2SO_4. A well-known acid compound of hydrogen, sulphur, and oxygen. When pure and free from water it is a colorless, oily liquid of specific gravity 1.84 (approximately) at 0° C. While it may readily be undercooled, it solidifies normally at about 10.5° C. (50.9° F.). At about 290° C. (554° F.) it begins to boil, breaking up into sulphur trioxide and water vapor, and as some of the latter is retained by the boiling acid, the temperature rapidly rises to about 338° C. (640° F.). It is highly hygroscopic, absorbing about 30 per cent of its weight of water. It readily chars organic matter, and is poisonous, not only on account of its powerful corrosive action, but also on account of a specific effect on the blood. Sulphuric acid is a dibasic acid, either one or both

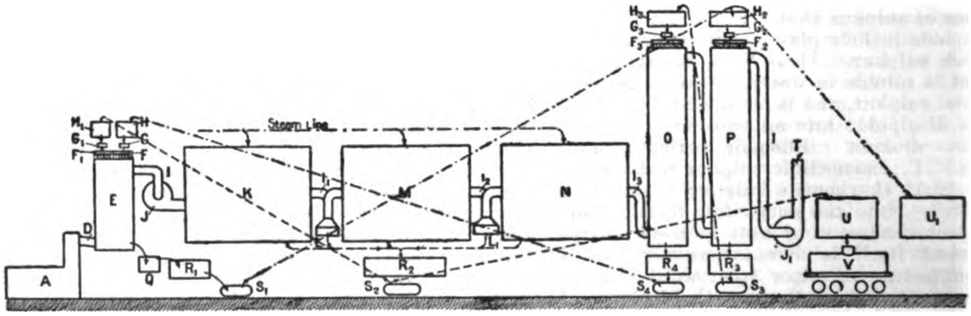


DIAGRAM SHOWING CHAMBER PROCESS FOR MAKING SULPHURIC ACID.

In the figure, *A* is a bench of pyrites burners, nitre oven, etc. The burner gas is conducted through pipe *D* to the Glover tower, *E*, where it meets the dilute acids and oxides of nitrogen. The fan *J* carries the gases through the pipe *I* to the first chamber, *K*, where oxidation of the sulphur dioxide takes place in presence of water vapor supplied by the steam line shown above the chambers, thence to the second and third chambers, *M* and *N*, through the flues I_1 and I_2 and surface condensers *L* and L_1. The acid drained from the bottom of each chamber and the condensers is collected in the tank R_2.

The pump S_2 delivers this acid to the tank H_1, over the Glover tower, or to the storage tank *U*, whence it goes to the tank car *V*. The strong acid coming from the Glover tower is collected in cooler *Q* and tank R_1 and is delivered by the pump S_1, to the tank H_2 over the second Gay-Lussac tower, *P*, and to the storage tank U_1. The gases from the last chamber, *N*, are conducted through the pipe I_3 to the first Gay-Lussac tower, *O*, and thence to the second Gay-Lussac tower, *P*, their flow being maintained by the fan J_1. The exhausted gases pass to the atmosphere at *T*. The nitrous vitriol from the first Gay-Lussac tower is collected in the tank R_4, and is delivered by the pump S_4 to tank *H* over the Glover tower. The nitrous vitriol from the second Gay-Lussac tower, containing but little N_2O_3, is collected in the tank R_3 and is delivered by the pump S_3 to the tank H_3 over the first Gay-Lussac tower. In different works this scheme varies somewhat in detail but not in its essential points.

of its hydrogen atoms being replaced by metals, with the formation, respectively, of either acid or neutral salts (sulphates). Its chemical constitution is generally assumed to be represented by the formula $(HO)_2SO_2$. By adding to it a little water it may be caused to form the monohydrate $H_2SO_4.H_2O$, which crystallizes out when the mixture is cooled. Glass bottles containing commercial sulphuric acid often burst in winter, owing to the separation of crystals of this hydrate, whose melting point is about 8° C. (about 46° F.), and which decompose into sulphuric acid and water above 205° C. (about 370° F.). If pure sulphuric acid is mixed with water in the proportion of 49 parts of the former to 18 parts of the latter, the well-defined dihydrate is formed, having the composition $H_2SO_4.2H_2O$.

The term "sulphuric acid," however, as technically and commercially understood, seldom if ever refers to the actual monohydrate or to any of the other recognized hydrates of sulphuric acid. It refers either to a series of solutions of the monohydrate in water or to a series of solutions of sulphur trioxide in the monohydrate $(H_2SO_4 + SO_3)$. The first series are known commercially as chamber acid (50°–55° Be′), oil of vitriol (66° Be′), and the monohydrate or concentrated acid, containing about 98.5 per cent of H_2SO_4. The second series are termed fuming or Nordhausen acids, and are always estimated alkalimetrically according to the percentage of free sulphur trioxide contained.

Technically, therefore, sulphuric acid might be considered to be the generic name of a series of solutions of sulphur trioxide (SO_3) in water, some of which solutions are distinguished by variations of properties which occur uniformly with uniform percentage mixtures of sulphur trioxide and water, most of which are, however, merely solutions of convenient strength for use in the arts.

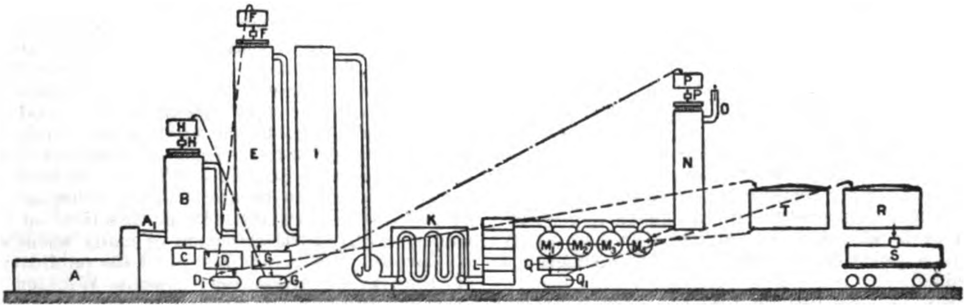


DIAGRAM SHOWING CONTACT PROCESS FOR MAKING SULPHURIC ACID.

A is a bench of pyrites burners. The burner gas passes through the flue A_1 to the first cleaning tower, *B*. Weak sulphuric acid is constantly flowing down this tower, becoming concentrated by the hot burner gas and absorption of the sulphur trioxide contained in the burner gas, and finally flows out at the bottom into the cooler *C* at a strength of from 62° to 64° Baumé. From the cooler *C* the strong acid passes to the tank *D* and is delivered by the pump D_1 to the storage tank *T*, or to the tank *F* over the second cleaning tower, *E*. A constant stream of strong sulphuric acid from the tank *F* is kept flowing down this tower. In this tower the burner gas coming from the top of *B* is further cleaned and dried by the action of the strong acid and then passes to the filter tower, *I;* the circulation of the gases through the train of apparatus is maintained by the fan *J*. Before entering the contact ovens, the mixed gases are reheated to the proper temperature for the combination of the sulphur dioxide and oxygen in the reheater, *K*.

The contact oven, *L*, consists of cast-iron rings with perforated shelves, or diaphragms, upon which is placed the contact mass.

The sulphur trioxide formed in the contact oven now passes through the absorption cylinders, M_1, M_2, M_3, M_4. These are cylindrical iron tanks connected in such a way that the gas passes from end to end, meeting the weak acid flowing in the opposite direction. Both the gas and the acid in M_1 are richest in sulphur trioxide, while in M_4 the gas and acid are weak. Sulphur trioxide is most readily absorbed by acid containing about 98% H_2SO_4. The strong acid, which is ready for the market as it comes from M_1, is collected in the tank *Q* and is delivered by the pump Q_1 to the storage tank *R*.

The gases coming from the last absorption tank, M_4, contain still a small amount of unabsorbed sulphur trioxide. In order to recover this, the gases are passed through the tower *N*, which is supplied with strong acid which absorbs the last traces of sulphur trioxide. The nitrogen and oxygen remaining pass into the air through the pipe *O*. The tank car *S* receives acid for shipment from the storage tank, *R*.

The manufacture of sulphuric acid is one of the greatest chemical industries. The processes involved include the production of sulphur dioxide, the transformation of this into sulphur trioxide, and the transformation of the trioxide into sulphuric acid. Of these, the oxidation of the dioxide is the most important, the dioxide itself being readily produced by burning sulphur, mineral sulphides, or sulphureted hydrogen, with free access of air. The resulting gases, technically termed burner gas, include from 5 to 8 per cent of the dioxide (the remainder consists of the nitrogen and excessive oxygen of the air and impurities). The two processes devised to effect the oxidation of the dioxide are alike catalytic in their action, in so far as the substances used, while producing the required chemical reaction, remain themselves in the end unchanged. These two processes are termed respectively the chamber process and the contact process.

Chamber Process. In the chamber process the burner gas is mixed in large lead chambers (and with more or less auxiliary apparatus) with nitric acid, or with the products of the action of sulphuric acid on sodium nitrate. The principal reactions involved, according to Lunge, are as follows:

(1) $SO_2 + NO_2 + H_2O = O : N(OH)SO_3H$.
(2) $2ON(OH)SO_3H + O = H_2O + 2ONOSO_3H$.
(3) $2ONOSO_3H + H_2O = 2SO_2(OH)_2 + NO + NO_2$.

In addition to the above principal reactions there are further reactions set up in the so-called Gay-Lussac and Glover towers, in which apparatus respectively the catalytic agent is recovered and made available (in the form of nitric acid) for further use. The principle of the chamber process, therefore, is the production of a dilute sulphuric acid by oxidizing (by nitric acid in the presence of water vapor) a burner gas containing say 5 per cent to 8 per cent of sulphur dioxide. During the process there is a reduction of the nitrogen from higher to lower oxides. These latter take up oxygen again and repeat the cycle in such a way that the nitric acid is practically recovered for further use. This recovery, however, is rarely complete—a certain mechanical loss being unavoidable. The strongest acid which can be produced by the chamber process will correspond to from 50 per cent to 60 per cent of sulphur trioxide. Stronger acids must be produced by driving off the contained water by heat or by isolating the acid by freezing. It is thus possible to produce the concentrated acid (oil of vitriol) of commerce, containing from 93.5 to 97 per cent of pure sulphuric acid; also distilled acid, containing up to 95.5 per cent of H_2SO_4; but the anhydrous can only be isolated by freezing.

Contact Process. In the contact process the method of production is directly synthetical, and acids of any desired strength may be made in one operation. In this process the pyrites burner gas must be first rendered absolutely free from everything other than sulphur dioxide, oxygen, and inert nitrogen, the usual impurities of burner gas, such as dust, moisture, arsenic, selenium, phosphorus, mercury, etc., derived from the raw material used, seriously interfering with the process. After purification, the dry gas is passed through a substance possessing the faculty of causing sulphur dioxide to oxidize into sulphur trioxide, without apparently suffering any change whatever in its own condition. This contact must be brought about under conditions as to temperature according to the substance used. The contact substances used are finely divided platinum in various forms, such as platinized asbestos and pumice, etc., crusts formed of platinum and some soluble sulphate, ferric oxide, cupric sulphate, diatomaceous earth, etc. The transformation of sulphur dioxide into the trioxide takes place best between 300° and 400° C. (572° to 752° F.). Above 450° C. the transformation grows incomplete, for at that temperature commences the dissociation of sulphur trioxide into dioxide and free oxygen—a dissociation which is complete at 900° C. The formation of sulphur trioxide having been attained, it simply remains either to condense it at the proper temperature in its crystalline condition or to absorb it in sulphuric acid or water until a solution of the required strength is obtained.

Fuming Sulphuric Acid. The contact process described above is also used to produce a fuming acid. Fuming acid is generally valued according to the amount of trioxide present, the balance being $SO_2(OH)_2$. If a fuming acid is made by the contact process, the absorption of sulphur trioxide takes place in wrought-iron vessels, upon which free SO_3 has little action. Cast iron is used for ordinary concentrated sulphuric acid.

The second method, less frequently employed for the manufacture of fuming acid, depends on the action of heat in decomposing some metallic sulphate, with evolution of sulphur trioxide. Sulphate of iron in the form of copperas (ferrous sulphate), and latterly crude ferric sulphate, have been employed. The substance used is heated in clay retorts, and the sulphur trioxide which is expelled is condensed in receivers charged with water, or with oil of vitriol or weak fuming acid. A more recent process is said to be the treatment of sodium pyrosulphate by sulphuric acid, with the following reaction:

$$Na_2S_2O_7 + H_2SO_4 = 2NaHSO_4 + SO_3.$$

The residue of sodium hydrogen sulphate is heated to 300°–320° C. in a special retort, and reconverted into pyrosulphate.

History. Geber was the first to describe sulphuric acid as a spirit which can be produced from alum and which possesses solvent properties. From the year 1613 sulphuric acid was prepared by the apothecaries by burning sulphur with access of air in moist vessels. The birth of the modern method of sulphuric acid making, however, dates from Roebuck's installation of lead chambers in Birmingham in 1746, and his further installation at Prestonpans, in Scotland, in partnership with Garbett. As late, however, as 1800 the Prestonpans works only yielded 111 per cent on the sulphur burned, with a consumption of 13 per cent of nitrate of soda (modern practice would yield 300 per cent of the acid on sulphur burned with a consumption of less than 3 per cent nitrate of soda). The chambers at that time were about 14 feet long, 10 feet high, and 4 feet, 10 inches wide. (They are now commonly 50 feet to 100 feet long, 20 feet to 25 feet high, and 20 feet to 30 feet wide.) In 1827 Gay-Lussac introduced his towers for the recovery of nitric acid. Another important step was the introduction, in 1859, by John Glover, of his denitrating and concentrating tower at the Washington Chemical Works, near Durham, in England. This completed the rational and economical method of manufacture known as "the chamber process." From that time on the history of the chamber process of manufacturing sulphuric acid has been largely one of minor improvements, economics, and investigations into the chemical reactions involved in the process.

In the meantime, however, as early as 1817 the catalytic action of platinum was discovered by Sir Humphry Davy, and this phenomenon was further investigated by Edmund Davy, Döbereiner, and others. In 1831 Peregrine Phillips, Jr., an acetic-acid manufacturer, discovered and patented the application of the catalytic action of platinum to the production of sulphur trioxide. The matter remained dormant until 1848, when the Belgian Schneider claimed to have discovered in pumice stone a substance of great catalytic activity. From this time on the subject received the attention of many scientists in Europe. But it was not until the publication of the investigations of Clemens Winkler in Dingler's *Journal*, in 1875, that the foundation of a commercial contact process can be said to have been securely laid. Subsequent work by Hanisch and Schroeder, Messel and Lunge, and others, followed. Finally, about 1880, the matter was taken up by the Badische Anilin und Soda Fabrik in Germany, and this firm, after a long, costly, and obstinate struggle, brought the process to a commercial success. Other manufacturers also have made the contact process an established success, the different manufacturers working on slightly different methods or different contact materials. As yet, however, the only contact material of demonstrated commercial value is platinum in one or the other form or combination. In the United States the first contact plant was erected in 1899, at Mineral Point, Wis., by the New Jersey Zinc Company under the patents of Schroeder. This plant was almost immediately followed by others, all of which are in successful operation; and while this process cannot be said to have superseded the old chamber process, its advantages are such that its complete triumph is probably only a matter of time and improved methods. Consult: John Lomas, *Manual of Alkali Trade, Including Manufacture of Sulphuric Acid* (2d ed., New York, 1886); Lunge and Hurter, *Alkali Makers' Handbook* (2d ed., ib., 1891); Georg Lunge, *Manufacture of Sulphuric Acid and Alkali* (Eng. trans., 4 vols., ib., 1903–11); Sir T. E. Thorpe, *Dictionary of Applied Chemistry* (5 vols., London, 1912–13).

SULPHURIC ETHER. See ETHER.

SULPHU′ROUS, or **SUL′PHUROUS, ACID** (H_2SO_3). A colorless liquid containing about 6.4 per cent of sulphurous anhydride (SO_2) and 93.6 per cent of water. The gas is a valuable disinfectant and has been used for this purpose from the most ancient times. The gas was formerly employed to disinfect buildings and rooms, although formaldehyde gas is gradually superseding it. See DISINFECTANTS; FUMIGATION.

SUL′PHUR SHOWERS. See POLLINATION.

SULPHUR SPRINGS. A city and the county seat of Hopkins Co., Tex., 93 miles east by north of Dallas, and on the St. Louis Southwestern and the Missouri, Kansas, and Texas railroads (Map: Texas, E 3). It has cotton gins, a cotton compress, cottonseed-oil mills, and manufactories of brick and tile, and lumber products. The commission form of government has been adopted. Pop., 1900, 3635; 1910, 5151.

SULPHUR SPRINGS RESERVATION. See PARK, NATIONAL, *Platt National Park.*

SULPICIANS, sŭl-pĭsh′anz. A society of priests founded in 1641 by Jean Jacques Olier (q.v.) to educate candidates for the priesthood. It took its name from the parish of Saint-Sulpice in Paris, of which Olier was pastor. When the number of priests had increased beyond the needs of the parish, some took charge of a seminary; and this has since been their principal work. In 1900 they had charge of 26 seminaries in France, but in 1904 the seminary of Paris was taken from them. They came to Canada in 1657 and had a large share in the founding of the city of Montreal as a Christian colony; for a long time they did all the priestly work there, and still conduct the seminary. On the invitation of Bishop Carroll they came to Baltimore in 1791 and founded a seminary there; in 1808 they established another at Emmitsburg, the later Mount St. Mary's College. They also have charge of the seminary in the diocese of San Francisco, and of the clerical students in the Catholic University at Washington.

SULPICIUS APOLLINARIS. A Roman grammarian and learned commentator of the second century, born at Carthage, repeatedly mentioned with high praise by his pupil Aulus Gellius (q.v.). He devoted himself especially to the study of Vergil. Metrical arguments or summaries of the several books of the *Æneid,* of six hexameters each, and like summaries of the plays of Terence, each in twelve iambic trimeters, written by Apollinaris, are extant. He wrote also *Letters.* Consult: J. W. Beck, *De Sulpicio Apollinari* (Groningen, 1884); M. Schanz, *Geschichte der römischen Literatur,* vol. iii (2d ed., Munich, 1905); W. S. Teuffel, *Geschichte der römischen Literatur,* vol. iii (6th ed., Leipzig, 1913).

SULPICIUS (sŭl-pĭsh′ĭ-ŭs) **SEVE′RUS** (c.363–c.410). An ecclesiastical historian, born in Aquitaine. According to Paulinus (Ep. xxii.) he went to live at Primuliacum, a village near Toulouse, and about this time he seems to have taken monastic vows. He was a friend of St. Martin, Bishop of Tours, whom he frequently visited, and whose life he wrote (*Vita S. Martini Turonensis*). His biography and his dialogues are of great historical value. The most important of Sulpicius's other writings is his *Historia Sacra,* composed about 403. This book was for a long time used as a textbook for history in the schools of Europe (till c.1656). There is an English version of his writings, by Alexander Roberts, in *Nicene and Post-Nicene Fathers* (vol. xi, 2d series, New York, 1894).

SULTAN, sŭl′tan *or* sụl-tän′ (Ar. *sulṭān,* emperor, empire, from *saliṭa,* to be imperious). A common title of Mohammedan princes since the time of the Ghaznivid Mahmud (997–1030). It is given, par excellence, to the ruler of Turkey, who takes the name "sultan khan," reigning sultan, or sultan of sultans. It is also given to the princesses of the royal house, and the Sultan's mother is called valide sultan; the mother of his first-born son is called hasseki sultan. In English a feminine form, "sultana," is usually employed for women.

SULTAN, sŭl′tan. A breed of small fowls, derived from Turkey, and kept for their beauty of plumage and docility as pets.

A SULTAN COCK.

SULTE, sụlt, BENJAMIN (1841–). A French-Canadian author, born at Three Rivers, in the Province of Quebec. Taken from school at the death of his father, who perished at sea, Sulte pushed his way through various employments into journalism and into the service of the government as translator. His most solid prose work is the *Histoire des Canadiens-Français* (8 vols., 1882–84), which was followed by *Histoire de St. François du Lac* (1886) and *Pages d'histoire du Canada* (1891). Sulte is also well known for his songs in *Les Laurentiennes* (1870) and *Les chants nouveaux* (1880). He also wrote *La langue française au Canada* (1898), *Histoire de Québec* (1908), and a number of other publications which appeared in reviews.

SULU, sōō-lōō′, or JOLÓ. The capital of the island and archipelago of the same name in the Philippines, situated on the northwest coast of the island of Sulu, 99 miles southwest of Zamboanga, Mindanao (Map: Philippine Islands, C 7). The old town, destroyed during the Spanish occupation of 1876–78, was the residence of the sultans from the time of the traditional first leader, Xarib, or Charib, who is reported to have come from Mecca during the latter part of the seventeenth century. The new town, laid out on the hill by the Spaniards at the time of their permanent occupation, is well constructed and fortified. The harbor is provided with a long stone pier and a lighthouse, and the town is an important shipping place. The population is but a few thousand.

SULU ARCHIPELAGO. The southernmost group of the Philippine Islands. It separates the Sulu and Celebes Seas and extends the western extremity of Mindanao southwestward to the northeastern extremity of Borneo (Map: Philippine Islands, C 8). Its combined area is estimated at 1561 square miles. The archipelago consists of several minor groups, each centred around a large island. Of the latter the largest are Basilan and Joló (Sulu) in the north and Tawi-Tawi in the south, whose areas, respectively, are 478, 326, and 232 square miles. The number of islands counted is 425, of which 16 are unnamed rocks. The larger islands are of volcanic formation, and consist of mountains from 1000 to 3000 feet high, with several extinct volcanoes. The mountains are generally surrounded by a coast zone of coral deposits, and most of the smaller islands are wholly of coral formation. The soil is extremely fertile, and the vegetation is luxuriant. The flora is more distinctly related to that of the Philippines, especially Mindanao, than to the Borneo flora; the forests produce the most valuable woods of the east—teak, bamboos, and palms.

Considerable areas in Joló Island are cleared and cultivated, the chief crop being rice, while coffee, cacao, corn, hemp, cotton, and indigo are also raised. The industries include weaving for domestic use, manufactures of cordage and of knives and hatchets, and pearl and shell fishing, the last being commercially important. Trade is almost wholly in the hands of Chinese merchants, and consists chiefly in the exportation of pearl shell to Singapore and Manila and the importation of manufactured goods. The dominant people are the Moros, or Mohammedan Malays, who had invaded and conquered the islands before the arrival of the Europeans. They practice polygamy and a mild form of slavery which the United States government has not abolished, though it has insisted that hereafter no person shall be enslaved. The people are governed directly by local chieftains called datos, nominally subject to the Sultan of Sulu. The population of the archipelago is over 121,000. The Sulu Archipelago, with the exception of the Basilan group (501.8 square miles), constitutes the Sulu District of Moro Province, while Basilan is a part of Zamboanga District. The capital of Sulu District is Joló.

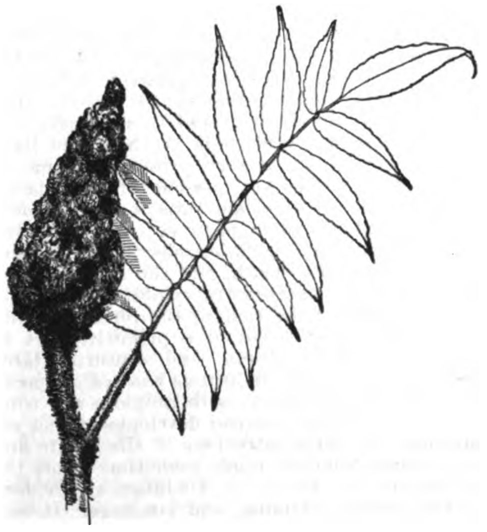
When the Sulu Archipelago was discovered by Spanish navigators it was already occupied by the Moros, and formed, together with its possessions in North Borneo, an independent state. The Moros showed a warlike and independent spirit. Spain claimed sovereignty over the islands and their dependencies, but did not exercise it beyond sending occasional punitive expeditions against the pirates, and her sovereignty was disputed by England and Germany. By 1875, however, Spain had gradually gained a foothold and begun to assume actual control. In 1877 traffic was declared free in the archipelago, and Spain abandoned her claim to North Borneo in favor of England. Finally in 1885 England and Germany formally recognized Spanish sovereignty in the islands. It had already been acknowledged by the Sultan in 1878. With the Philippine Islands the Sulu Archipelago passed into the possession of the United States in 1898. In December, 1899, a treaty was concluded between the Sultan and the United States by which American sovereignty over the islands was recognized. The Sultan was acknowledged and an annual stipend was conferred upon him. The Moros were guaranteed immunity in the practice of their religion. See F. Combés, in *Historia de Mindanao y Joló* (Madrid, 1897), and A. H. S. Landor, *Gems of the East* (New York, 1904).

SULZER, zụl′tsẽr, Johann Georg (1720–79). A Swiss philosopher, born at Winterthur. Educated in Zurich, he went in 1742 to Berlin, where he entertained friendly relations with Euler and Maupertuis, became professor of mathematics at the Joachimsthaler Gymnasium (1747), then at the Ritterakademie (1763), and was elected a member of the Academy. His chief work, in which he sought to reconcile the doctrines of Wolf with the French and English philosophers, is the *Allgemeine Theorie der schönen Künste* (1771–74; new ed., with literary additions by Blankenburg, 1792–94), supplemented by *Nachträge, oder Charakteristik der vornehmsten Dichter aller Nationen*, edited by Dyk and Schatz (1792–1808). With Ramler he edited *Kritische Nachrichten aus dem Reiche der Gelehrsamkeit* (1750).

SULZER, sŭl′zẽr, William (1863–). An American politician, born in Elizabeth, N. J. He studied at Columbia Law School, was admitted to the bar in 1884, and practiced in New York City. From the outset he was active in Tammany politics. He was a member of the State Assembly from 1889 to 1894, of which he was Speaker in 1893 and minority leader (1892–94). Elected to Congress in 1894 and reëlected thereafter successively until 1912, he was an active member of the committee on foreign affairs, championing the cause of the Cuban insurgents, the Boers, and the Russian-American Jews. In 1912 he was elected Governor of New York. He at once advocated radical legislation and proclaimed his independence of machine control. His relations with Charles F. Murphy of Tammany Hall grew steadily less friendly. When he vetoed, as insufficient, the primary law which the Legislature had passed, a conflict developed between him and certain party leaders. Although assailed, he toured the State and called the Legislature in special session to adopt an adequate primary law. Charged with having filed with the Secretary of State a false statement of his receipts and expenditures relative to his campaign fund, he was impeached by the Assembly on this and other charges in 1913. He was tried by the Court for the Trial of Impeachments and was convicted of making a false statement in reference to his campaign fund, although the court found him not guilty of the crime of perjury. The judgment of the court while removing Sulzer from office as Governor also provided that he be not disqualified from holding any other office of honor, trust, or profit under the State. It was widely believed that, even if guilty as charged, he was attacked only because he had refused to obey the machine's commands. He was elected to the State Assembly as a Progressive in the same year. In 1914, after losing the Progressive gubernatorial nomination, he was an Independent candidate, and received without any party support 126,270 votes. He published *Governor Sulzer, the Political Bosses, and the Legislature* (1914).

SUMACH, sū′măk *or* sho͞o′măk, or **SUMAC**

(OF. *sumac, sumach,* Fr. *sumac, sommac,* from Ar. *summâq,* sumach, from *samaqa,* to come of good stock), *Rhus.* A genus of about 120 species of shrubs and small trees of the family Anacardiaceæ, distributed over almost all the world, except its coldest regions. The following species are of commercial importance: Venetian sumach (*Rhus cotinus*), known also as wig sumach or wig tree, is a native of southern Europe and western Asia, and is often planted under the name smoke tree as an ornamental shrub. It has simple leaves and hairy corymbs of fruit, which have a sort of resemblance to periwigs. The wood, which dyes yellow, and, with the addition of other substances, green and brown, is known in trade as young fustic. The leaves are astringent, and are used for dyeing Turkey red. The root is also used in dyeing, and the whole plant is used for tanning in Italy. The seed resembles the almond in flavor. *Rhus cotinoides,* a small tree found from Tennessee southward, is very similar to the smoke tree. The very acid fruit of the elm-leaved sumach (*Rhus coriaria*), a native of the Mediterranean region, has been used from the earliest times as a condiment. The Virginian sumach, or staghorn sumach (*Rhus typhina*), is a native of almost all parts of North America, with curiously crooked branches, covered, when young, with a soft velvety down. The staghorn sumach varies from a shrub to a small tree 30 feet high. The smooth-leaved sumach (*Rhus glabra*), a similar species, also North American, is a shrubby plant seldom more than 3 feet high. The collection of the leaves of the sumach, especially *Rhus typhina,* for tanning is an industry in parts of the South. The varnish sumach or Japan varnish tree (*Rhus vernicifera*), a native of Japan and Nepal, yields a varnish much used in Japan for lacquer-work. The expressed oil of the seeds becomes as hard as tallow, and is used for candles. In Australia the wood of *Rhus rhodanthema* (or *Rhodasphæra rhodanthema*) is considered one of the most valuable cabinet woods. It is dark yellow with a satiny lustre, and takes an excellent polish. The leaves and bark are used in tanning. The name tanner's sumach is given to *Coriaria myrtifolia,* a European shrub of the family Coriariaceæ. The leaves are astringent, and are used for tanning and for dyeing black.



STAGHORN SUMACH (*Rhus typhina*).

The popularly reputed poisonous American species are botanically confused. *Rhus toxicodendron,* a low shrub, is believed to be common only at the South; *Rhus radicans,* the so-called poison oak or ivy, a low, trailing or climbing species, referred by some botanists as a variety of the above species, is more widely distributed. *Rhus vernix,* the so-called poison alder, sumach, dogwood, or swamp sumach, has long been reputed to cause irritation of the skin in some people and to be inert in others, a reputation also pertaining to the preceding species. A saturated alcoholic solution of lead acetate is considered a specific. The fluid extract of Grindellia is similarly employed.

SUMAROKOV, sōō′mȧ-rō′kôf, Alexander Petrovitch (1718–77). A Russian writer of the pseudo-classical period. He was born in Finland, was well educated, entered the military service, became Count Rumiantsev's adjutant, and later reached a high rank. When the first permanent theatre was established at St. Petersburg in 1756 he was made director, and also wrote plays for production at the theatre. Petty of character, quarrelsome, and overambitious, he left the capital, incensed at the insufficient recognition he had received, and began to stage his works at Moscow. After a time he got into disputes with the management of the theatre there, and in despair took to drink, dying in obscurity. Although clumsy and ineffective, his tragedies played an important part in the development of the Russian drama, into which he was the first to introduce the French pseudo-classical theory. His comedies and satires have a great deal of genuine humor and wit, and have influenced considerably Sumarokov's followers. Sumarokov attempted every kind of literary production except the novel. His works were published at Moscow (2d ed., 10 vols., 1787). His best-known drama, *The False Demetrius,* has been rendered into English as *Demetrius the Impostor* (London, 1806).

SUMATRA, sōō-mä′trȧ. One of the Sunda Islands, the most westerly, also the largest, not reckoning Borneo, of the Dutch East India Islands, separated from the Malay Peninsula by the Malacca Strait, and from Java by the Sunda Strait (Map: East India Islands, B 5, 6). It extends in a northwest and southeast direction. Its length is 1050 miles; its breadth ranges from 90 to 240 miles. Area, 161,612 square miles.

A high mountain, the Barisan, which widens into three or four parallel ranges, including plateaux, and which is marked by many volcanoes, follows the west shore. To the east, in all the central part, extend lower stretches of level and undulating country sloping eastward, where all the main rivers are found, flowing eastward, often through marshy flats at the coast. The highest elevation, Korintji, 12,480 feet, is in the Residency of Padang in the middle of the island. In the north are plateaus averaging 4000 feet in elevation; next south is a region of extinct volcanoes and deep valleys; in the middle belt are also volcanoes rising to 10,000 feet; the heights diminish in the south but the character of the mountains are not so well known. At least eight active volcanoes exist, and the number of volcanic peaks and craters is large (66 being known).

There are numerous lakes; among the largest are Toba, high up among the northern mountains; Maninju, 50 square miles, in a crater, Singkara, of like size and the source of the Ombilin River and Korintji, near the peak of the same name.

The main rivers are the Musi, Jambi, Indragiri, and Kampar. They are of much importance for navigation. Around a large part of the coast extend rows and groups of islands of more or less significance, and once a portion of the mainland—Banka, Linga, Rupert, Simalu, Siberut, etc. As a whole, Sumatra geologically belongs to the neighboring continental regions; sandstone, limestone, slate, and eruptive formations abound in the island.

The equator passes nearly through the centre of the island; accordingly the even temperature is constantly high, the mean annual temperature ranging from 77° F. to 81° F. The annual rainfall varies from approximately 90 to 185 inches. The lower sections of the island are unhealthful and thinly peopled, the higher are pleasant and habitable. Thunderstorms and waterspouts occur frequently, and earthquakes now and then. The flora is practically that of the Malay Peninsula and Borneo, containing a few remarkable special features, such as gigantic forms of arum. A large part of the island is overgrown with trees and foliage. The mountains are rich in tall timber. Oak, camphor, and teak trees abound. Sumatra is unsurpassed for fauna, nearly all the large equatorial types being present. Buffaloes are the leading live stock. The rhinoceros, elephant, tiger, tapir, panther, deer, and many species of the ape are also largely represented. The supply of minerals is large. The island yields coal abundantly, and large tin deposits on Singkap Island on the east coast are being worked. Petroleum wells flow in the Palembang region, and there is an important output of petroleum in Langkat.

Agriculture is the occupation of the natives. All the tropical crops are or can be grown. The native princes and the government farm out land to cultivators. The natives skillfully manufacture filigree articles in gold and silver, fabrics, and household articles. The northeast coast, around Deli, is a rich and extensive tobacco country. The pepper trade is important. Coffee, bamboo, rubber, copra, and gums are also exported. There are many good roads in various coast districts, and a fair one from Palembang to Benkulen. A railway extends from Padang to coal mines in the interior; altogether there were in operation, in 1912, 337 kilometers (209 miles) of railway.

Java and Madura are the central, civilized, and most important part of the Dutch East Indies, the remainder being known as outposts or outpost provinces. Seven of these outpost provinces are included in Sumatra. So far as is practicable the government is patterned after that of Java, but Dutch control in much of the interior is merely nominal. Besides several Dutch residents there is a governor for the administration of the West Coast and a civil and military governor for Achin (Atjeh). The area of these seven outpost provinces, which include many small islands off the coast, is computed at 178,694 square miles; of Sumatra proper, somewhat less than 167,500 square miles. The most recent available returns of population are for 1905; these, with areas, are shown in the table.

Of the total population in 1905 the number of indigenes was returned at 3,962,107; Chinese, 148,946 (of whom 99,236 in the East Coast); Europeans, 8190. The principal towns are Padang (with 91,440 inhabitants in 1905), Palembang (60,985), Benkulen, Deli, Achin, and Jambi.

OUTPOST PROVINCES	Sq. miles	Pop., 1905
West Coast:		
Padang Highlands	......	403,431 [3]
Padang Lowlands	......	905,040 [3]
Tapanuli	......	413,301 [3]
Total West Coast	31,788	1,721,772 [3]
Benkulen	9,437	204,269 [4]
Lampong Districts	11,338	156,518 [3]
Palembang	53,718	796,354 [3]
East Coast	35,481	568,417 [4]
Achin	20,550	582,175 [4]
Riouw [1]	16,382	112,216 [4]
Grand total [2]	178,694	4,141,721 [4]

[1] Consists of Indragiri in Sumatra and the Riouw and Lingga archipelagoes.
[2] Including outlying islands except Banka.
[3] Fairly accurate.
[4] Approximate.

The natives of Sumatra, exclusive of the intruding Hindus, Arabs, Tamils, Indo-Chinese, and Chinese, belong to the Malayan stock, linguistically and physically, although some authorities group as Indonesians such peoples as the Battaks and a few others. Among the most important and most interesting tribes are the Achinese of the extreme northwest, noted for their long struggle against the Dutch, the Battaks of the northern interior and northwest coast, and their neighbors in the Nias and Batu islands, the Kubus, a very primitive people of the forests and marshy regions of Palembang, the so-called Menangkabau Malays of the middle of the island and other parts east and west, the Palembangs, Rejangs, Passumahs, Lampongs, and other tribes to the south, and the Abongs. The Malayan people of Sumatra exhibit many varieties of culture, from that of the forest-dwelling Kubus and other tribes of a primitive sort to those who under Hindu, and centuries later under Mohammedan, influences reached a considerable degree of culture, with religious and commercial as well as political development and expansion. The first intrusions of Hindu life and culture into Sumatra began some time before the Christian era. Traces of Hinduism are evident in architecture, religion, and language. It was in all probability from Java that Buddhism in the sixth century made its way into Sumatra, where, however, it never obtained general vogue. The Battaks, some of whose divinities bear corrupted Indian names, possess an alphabet of Hindu origin. Hindu influences were probably at their height in the eighth century. From the thirteenth to the fifteenth century Mohammedan influences prevailed and many of the tribes were converted to Islam and a number of sultanates were established. The Mohammedan influence upon politics, religion, and language was great. Since then the various European conquerors and intruders (Portuguese, English, Dutch) have made themselves felt, but chiefly in the coast regions. On the whole the native population of Sumatra, as is also the case in Java, is on the increase. Mohammedanism is generally professed in the coast districts and also to a great extent in the interior.

Marco Polo visited Sumatra in 1292, and the first Portuguese in 1508. In the seventeenth century the Dutch obtained a firm foothold, having forced out the Portuguese. From 1812 to 1819 the English held the island. In 1825 Benkulen, where the English had been established for nearly a century and a half, was transferred to the Dutch. The conquest of the natives has been in progress since the discovery of the island and has not yet been entirely completed, although almost all of the island is now under the control of the government.

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SUMBA, sōōm'bȧ, or Sandalwood Island (q.v.). One of the Sunda Islands (q.v.).

SUMBAWA, su̦m-bä'wȧ. An island of the Dutch East Indies, one of the Sunda group, situated between Lombok and Flores (Map: East India Islands, E 7). Its area is 4300 square miles, but including the neighboring islands it is 5240 square miles. Four mountain ranges traverse Sumbawa from west to east, the northern being volcanic with Tambora (9055 feet), the southern containing a limestone formation. Mid-Sumbawa is a region of circular hills of lava and tufa, and the land is covered with a long silver-colored grass. The natives engage in agriculture. Sumbawa, with its four free states, is included, for the administrative purposes of the Dutch, under Residency No. XI of Insulinde or Island India (government of southern Celebes). The population is 75,000, of which 11,000 are foreigners, who control the trade.

SUMBUL, sŭm'bŭl *or* su̦m'bu̦l. See Musk Plant.

SUM'DUM' (or **HOLKHAM**) **BAY.** One of the most remarkable of the glacial fiords of southeast Alaska, situated about lat. 57° 30′ N., long. 133° W., and debouches into Stephens Passage (Map: Alaska, N 7).

SU'MENEP. See Madura.

SUME'RIAN LANGUAGE. The language spoken by the Sumerians. (See Babylonia.) The first successful decipherers of the cuneiform characters, Hincks, Rawlinson, and Oppert, observed that the wedge-shaped signs were employed in writing languages not akin to the Assyrian, that the inventors of this system of writing cannot have been Semites, since the signs have syllabic values and some characteristic Semitic sounds are not represented, and that one of these languages was used in Babylonia itself. Hincks thought that these languages were Aryan; Rawlinson regarded them as Scythian, meaning by this term Mongolian; Oppert considered the Babylonian non-Semitic tongue as Kasdo-Scythian. The term "Accadian" was first used by Rawlinson in 1855, the term "Sumerian" by Oppert in 1869. There was practical unanimity among all Assyriologists before 1874 as to the agglutinating and non-Semitic character of this language. In that year, however, Halévy began his protest against the very assumption that the Sumerian language ever existed. He first attempted to prove that the Sumerian language did not belong to the Turanian family and that the Turanian people cannot be supposed to have lived in Babylonia, and then maintained that the texts claimed to be Sumerian could be regarded as composed in an ideographic writing invented by the Assyrians in addition to the phonetic system and having the same values in pronunciation. Of the Sumerian signs in the syllabary, he found Semitic values for 114. In 1876 Halévy modified his view by admitting that the Sumerian signs could not have been pronounced like the ordinary Assyrian words. In his opinion the so-called Sumerian was only a hieratic or priestly system of writing used as a cryptography for purposes of concealment. Against this theory especially Oppert and Lenormant, Sayce, and Schrader urged many arguments, such as the impossibility of finding real Semitic values for the Sumerian signs and the improbability of an artificial language having been created as a secret means of communication between priests and then used for inscriptions in which kings recount their victories and their building enterprises. In 1880 Haupt indicated the existence of two dialects, Emeku and Emesal, of the Sumerian as shown by certain differences observed by earlier scholars without full appreciation of their significance. Even in view of this fact, explained by Halévy as due to varieties of cryptography, the difficulty of classifying the Sumerian, the apparent silence of the monuments concerning a nation speaking this language and conquered by the Babylonians, and the manifest influence of the Semitic speech on the vocabulary, led some scholars to hesitate. Meanwhile the study of the Sumerian, on the assumption that it was a real language, continued. Lehmann's investigations rendered it probable that the native name of the people speaking this language was Shumeri, in distinction from the Akkadi, who were the Semites. The Semitic language is indeed designated as Akkadian in contrast with the Sumerian in an inscription from the reign of Samsuditava (1963–32 B.C.), as Messerschmidt has shown (*Orientalistische Literaturzeitung*, Leipzig, 1905). In view of the Greek transcriptions of Sumerian words, published and discussed by Pinches and Sayce in 1902, it is no longer possible to doubt the existence of a Sumerian language; but these texts raise the question whether Hellenistic settlers in Babylonia between 146 and 80 B.C., the date assigned by Sayce, were learning an absolutely dead language for historical purposes or a tongue to some extent still spoken. Lehmann's opinion that the home of the Akkadians was in north Babylonia, that of the Sumerians in south Babylonia, which was still adhered to by King in 1910, may have to be modified in the light of the texts published by Scheil in 1911, showing that the earliest Sumerian dynasties, those of Opis and Kish, were north Babylonian.

The Sumerian is found in bilingual syllabaries and word lists, bilingual hymns and prayers, bilingual inscriptions of kings, and a constantly increasing number of unilingual inscriptions. Of these the earliest show the least evidence of a Semitic influence. These are in the Emeku dialect. Those in the Emesal dialect naturally reveal more traces of the Semitic vernacular. Sumerian loan words in the Akkadian, of which

Leander has counted 217, are taken from the Emeku dialect. The Sumerian is made up of monosyllabic roots and shows no tendency to triliterality; it is fond of compounds, which are rarely found in the Semitic languages, and expands its nouns by many prefixes and suffixes; it has no gender. The plural is often formed by duplication, as *kur-kur* (lands), *si-si* (horns), and sometimes by *ini;* the genitive is sometimes expressed by the suffix *ge* or *gid;* instead of prepositions it has postpositions, such as *-shu*, to, *-ta*, from, *-da*, with; the pronouns are either independent or pronominal suffixes, but altogether different from the Semitic; the numerals resemble the Semitic only in making the twenties, thirties, etc., in the plural, while the forms are entirely different; the verb has practically the same derived stems as the Semitic and Hamitic, but has a greater variety of prefixes, infixes, and suffixes. The attempts to discover the affinities of this language have not yet been successful, but it is probably the oldest known language in the world; it has an *e* vowel and an *o* vowel and also a consonant *f*, as the Greek transcriptions show. From the Sumerian vocabulary it is evident that the people who spoke this language had reached a comparatively high civilization. The sexagesimal system was in vogue, and the beginnings of astronomy and mathematics are with much plausibility ascribed to the race who spoke the *lishan Shumeri* or Sumerian language.

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SUMERIANS. See Sumerian Language; Babylonia, *Ethnology*.

SUMIDA-GAWA, sōō'mē-dā-gä'wā. A river in the island of Hondo, Japan, rising northwest of Tokyo on the border of the provinces of Musashi and Kai, and entering the Bay of Tokyo, after a course of some 90 miles. It is navigable for small boats. In Tokyo it is a place of popular resort. On its banks are tea houses, temples, and a great avenue of cherry trees. In July it is the scene of a great festival called "river opening."

SUMMARY PROCEEDINGS (from Lat. *summa*, main thing, substance, sum, fem. sing. of *summus*, superlative assigned to *super*, above, over). Proceedings in the nature of trials which are conducted before judicial officers without juries, and in a speedy and peremptory manner. Such proceedings must be specially authorized by statute, as they are not sanctioned by the common law. The Federal constitutional guaranty of the right to trial by jury does not extend to such civil and criminal cases as were not triable by jury at common law, thus leaving the States free to dispose of such cases by summary proceedings if they deem it expedient to do so. Most of the State constitutions also secure the right to trial by jury in all important cases. However, for the speedy administration of justice in trivial cases, both civil and criminal, the statutes of nearly all the States provide for the determination by summary proceedings of such petty misdemeanors as the violation of municipal ordinances as to fast driving, etc., disorderly conduct, and other minor offenses.

Certain statutory proceedings for the purpose of promptly ejecting or dispossessing tenants are also known as summary proceedings in some States. See Jury; Trial.

SUMMER. A term, found in old English architecture, applying to a chief beam of a floor, or what is ordinarily termed a girder. When a summer is used to support a wall or other superstructure, as in the front of a building, it is known as a breastsummer (q.v.). Summer is also used to denote a stone at the top of a pier or of a wall where an arch, lintel, or other work is supported.

SUMMER, INDIAN. See Indian Summer.

SUMMER DUCK. The wood duck (q.v.).

SUM'MERFIELD, John (1798–1825). An American Methodist clergyman, born at Preston, England. He was educated at a Moravian school. In 1812 his family removed to Dublin. Here he became dissolute and was finally imprisoned as the result of indorsing the notes of worthless companions. Converted in 1817, he joined the Wesleyans and in 1819 was preaching to immense audiences in Dublin. In 1821 he came to the United States and entered the ministry of the Methodist Episcopal church, joining the New York Conference. He was greeted with enthusiastic crowds wherever he spoke. A short time before his death he was instrumental in founding the American Tract Society. He was the author of *Sermons and Sketches of Sermons* (1842). Consult John Holland, *Memoirs of the Life and Ministry of Rev. John Summerfield* (New York, 1829; 6th ed., 1844); W. M. Willett, *The Life of Rev. John Summerfield* (Philadelphia, 1857).

SUMMER REDBIRD, or **TANAGER.** See Tanager.

SUM'MERS, Sir George. See Somers, Sir George.

SUMMERS, Thomas Osmund (1812–82). An American Southern Methodist clergyman, editor, and theologian. He was born at Corfe Castle, Isle of Purbeck, Dorsetshire, came to America in 1830, and joined the Baltimore Conference (1835). He was missionary to the Republic of Texas (1840); was transferred to the Alabama Conference (1843); was secretary of the Louisville convention where the Methodist Episcopal Church South was organized; and subsequently was secretary of every General Conference of his church until his death. As general book editor from 1845 until his death, he edited most of the publications of the denomination. He founded the *Sunday School Visitor* and edited it for four years; the *Quarterly Review* he edited for nine years. Summers was professor of systematic theology in Vanderbilt University and dean of the theological faculty (1872–82). He wrote numerous works, including a commentary in six volumes on the Gospels, Acts, and Romans (1868–74) and *Systematic Theology*, edited by J. J. Tigert (2 vols., 1888). Consult O. P. Fitzgerald, *Dr. Summers: A Life Study* (Nashville, 1884).

SUMMERS, Walter Coventry (1869–). An English classical scholar. He was educated at St. John's College, Cambridge, and was lecturer in Latin at Owens College, Manchester (1895–1903), and thereafter was professor of Latin at the University of Sheffield. His publications include: editions of Sallust (1900, 1901), Ovid (1902), Tacitus (1904), and of Selected Letters of Seneca (1910); *A Study of the Argonautica of Valerius Flaccus* (1894); texts of Persius and Silius Italicus in the *Corpus Poetarum Latinorum* (1900–04); *The Authorship of the Hercules Oetæus* (1905); and the discussion of "Silver Poetry" in J. E. Sandys's *Companion to Latin Studies* (1910).

SUMMER SCHOOL. The name applied either to institutions the sole purpose of which is the giving of instruction during the summer months, or to the summer sessions of any institution of learning. Some universities in the United States offer courses extending over a part of the summer, and a few, like the University of Chicago, have regular summer quarters as part of the system of continuous sessions. The successful completion of summer-school courses gives credit towards the degrees of the institution at which they are taken. Other summer schools exist independently, usually at some situation favorable for summer resort. Such are the schools at Chautauqua, N. Y. Conditions of admission are usually not required. Certificates are given for work done. More recently city-school systems have introduced vacation schools in the summer, chiefly for backward pupils and for physical culture.

SUMMERSIDE. A town and the county seat of Prince County, Prince Edward Island, Canada, situated on Northumberland Strait and on the Prince Edward Island Railway (Map: Prince Edward Island, G 3). It is a centre of the fox-ranching industry and has an export trade in oysters and lobsters. Pop., 1901, 2875; 1911, 2678.

SUM'MERSON, Esther. The heroine of Dickens's *Bleak House*.

SUM'MERVILLE. A city in Richmond Co., Ga., adjoining Augusta on the northwest, on the Central of Georgia Railroad. It is a residential suburb of Augusta and a winter resort. A United States arsenal situated here is the headquarters of the Ordnance Department of the Gulf. Pop., 1900, 3245; 1910, 4361.

SUMMER YELLOWBIRD. See Warbler.

SUMMIT. A city in Union Co., N. J., situated on the top of the Orange Mountains, 12 miles west of Newark, on the Delaware, Lackawanna, and Western and the Rahway Valley railroads (Map: New Jersey, D 2). It is attractive because of its elevation and the natural beauty of its scenery. It has a public library, the Overlook Hospital, and many fine suburban homes. There is a silk factory with 400 hands. Pop., 1900, 5302; 1910, 7500; 1915 (State census), 9136.

SUMMONS (OF. *semonse*, Fr. *semonce*, summons, admonition). A writ or process by which a defendant is notified to appear in court and answer the cause of action alleged in the plaintiff's complaint or declaration. It has superseded the *original writs* for the purpose of beginning an action in England and in most of the United States. In the absence of statutory provisions to the contrary, a summons must be signed by the clerk of the court in which the action is brought, but under the codes it is usually signed by the plaintiff's attorney. See Procedure; Service of Papers and Process; Writ.

SUM'MUM BO'NUM. See Ethics.

SUM'NER, Charles (1811–74). An American statesman. He was born in Boston, Jan. 6, 1811, graduated at Harvard in 1830; entered the Harvard Law School the following year, and was admitted to the bar in 1834. In early life he maintained unusual literary activity, writing chiefly upon legal topics, and appearing as a lecturer. His strength becoming overtaxed from literary labor, he sailed for Europe in 1837, traveling for three years, devoting much time to languages, literature, and history. Returning to America in 1840, he began to take an active interest in the antislavery movement, and in 1845 he delivered a notable Fourth of July oration at Boston, on "The True Grandeur of Nations." This gave offense to prominent Whigs and led eventually to his withdrawal from their party. This oration was soon followed by others of great force, mainly against slavery. He was a leader of the "Conscience Whigs" of Massachusetts, who helped to form the Free Soil party. In 1851, through a combination of Free Soilers and Democrats, he was elected to the United States Senate, of which body he was a member until his death. Here he waged an uncompromising war on slavery. His first important speech (August, 1852) was entitled "Freedom National; Slavery Sectional." This was followed in 1856 by another on "The Crime against Kansas," in which he reflected severely upon Senator Butler of South Carolina. This arraignment led to an assault in the Senate Chamber upon Sumner by Preston Brooks (q.v.), a Southern Representative and a relative of Butler, Sumner being so injured that he was incapacitated for nearly four years. This attack led to the disease which ended his life. In December, 1859, he resumed his seat, but took little part in the debates until the middle of 1860, when he delivered a speech on "The Barbarism of Slavery." From the beginning he was recognized as one of the leading men in the Republican party. In 1861 he became chairman of the Senate Committee on Foreign Relations, and made a number of able speeches on questions of foreign concern during the war, notably on the Trent Affair (q.v.).

For ten years of a critical period Sumner held this chairmanship. He took an active part in the debates on reconstruction and allied questions, ably advocating what came to be known as the "suicide theory" of the status of the Southern States at the close of the war. He favored negro suffrage, since he believed the negro could only be protected by giving him the ballot. (See Reconstruction.) He supported impeachment proceedings against President Johnson and secured the enactment of a civil rights law to secure equality of treatment to negroes in public places, subsequently declared unconstitutional by the Supreme Court. He broke with the Grant administration on the question of the annexation of Santo Domingo, and in 1872 joined the Liberal-Republican movement in advocating the election of Greeley for President. Sumner was a pioneer in civil service reform, and in 1864 introduced such a bill in the Senate. Sumner's *Works* were published in 15 volumes (Boston, 1874–83). Consult: E. L. Pierce, *Memoir* (4 vols., Boston, 1877–93); Moorfield Storey, *Charles Sumner*, in the "American Statesmen Series" (ib., 1900); G. H. Haynes, *Charles Sumner* (New York, 1909); W. G. Shotwell, *Life of Charles Sumner* (ib., 1910); Gamaliel Bradford, *Union Portraits* (Boston, 1916).

SUMNER, Edwin Vose (1797–1863). An American soldier, born in Boston, Mass. He was educated at Milton Academy, entered the United States army, serving in the Black Hawk War, and on the Western frontier. In 1838 he took charge of the school of cavalry practice at Carlisle Barracks, Pa. In the Mexican War, having attained the rank of major, he participated in all engagements of Scott's army from Vera Cruz to the city of Mexico, was wounded at Cerro Gordo, and for gallantry in holding in check a body of 5000 Mexican lancers at Molino del Rey was brevetted colonel. In March, 1861, he was promoted to the rank of brigadier general, and relieved Albert Sidney Johnston (q.v.) of the command of the Department of the Pacific. In the following year he was recalled and placed in command of the First Corps of the Army of the Potomac. He distinguished himself in the Peninsular campaign, particularly at Seven Pines (q.v.); was twice wounded in the Seven Days' Battles; was brevetted major general in the regular army and was appointed major general of volunteers; and took part at Antietam, where he was again wounded. He commanded the right wing of Burnside's army at Fredericksburg. Relieved at his own request after the appointment of Hooker to succeed Burnside, he was assigned to the command of the Department of Missouri, and died suddenly while on his way thither.

SUMNER, Increase (1746–99). An American jurist, born at Roxbury, Mass. He was educated at Harvard, where he graduated in 1767, and studied law in the office of Samuel Adams. He was admitted to the bar in 1770, and he was a member of the State Constitutional Convention of 1779. In 1782 he was elected to Congress, but at the same time was offered an associate justiceship of the Supreme Court, which he held till 1797. In 1789 he was a member of the convention which adopted the Constitution of the United States. In 1797 he was elected Governor of Massachusetts, and held that office during the remainder of his life.

SUMNER, William Graham (1840–1910). An American economist, born at Paterson, N. J. He graduated at Yale in 1863, studied at Göttingen and Oxford, and was tutor at Yale in 1866–69. Ordained in the Protestant Episcopal church in 1867, for some time he was assistant at Calvary Church, New York, and rector at Morristown, N. J. After 1872 he was professor of political and social science at Yale. His pungent and incisive advocacy of free trade attracted wide notice. Among his writings are: *History of American Currency* (1874); *Lectures on the History of Protection in the United States* (1875); *Life of Andrew Jackson* ("American Statesmen Series") (1882); *What Social Classes Owe to Each Other* (1882); *Essays in Political and Social Sciences* (1883); *Protectionism* (1885); *Robert Morris* (1891); *The Financier and Finances of the American Revolution* (1892); *A History of Banking in the United States* (1896); *Folkways* (1907). Posthumously published were *Earth-Hunger and Other Essays* (1913) and *The Challenge of Facts and other Essays* (1914).

SUMNER METHOD. See Navigation.

SUMO, so͞o′mō. A Central American tribe. See Ulua.

SUMP'TUARY LAWS (Lat. *sumptuarius*, relating to expenditure, from *sumptus*, expenditure, expense). Laws to prevent extravagance in private expenditure, and indirectly to prevent immorality and crime. The purpose of sumptuary legislation may be grouped under the following heads: (1) To prevent poverty and diminish the cost of supporting the poor; (2) to increase the possible revenue of the state by diminishing private expenditure; (3) to prevent luxury when considered an evil; (4) to favor certain commercial or political interests; (5) to enforce class distinctions; (6) to prevent the consumption of commodities, as liquors and tobacco, which are considered dangerous to health and morals. Sumptuary laws were common in ancient legislation. By means of them Greece endeavored to inculcate simple habits of life among her people. Women, except prostitutes, were forbidden to wear expensive attire, as gold or embroidered apparel. The laws of Solon forbade costly banquets and funerals. At an early period in Roman history the censors, to whom was intrusted the superintendence of public and private morality, punished all persons guilty of luxurious living; but as the love of luxury grew with the increase of wealth and foreign conquest, various legislative enactments were passed with the object of restraining it. The Twelve Tables limited expenditures for funerals. Other early laws of Rome limited the expenditures of women, specified the number of guests at an entertainment, etc.

Sumptuary laws found favor in England from the time of Edward III down to the Reformation. In the reign of Edward III one act prohibited more than two courses at a meal or more than two kinds of food at a course, except in the principal festivals. Another act prescribed the kinds of clothing the various classes might wear, except for the nobility above the knights.

When the mercantilistic theories of government emerged nations endeavored to control consumption by prohibiting the use of commodities produced abroad. It was held that the luxury of a people enriched other nations and impoverished their own. An English law prohibited the wearing of silk in order to encourage the manufacture of woolen goods in England. In France a law at one time prohibited the wearing of gold and silver embroidery, silks, and fine linens.

Aside from protectionism sumptuary legislation to-day comes under the head of police regulations and is aimed to preserve the public health and morals. Under the United States Federal and State constitutions no restriction can be placed on the consumption of commodities or traffic in them, save as the public health, protection, and safety require it. The chief restrictive legislation is directed against the traffic in intoxicating drinks. Consult: W. Denton, *England in the Fifteenth Century* (London, 1888); W. J. Ashley, *Introduction to English Economic History and Theory* (2 vols., New York, 1893); William Cunningham, *Outlines of English Industrial History* (3d ed., Cambridge, 1904).

SUMTER. A city and the county seat of Sumter Co., S. C., 43 miles by rail east by south of Columbia, on the Atlantic Coast Line, the Carolina, Atlantic, and Western, and the Southern railroads (Map: South Carolina, D 3). It is known for its large trade in cotton. There are a cotton compress, cotton and cottonseed-oil mills, lumber mills, telephone, magneto, buggy, shoe and building-supply factories, a foundry and machine shop, tobacco flue shops, coffin and casket factories, and a manufactory of golf sticks. Noteworthy features are the St. Joseph's Academy for Girls and the Y. M. C. A. The commission form of government was adopted in 1913. Pop., 1900, 5673; 1910, 8109; 1915 (U. S. est.), 9392.

SUM'TER, FORT. See FORT SUMTER.

SUMTER, THOMAS (1734–1832). An American soldier, born in Hanover Co., Va. He early removed to South Carolina; fought against the Cherokees; served under Braddock in 1755, and in March, 1776, became lieutenant colonel of the Second Regiment of South Carolina Riflemen. Until the capture of Charleston (1780), he served in the interior of the State against the Loyalists and Indians; but subsequently raised a regiment in North Carolina and engaged actively in partisan warfare. On July 12, 1780, he defeated a force of mounted infantry under Captain Huck, and soon afterward was made a brigadier general of State troops. On August 1st he made a spirited but unsuccessful attack on Rocky Mount, and on August 6th defeated 500 regulars and Tories at Hanging Rock, but was subsequently driven back. He then cut Cornwallis' line of communications between Charleston and Camden, capturing a supply train; but later his force was almost annihilated by Tarleton at Fishing Creek. Enlisting another regiment, he defeated Major Wemys at Broad River (November 9th), and on November 20th repulsed an attack of Tarleton at Blackstock Hill, with great loss to the latter. Here Sumter was severely wounded, but he returned in February, 1781, and continued to render efficient service as a partisan commander. After the war Sumter sat in the State convention of South Carolina which ratified the Federal Constitution, was a member of Congress in 1789–93 and 1797–1801, and of the United States Senate from 1801 to 1809 and again from 1811 to 1817, and was United States Minister to Brazil in 1809–11. He was the last surviving general officer of the Revolution. Consult E. McCrady, *The History of South Carolina in the Revolution*, 2 vols. (New York, 1901–02).

SUMY, so͞o′mė. The capital of a district in the Government of Kharkov, Russia, situated 125 miles northwest of Kharkov (Map: Russia, D 4). Its chief manufactures are machinery, tobacco, and liqueurs. Pop., 1911, 51,545.

SUN (AS. *sunne*, Ger. *Sonne;* connected with AS. *sol*, Lat. *sol*, sun). The central governing body of the solar system (q.v.), and the chief source of light and heat. To us the sun is the most important of all the heavenly bodies, since upon it depends life on the earth. The sun's apparent angular diameter is 32′ 0″; diameter in miles, 865,000; density, 1.41, water being 1; mean distance from the earth, 92,930,000 miles. The sun's distance from the earth is the fundamental unit of linear measures in cosmic astronomy. The method of the determination of this distance is given under PARALLAX.

Successive generations of astronomers have been able to gather much information as to the appearance, constitution, and structure of the sun. The theory at present accepted is as follows: The visible light-giving surface, as we see it in the telescope, is called the photosphere. It may be a collection of luminous clouds, holding in suspension certain particles condensed out of the extremely hot gaseous material of which the innermost nucleus of the sun is probably composed; or it may be purely gaseous, under sufficient pressure to yield a continuous spectrum. Just outside the photosphere is a thin shell of gaseous matter called the reversing layer, composed of many substances such as we find among the known chemical elements of our earth. It is observed, and its existence demonstrated, by the spectroscope. According to Kirchhoff's theory, when light coming from incandescent solids or liquids (or gases under pressure) is passed through vaporized matter, the vapors absorb or cut off the light from certain definite parts of the spectrum. To each vaporized substance belongs its own series of such points in the spectrum; and these correspond exactly to the positions which would be occupied by bright lines in a spectrum derived directly from such vaporized substances themselves, if rendered incandescent. Thus the ordinary solar spectrum is crossed by certain well-known dark lines corresponding to the absorption of certain parts of the photospheric light by the vapors of the reversing layer. Now if it were possible to get rid of the light of the photosphere and examine directly the light of the reversing layer, we ought to see the spectrum of ordinary incandescent gases. This observation can actually be made at the time of a total solar eclipse. If we watch the solar spectrum very carefully just before the beginning of totality, when the moon's advancing edge is on the point of obscuring the sun completely, there will come a moment when nothing remains in sight but the gases of the reversing layer. At that instant the dark lines in the spectrum are suddenly reversed, becoming bright like the lines in the spectrum of a gas heated to incandescence artificially in the laboratory. This remarkable observation was made by Young (q.v.) at the Spanish eclipse of 1870, and repeated photographically at many subsequent eclipses. All of these bright lines can now be photographed on any clear day of good definition with the powerful spectrograph and tower telescope of the Mount Wilson solar observatory (q.v.).

The chemical constitution of the sun has been studied with great care spectroscopically. The spectroscope, when suitably arranged for the purpose, enables us to compare solar light with light obtained in the laboratory from vapors of terrestrial substances raised to incandescence by artificial heating. In this way many terrestrial chemical elements have been identified in the sun; in fact, if the earth were heated to the temperature of the sun it would give a very similar spectrum. This is a fact of importance in its bearing on the origin and evolution of the solar system. See NEBULÆ; COSMOGONY.

The most conspicuous phenomena of the solar surface are the sun spots (Fig. 1). These resemble great holes or depressions in the photospheric surface, usually having a dark spot in the middle surrounded by a sort of radial grating. They vary in diameter from 500 to 30,000 miles for the central dark part (umbra) and range up to 100,000 miles or more for the surrounding less dusky portions. At times they are large enough to be seen with the naked eye. The faculæ are bright streaks seen in various parts of the photospheric surface, but usually near spots, and most conspicuous when approaching the edge of the solar disk. The spots usually begin as mere dots, and then grow gradually or rapidly to the enormous dimensions already stated. At times they break into several pieces, giving rise to a group or collection of several spots. They are by no means immovable upon the solar surface, but have more or less irregular motions of their own, those near the sun's equator traveling (on the average) farther from the poles, and those in higher solar latitudes increasing their distance from the equator. But no sun spots are ever found farther from the solar equator than lat. 45°, and few are nearer the equator than lat. 5°. One of the most remarkable things about the spots is the fact that their frequency is periodic. Once in about 11 years they have a maximum frequency, and astronomers are able to record their occurrence in greater numbers than usual. The cause of this periodicity is unknown.

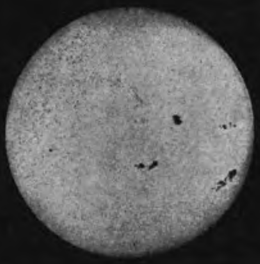
The so-called chromosphere is a great layer composed of very hot gases, principally hydrogen, helium, and calcium vapor, surrounding the sun chiefly outside the reversing layer, which may be regarded as its lower portion. It is supposed, however, that both these strata are mixed together, except that the hottest and densest gases are in the lower or reversing layer. This chromospheric layer can be seen for an instant at the beginning or end of a total solar eclipse, and it is found to consist principally of a mass of red flames. The color is due to the preponderating presence of hydrogen, and it is this color that gives rise to the name chromosphere or colorsphere. The presence of flame does not, however, indicate a process of combustion in the usual sense of the word. For instance, coal burning in an ordinary stove is really being combined chemically with the oxygen of the air, and chemical combination of that character is certainly not going on in the sun.

The most interesting features of the chromosphere are the prominences. These are great eruptive jets of luminous hydrogen, helium, and calcium vapor rising from the solar surface, sometimes to a distance of hundreds of thousands of miles into space. They were first seen during total solar eclipses, when the bright light of the central solar disk had been obscured by the interposed moon. Under ordinary circumstances the central solar light illuminates our terrestrial atmosphere very strongly, and enough of this light is reflected from the air itself into our telescopes to mask completely the fainter light of the prominences. But it has been found possible to study the prominences spectroscopically during full sunlight, and without waiting for a solar eclipse. This was first done visually in 1868 by Janssen, Lockyer (q.v.), and Huggins (q.v.), and photographically by Hale (q.v.) in 1892 and Deslandres in 1894. The two latter astronomers working independently of each other, the former in Chicago and the latter in Paris, devised certain instruments called spectroheliographs, by means of which it is possible to take pictures of the chromosphere and prominences over the entire solar circumference at once and in full sunlight (Fig. 2). It has been learned from observations with the spectroscope and spectroheliograph that the velocity of motion in eruptive prominences may be as great as several hundred miles per second, indicating real explosions of incalculable force. But many of the prominences are cloudlike or quiescent, and change slowly in form. Fig. 3 represents a quiescent prominence about 80,000 miles high, photographed with the spectroheliograph on Mount Wilson.

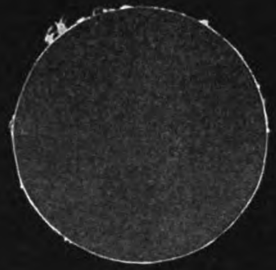
Besides recording photographically the chromosphere and prominences on the sun's circumference, the spectroheliograph has opened to investigation the solar atmosphere in projection against the disk. Thus, while a direct photograph of the sun shows only the spots (Fig. 1) and occasionally a few bright faculæ near the circumference, a spectroheliogram reveals extensive bright clouds of calcium vapor (the *flocculi*) in the solar atmosphere (Fig. 4). In general, these are too low to appear as prominences at the circumference. But by adjusting the spectroheliograph so as to photograph the disk with the red hydrogen line (*Hα*), we can record the prominences themselves in projection. We can also render them visible in relief, by applying the principle of the stereoscope (q.v.), which unites into a single image two photographs taken from different points of view, and thus corresponding to the different images of a terrestrial object seen with the two eyes. In the case of the sun, the axial rotation provides the simplest means of obtaining the two images required. We combine for the stereoscope two photographs of the hydrogen flocculi taken a few minutes apart, and thus obtain the stereogram here reproduced (Fig. 5). This is a negative, as the best effect is obtained in this way; i.e., all of the bright regions shown are actually dark, and vice versa. In examining Fig. 5 with a stereoscope, two roughly circular white spots will be seen to the right of the centre. These mark the positions of two sun spots, which were members of a group containing several other spots here concealed by the overlying atmosphere. The structure of the chromosphere is like that of a field of grain, and the tips of the slender columns, which appear like bright dots (in reality dark) in the undisturbed region near the edges of the picture, are drawn out by the wind that blows towards the spot group into filaments, which rise towards a higher level and finally end abruptly. In the adjoining cavity, of honeycomb structure, at the bottom of which the spots lie, a long ridgelike prominence rises precipitously to an elevation of several thousand miles.

Just above the centre of the picture there is a crater-like cavity resembling a chrysanthemum. This marks a whirling vortex immediately over a sun spot. When such vortices in the chromosphere were discovered with the spectroheliograph on Mount Wilson in 1908, it was inferred that the sun spots below them might also be vortices, similar to terrestrial tornadoes or waterspouts. Recent advances in physics had shown that all hot bodies give out electrically charged particles, and a whirling mass of such

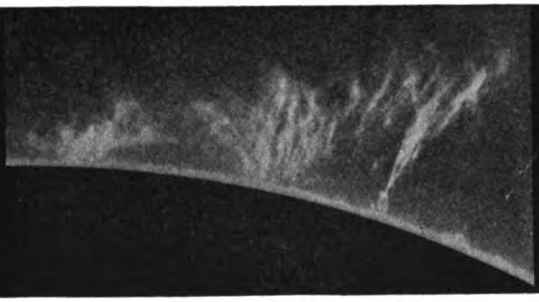
SUN



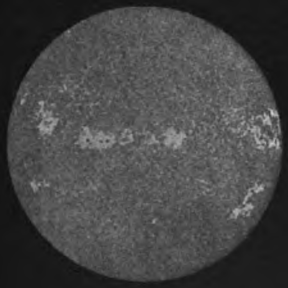
1. Direct Photograph of Sun, Aug. 7, 1908. The dark spots are sun-spots.



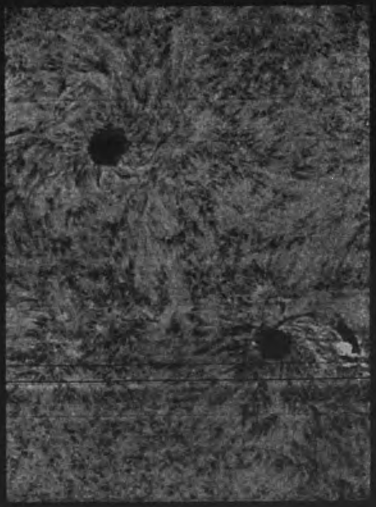
2. Chromosphere and prominences, photographed with spectroheliograph.



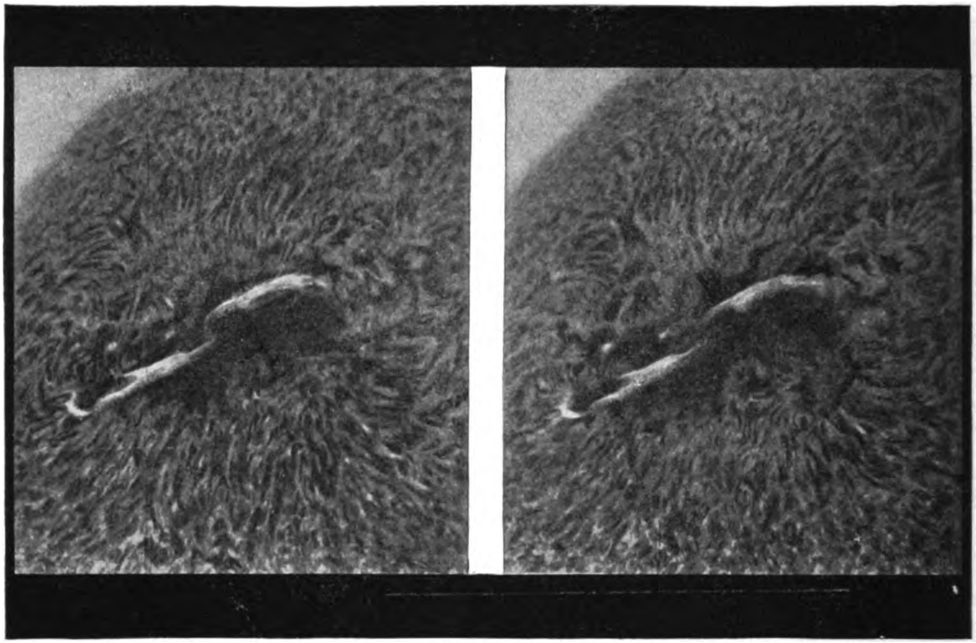
3. Solar prominence 80,000 miles high, photographed with spectroheliograph.



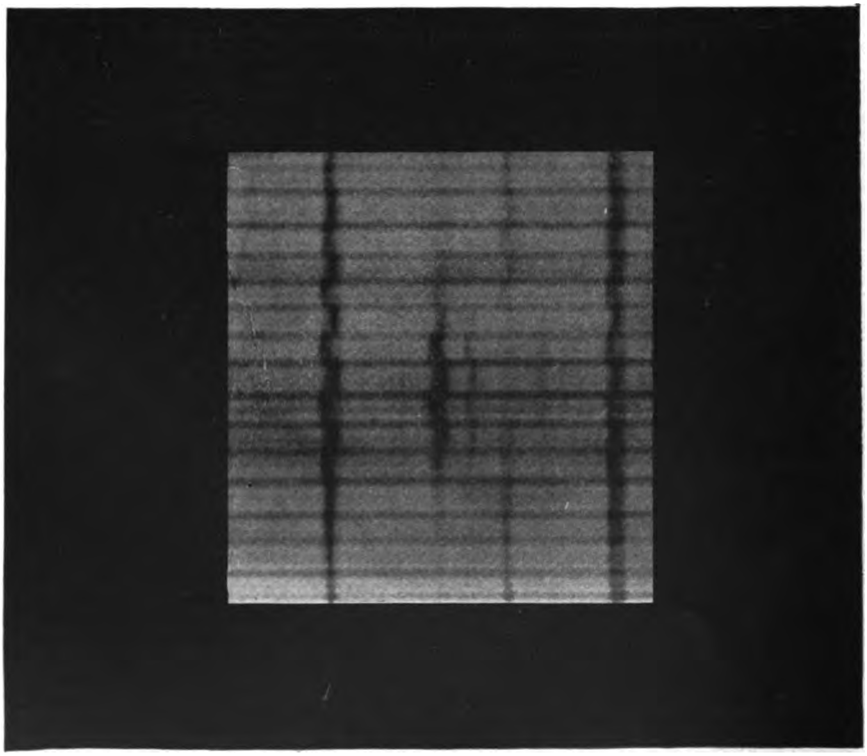
4. Spectroheliogram showing bright clouds of calcium vapor (Calcium flocculi,) Photographed with spectroheliograph.



5. Hydrogen flocculi surrounding sun-spots, showing right and left-handed vortices. Photographed with spectroheliograph.



6. Steroscopic view of the solar atmosphere above a group of sun-spots, August 7, 1915.



7. Portion of sun-spot spectrum, showing effects of magnetic field.

particles would produce a magnetic field if the negative charges preponderated over the positive, or vice versa. Hence a magnetic field was sought for in sun spots.

Zeeman discovered in 1896 that the single lines in the spectrum of iron and other substances are split up into three or more components if the luminous vapor which produces them is observed between the poles of a powerful magnet. Moreover, the light of these components is polarized in a perfectly characteristic way, so that either component can be cut off at will by means of suitable polarizing apparatus. This test, applied on Mount Wilson in 1908 to the lines of iron and other substances in the spectra of sun spots, which had previously been found to consist of two or more components, showed the distinguishing features of the Zeeman effect. In Fig. 7, which is reproduced from a photograph of a sun-spot spectrum taken with the 75-foot spectrograph of the 150-foot tower telescope of the Mount Wilson Observatory, the iron line λ6173 is plainly resolved into three components, of which the two outer ones are cut off alternately on the successive horizontal strips (which correspond to the strips of a quarter-wave plate used with a Nicol prism over the slit of the spectrograph).

Hundreds of lines in the spot spectrum exactly correspond in number of components and polarization phenomena with their laboratory counterparts, leaving no doubt that sun spots are electric vortices, containing magnetic fields of intensities sometimes as great as 5000 gausses. As a single glance at a spot spectrum shows whether the red or violet component of a Zeeman triplet is transmitted by a known arrangement of the polarizing apparatus, the magnetic polarity, corresponding to the direction of whirl, of the spot vortex can be learned. In this way the association of spots of opposite polarity in pairs and the law of their rotation in the northern and southern hemispheres have been determined.

The inference that sun spots are vortices, here based upon the presence of overlying vortices in the chromosphere and the existence of magnetic fields in the spots themselves, has been confirmed by the discovery of Evershed, who proved that the spot vapors are whirling rapidly by measuring their velocities of approach and recession with the spectrograph. His results, confirmed and extended by St. John, show that the vortices in the chromosphere are secondary phenomena, induced by the low-lying spot vortices in the photosphere below them.

Following up the discovery of magnetic fields in sun spots, the Mount Wilson observers have proved by similar methods that the entire sun is also a magnet. Its polarity is the same as that of the earth, while the intensity of its magnetism is about 80 times as great. The sun's magnetic axis also does not coincide exactly with its axis of rotation, but the inclination is apparently considerably less than in the case of the earth.

Extending far out beyond the chromosphere and prominences, and usually recognized as the sun's outermost envelope, is the corona. It is visible only at the time of total eclipse, when the central part of the solar disk is completely obscured. The appearance of the corona at such times is very sudden; the advancing edge of the moon slowly and gradually covers more and more of the sun's surface, until finally only a sickle-shaped filament remains. Then suddenly this too disappears, and on the instant the superb corona bursts into view, truly one of the most magnificent objects in the whole range of nature's phenomena. The inner corona, close to the solar disk, is relatively very bright; farther out it fades rapidly into a beautiful crown of filmy light. There are threadlike streamers, interlacing with complex involutions, and extending often many millions of miles into space above the solar surface.

Although observed visually from the most ancient times, it was not until the application of photography to astronomical observation that we have been able to fix with some approach to certainty the details of the coronal structure.

The corona undergoes more or less regular changes in form in a period of about 11 years, showing long equatorial extensions at the time of sun-spot minimum and a more uniform distribution in all directions at the spot maximum. Analysis of its light indicates distinct radial polarization in the outer corona, but this decreases and finally disappears near the sun. This polarization is doubtless caused, as in the earth's atmosphere, by diffuse reflection within the corona. Spectroscopically the corona reveals the presence of rare luminous gases, possibly containing in suspension particles of solid or liquid matter, but no existing theory will explain quite satisfactorily its mechanical construction. Possibly electric forces are wholly or partly responsible for its existence and radiation; certain it is that we still have in the corona one of the "pending problems" of astronomy. Very interesting questions are raised by a study of the sun's radiation of light and heat.

The extensive investigations of Abbot, made with an improved form of Langley's spectrobolometer and various types of pyrheliometers, have yielded a result of 1.93 calories for the so-called "solar constant" of radiation. This is the amount of radiation received from the sun in one minute on an area of one square centimetre at a point just above the earth's atmosphere. Although still retaining the old name of "solar constant," this quantity has been found by Abbot to undergo variations, which are often as great as 5 per cent within a single week. These short period variations appear to be irregular in character, both in amount and time. But there is also a small but distinct change of the solar radiation corresponding with the sun-spot period as Abbot's average values of the "solar constant" increase with the number of spots on the sun.

The temperature of the sun, as derived from determinations of the position of maximum intensity in its energy spectrum, is of the order of 6,000° C., or nearly twice that of the electric arc light. The source of its vast amount of light and heat has been for a long time a mystery. It cannot be a question of combustion, because in that case the sun would have been consumed long ago, even if made of solid coal. The theory most commonly accepted is due to Helmholtz. It assumes that the sun's bulk is slowly contracting, and that the energy thus produced is turned into heat. It has been computed that a diminution of 150 feet annually in the sun's radius would be sufficient to account for the heat developed. But as the past duration of the solar radiation as thus computed falls short of the demands of the geologists, it is possible that radioactive phenomena, involving the spontaneous disintegration of atoms, may account for the additional heat required. See RADIOACTIVITY.

The rotation of the sun on its axis occupies about 25 days (at the equator). This period is determined by watching the spots, faculæ, or flocculi, go around with the sun and also by spectrographic observations of the approach and recession of the eastern and western limbs. The rotation axis is inclined about 7° to the ecliptic plane, like that of the earth; if continued to the celestial sphere, it would pierce it midway between the bright star Vega and the polestar. And there is one very peculiar feature in the rotation due perhaps to the fact that the sun's vast bulk has not yet been completely transformed from the gaseous to the liquid or solid stage. The equatorial regions rotate faster than those in higher latitudes, showing the existence of strong rotary surface currents of different velocities. Moreover, Adams and others have shown that the absolute velocity and the law of its variation from equator to poles vary at different heights in the solar atmosphere. No thoroughly satisfactory explanation of these phenomena has yet been obtained by astronomers.

Bibliography. Sir J. N. Lockyer, *Solar Physics* (London, 1874); id., *Chemistry of the Sun* (New York, 1887); id., *The Sun's Place in Nature* (London, 1897); C. A. Young, *The Sun* (New York, 1900); Kayser, *Handbuch der Spectroscopie* (Leipzig, 1902); C. G. Abbot, *The Sun* (New York, 1911); R. A. Sampson, *The Sun*, in "Cambridge Manuals of Science and Literature" (Cambridge, 1914); R. W. Willson, *Times of Sunrise and Sunset in the United States* (Cambridge, Mass., 1914); W. T. Olcott, *Sun Lore of all Ages* (New York, 1914); also Mount Wilson Solar Observatory, *Contributions* (Chicago, Washington, 1905 et seq.); *Astrophysical Journal* (ib., monthly). See ASTRONOMY; APEX OF THE SUN'S WAY; ECLIPSE; ORBIT; PERTURBATIONS; PLANETS; SOLAR SYSTEM.

SUN, TEMPLE OF THE. An immense temple in ancient Rome erected by Aurelian, after the taking of Palmyra (q.v.) on the site of the early Pulvinar Solis on the Quirinal Hill. Consult S. B. Platner, *The Topography and Monuments of Ancient Rome* (2d ed., Boston, 1911).

SUN AND LION, ORDER OF THE. A Persian civil and military order of merit with five classes, founded in 1808 by Shah Fath Ali on the model of the French Legion of Honor. The decoration is a silver star, bearing a lion with a sword. See Plate of ORDERS.

SUN ANIMALCULE. See HELIOZOA.

SUN BEAR. See BEAR, *Sun Bear*.

SUNBIRD. A bird of the tropical passerine family Nectarinidæ, which may be regarded as occupying nearly the same place in the Old World as do the humming birds in America. They are all of small size, although none are so small as the smallest humming birds, which they rival in brilliancy of plumage. Like them, they feed partly on the nectar of flowers, which they suck by their long bill, but chiefly on the minute insects which the flowers attract; they do not, however, flutter on the wing when feeding, like humming birds, but perch on or beside the flower into which the bill is to be inserted. The species are very numerous, and are natives of the southern parts of Asia, the Eastern Archipelago, and Africa. The resplendent metallic plumage belongs only to the male, and only to the breeding season. They have been described and depicted in a magnificently illustrated monograph by Shelley, *The Nectarinidæ* (London, 1876–80). See Plate of CREEPERS.

SUN BITTERN (so called because of its brilliant ocellated plumage). A curious bird of South and Central America, about the size of a chicken, allied to the cranes and more closely to the kagu (q.v.), the two species of which constitute the genus *Eurypyga* and the family Eurypygidæ. It haunts river banks, feeds upon small fish, crustaceans, and insects, and utters a soft or plaintive, long-drawn whistle. In the mating season it executes a fantastic dance, with its wings spread about its head, showing a pattern comparable to the sun's rays. Its nest is a rude affair in a bush or on a low tree branch. The best-known species is *Eurypyga helias*, which is beautifully variegated with brown, black, and white tints. This bird is often domesticated by the Brazilians. Consult Alfred Newton, *Dictionary of Birds* (New York, 1896). See Plate of BUSTARDS.

SUNBURN, ERYTHEMA SOLARE. The local effects of exposure to the sun's rays may be slight and confined to a little redness and tingling, or may produce severe blistering and loss of the superficial layers of the skin. Freckles (q.v.) are made more apparent by the sun's rays, particularly in persons of fair complexion, but it is doubtful if they are actually caused by the sun. Sunburn may be prevented to some extent by protecting the exposed parts of the body by sunshades, veils, etc., by grease paint, cold cream, and face powder. Slight cases of sunburn require no treatment, or may demand only the application of bismuth, boric acid, or zinc oxide, or sprinkling with rose water. Severe cases, with blistering and much pain, are treated in the same manner as burns elsewhere on the body. See BURNS AND SCALDS.

SUN'BURY. A borough and the county seat of Northumberland Co., Pa., 54 miles north of Harrisburg, on the Susquehanna River and on the Pennsylvania and the Philadelphia and Reading railroads (Map: Pennsylvania, H 5). There are the Mary M. Packer Hospital, the courthouse, jail, and two parish houses. Sunbury has a silk mill and converting works, two coffin works, planing mills, a foundry, machine shops, flour mills, and large repair and machine shops of the Pennsylvania Railroad. Sunbury was founded in 1772 on the site of an old Indian village and of Fort Augusta, built in 1756, during the French and Indian War. It was first incorporated in 1797. Pop., 1900, 9810; 1910, 13,770; 1915 (U. S. est.), 15,859.

SUNDA (sŭn'då) **ISLANDS.** A name commonly applied to all the islands of the Malay Archipelago lying west of the Molucca and Banda seas, and separating the China Sea from the Indian Ocean (Map: East India Islands, B 6). They include the four large Sundas, Sumatra, Java, Borneo, and Celebes, with their dependent islands, and the lesser Sundas, Bali, Lombok, Sumbawa, Flores, Sandalwood Island, Timor, and others extending in a chain eastward from Java. The Sunda Islands are named from the Sundanese, ethnographically a Malayan people of the western part of Java. They are shorter in stature than the Javanese proper, and somewhat more brachycephalic. They have also been less influenced by Hindu culture.

SUN DANCE. The great annual religious ceremony common to all the tribes of the Plains with the exception of the Comanche and perhaps one or two others. Its purpose varied, but in general it was performed to promote the prosperity of the tribe. Although anticipated as a yearly tribal event in some tribes, it is usually made or organized on each occasion in fulfillment of a vow by some particular individual in gratitude for recovery from sickness or for some other blessing. The Crow held the ceremony exclusively to avenge the death of a relative. The management of details is in charge of certain priests, together with the warrior societies. The dance usually takes place about the beginning of summer and with all its attendant ceremonies lasts more than a week, the dance proper continuing four days and nights. The entire tribe assemble for the occasion and pitch their tepees in a great circle, in the centre of which is erected the medicine lodge of leafy cottonwood saplings. The centre pole of the lodge is decorated with streamers and symbolic paints, besides which a sacred bundle, usually wrapped in a buffalo skin, is fastened near the top. The centre pole is cut down by the women with much ceremony. The dancers are stripped and painted, the paint design differing in symbolic character at each stage of the dance, and are prohibited from eating or drinking during the four days of the dance. Among most of the tribes they formerly also subjected themselves to voluntary torture by leaning their weight upon ropes fastened to wooden skewers driven through the flesh of their breasts and shoulders. In the Mandan Okipa, an analogous ceremony, this torture was carried to an almost incredible degree; the victim was lifted completely from the ground and permitted to swing from the roof pole in this condition, after which one or more fingers were chopped off as a further sacrifice. Among the Kiowa such torture was unknown.

The dancers form a half circle about the centre pole, each one looking steadfastly upon the sacred bundle at the top and constantly facing the sun in its course, with their arms swinging at their sides, and holding between their teeth whistles of eagle bone with which they keep up a continual shrill whistling. At the west end of the medicine lodge is an altar of bushes and variously decorated twigs within which are the sacred buffalo skull, the sacred pipe, and other ceremonial objects. On another side are the drummers, who sing the songs of the sun dance to the accompaniment of a powerful drum. Throughout the ceremony there is a rapid succession of ceremonial performances, including addresses, feasting, giving of presents, and initiation of new members into the various societies. Owing to the torture features, the dance has been almost completely suppressed by the government. Consult: G. A. Dorsey, "Arapaho Sun Dance," "Cheyenne Sun Dance," and "Ponca Sun Dance," in *Field Museum of Natural History, Publications: Anthropological Series*, Nos. 75, 99, 102, 103 (Chicago, 1903–05); H. L. Scott, "Notes on the Kado, or Sun Dance of the Kiowa," in *American Anthropologist* (Lancaster, Pa., 1911); George Catlin, *North American Indians* (new ed., 2 vols., Philadelphia, 1913); R. H. Lowie, *The Sun Dance of the Crow Indians* (New York, 1915).

SUNDARBANS, sụn′dar-bŭnz′, or **SUNDERBUNDS**, sŭn′dẽr-bŭndz′. The group of low islands forming the delta of the Ganges, British India (Map: India, F 5). Area, 7500 square miles. Only the northern part is inhabited, the southern being mainly jungle, sometimes submerged during floods, infested by tigers, leopards, buffaloes, crocodiles, and snakes. The only town worthy of mention is Port Canning, connected with Calcutta by rail.

SUNDAY (AS. *sunnandæg*, OHG. *sunnuntag*, Ger. *Sonntag*, Sunday, from AS. *sunnan*, sun + AS. *dæg*, Ger. *Tag*, day). The first day of the week, observed by Christians almost universally as a holy day in honor of the resurrection of Christ. For some time after the foundation of the Christian Church the converts from Judaism still observed the Jewish Sabbath to a greater or less extent, at first, it would seem, concurrently with the celebration of the first day; but before the end of the apostolic period, Sunday, known as the Lord's day, had thoroughly established itself as the special day to be sanctified by rest from secular labor and by public worship. The hallowing of Sunday appears incontestably as a definite law of the Church by the beginning of the fourth century; and the Emperor Constantine confirmed the custom by a law of the state. Throughout the mediæval period the authority of the Church was so universally recognized that secular legislation in this regard was almost unnecessary. The Catholic church then required, and still requires, abstinence from servile work on that day, and the assistance at mass of all who are not lawfully hindered.

In the mediæval period the courts were presided over or dominated by the clergy, and Sunday early became in the legal sense a *dies non* (q.v.), on which legal proceedings could not be conducted. By the common law, however, all other business might lawfully be transacted on Sunday. The first substantial limitation of this right was imposed by the Statute 5 and 6 Edw. V, c. 3, which provided that all secular labor should be unlawful on Sunday, except in cases of necessity. This was supplemented by the sweeping Act of 29 Car. II, c. 7, which prohibited all worldly business on the Lord's day, except where absolutely necessary or for charity. These statutes have been substantially followed in practically all of the United States. The New England States were the first to regulate the observance of Sunday by a series of statutes. The Constitution of the United States prohibits the restriction of religious liberty or the enforcement of religious observances, and therefore, in law, Sunday is regarded merely as a civil day, which is a convenient one for the suspension of business, because of its observance as a holy day by a great majority of the people. These statutes are constitutional as a valid exercise of the police power. Works of necessity and great public convenience are usually excepted. Thus, a physician may carry on his practice, making lawful charges for his services; drug stores may keep open; transportation lines may handle freight and passenger traffic; milk dealers are usually permitted to deliver their product; and all persons whose business conduces to the public health are permitted to continue their activities. Where a cessation of operations would cause great financial loss an exception is commonly made.

Where a person is traveling on Sunday in violation of law, and is injured, he is not precluded from recovering damages if he is otherwise entitled thereto. Although contracts entered into on Sunday were valid at common law, the courts of many States have interpreted their Sunday statutes as including this kind of a business transaction. A payment of a debt on

Sunday is generally held to discharge the obligation. Wills executed on Sunday may be probated in most jurisdictions. It is an almost universal rule, however, that legal process may not be validly served on Sunday. In most States the legal Sunday begins at midnight on Saturday night and continues 24 hours. In a few New England States Sunday ends at sunset. Many States exempt Hebrews and others who observe Saturday or some day other than Sunday as a holy day from the operation of the Sunday laws, but if such persons do not keep sacred any other day, they must suspend business on Sunday.

The need of one day in seven for rest from labor has long been recognized from an economic standpoint also, more and better work being produced by the rest. Sunday labor in the United States is, however, increasing. That the increase is general is shown by the growing opposition of the labor unions, and their frequent demands for shorter hours throughout the week, on the ground that they have no assurance of the Sunday respite.

SUNDAY, WILLIAM ASHLEY, popularly known as BILLY SUNDAY (1863–). An American evangelist, born at Ames, Iowa. Between 1883 and 1890 he was a professional baseball player with the Chicago, Pittsburgh, and Philadelphia teams of the National League and in 1891–95 served as assistant secretary of the Y. M. C. A. in Chicago. He began his evangelistic work in 1896, and in 1903 was ordained a Presbyterian minister. The number of his converts for the period 1904–13 was estimated at 75,000. Perhaps his most successful revival was the one conducted by him at Philadelphia in 1915. By some Sunday was considered a sensationalist, and by others a sincere man possessed of great power to move his hearers. His extreme unconventionality of method brought him most criticism. Consult W. T. Ellis, *"Billy" Sunday, the Man and his Message* (Chicago, 1914).

SUNDAY LETTER. See DOMINICAL LETTER.

SUNDAY SCHOOLS. An agency of the Church for instructing learners of all ages. It seems that when the Jews lost their national life they sought to retrieve their greatness through education. Hence about 70 B.C. they established schools in connection with their synagogues. Probably these suggested to the early Christians the idea of catechetical instruction—an idea that was carried into Egypt and through Mesopotamia to Armenia, where, in the fourth century, Gregory the Illuminator propagated the faith by compelling the attendance of children in Bible schools. During the Middle Ages Waldenses, Albigenses, and Lollards carried on this Bible-study tradition. During the seventeenth and eighteenth centuries, however, direct Bible teaching was set aside for the memorization of answers in the catechism.

In England the rebirth of the Sunday school in 1780 was due to Robert Raikes (q.v.). Aided by John Nichols, editor of the *Gentleman's Magazine*, George Whitefield, John and Charles Wesley, and even by the Queen, Raikes was able to expand his work. A Sunday-school society was established in 1785 which during the next 10 years distributed 9200 spelling books, 25,000 Testaments, and 5300 Bibles to 1012 schools and 65,000 pupils. By the close of the century the employment of teachers had ceased, and in 1811 volunteer instructors were caring for 400,000 children, despite a threatened stoppage of the work by the Archbishop of Canterbury, who feared the influence of secular instruction on Sunday.

In America Sunday schools were established at Plymouth in 1669, at Roxbury in 1674, and at other Puritan settlements where, after the morning service, the children were taught in the Scriptures and catechism by men and women. Ludwig Thacker conducted a school in the Dunker community near Philadelphia from 1744 until 1777, when the battle of Brandywine made it necessary to use the community buildings as hospitals. After the Revolution the Sunday-school idea was advanced by the Methodists, for John Wesley in his "Discipline" had urged on each church the importance of teaching its children whenever 10 could be gathered together. Bishop Asbury established a Raikes school. In 1793 a negress, Kate Ferguson, who had never heard of Raikes, organized a poor children's school in New York City. Other denominations began to interest themselves in the problem of instruction, and the result was the organization of the First Day or Sunday School Society of Philadelphia, Jan. 11, 1791. Of this, Bishop White of the Protestant Episcopal church was president and Matthew Carey, a Catholic, secretary. The organization was followed by that of the Female Society for the Promotion of Sabbath Schools, whose leaders were benevolent women of several denominations. In February of 1816 the men of New York similarly organized, and the Boston Society for the Moral and Religious Instruction of the Poor came into being. The next year the Philadelphia Sunday and Adult School Union, embracing members outside of the city as well as those within, employed a missionary and issued Scripture tickets and other matter. The missionary organized 60 schools.

American Sunday School Union. These various movements led naturally to the formation of the American Sunday School Union in Philadelphia, May 25, 1824. Immediately this society began to send its missionaries into the Western wilderness. Perhaps the most effective was Stephen Paxson, who, traveling from the Alleghanies to the Rockies and from the Great Lakes to the Gulf, organized 1314 schools with 83,405 pupils before he retired in 1868. As a general thing this society has not worked in the large cities, preferring to send its missionaries as pastors to people remote from the organized churches. It has always been strictly undenominational, leaving its schools to develop into the kind of churches that appeal most to them. It carries on its work over the whole United States, which it divides into 10 districts, each under a superintendent to direct the missionaries. Its report for 1915 shows that the Union organized during that year 1368 schools with 47,000 pupils, visited 188,652 families, and distributed 34,443 Bibles, Testaments, and hymn books, and books to the value of $21,482.95. Of its schools previously organized 86 became churches during this year.

International Sunday School Association. Between 1820 and 1830 local conventions were held, the fruits of which suggested a large representative meeting. So in 1832 delegates from 15 States came together at Philadelphia as the First National Convention. A similar body met several times before 1872; but that year marks the adoption of a uniform system of lessons. In 1875 the movement became international, and since 1889 it has been world wide. From the report of the last convention held in Chicago in

1914 it is gathered that North America has 175,685 Sunday schools with 18,441,036 pupils and 1,690,000 teachers, or double the numbers reported at the Chicago convention of 1887. These schools send delegates to 2592 county conventions out of a possible 3442, and to other general meetings; so that, in 1914, 58,435 gatherings were held. In all of these conventions the departmental work and other phases of the International Convention are emphasized. Three divisions of pupils are recognized: elementary, secondary, and adult; four departments organized: teacher training, missionary, visitation, and temperance; and a general emphasis laid on evangelistic effort and workers' conferences. The most striking advance in the last triennium of the association's history was the increased interest in adult Bible study. In all, 50,000 adult classes are organized with 2,000,000 members. Another great advance has been made in the so-called "teen age" group, one effect of which was the admission into the various churches of 1,055,444 pupils during 1915.

Denominational Work. The various denominations have been greatly benefited by their joint effort to establish the Sunday school on a solid pedagogical basis, for they have received members trained to do their work. Most of the churches have encouraged the growth of Sunday schools within their own ranks by establishing boards and publishing houses to furnish the various lesson helps, references, and books, children's papers, cards, and material that the new teaching requires, at as near cost as possible. They send out missionaries to organize schools. But they are as constantly receiving churches born of both the American Sunday School Union and the International Sunday School Association as they are giving their talent, their money, and their united efforts to these organizations—the one undenominational, the other interdenominational.

Lessons and Helps. The first movement towards standardizing the courses of study was made by the Reverend, afterward Bishop, John H. Vincent, who in 1865 published the *Teacher*, a periodical containing 24 lessons for the year, with "Parallel Passages, Persons, Places, Dates, Doctrines, and Duties." Rev. Edward Eggleston, author of *The Hoosier Schoolmaster*, continued the publication after 1869 and issued 35,000 copies annually. The success of the *Teacher* brought the question of uniform lessons before the National Convention in 1872. The result was the appointment of a lesson committee which, including English and French correspondents, has since compiled what are known as the *International Lessons*. They were designed to complete the study of the Bible in six years, the average Sunday-school life of the child. A special feature has been the Temperance Lesson, included in each quarter's assignment. The American Sunday School Union was a pioneer in publishing these lessons and other matter, including books for both pupils and teachers forming the first circulating library for Sunday schools.

Grading. Another important movement led to the grading of the schools. In 1891 the Rev. Erasmus Blakesley, who had designed a graded course of study, helped to organize the Bible Study Union. From this came a system of lessons beginning with a simple sewing card for infants and ending with an intensive Bible study for adults. The International Lesson Committee, in 1895, recognized the demand for special primary lessons by issuing an optional course for beginners with its regular uniform lessons; but it was not until 1909 that the committee published its graded course, now offered as a choice with the uniform lessons.

Educational Efficiency. The recognition of value in the graded lessons has helped to solve other educational problems. Early in the twentieth century thousands of schools began to apply the principles of secular education. Children of the same grade in the public schools have been grouped in the corresponding Sunday-school grade; and to their biblical study have added the aids of the public school from the kindergarten to the college (sand-boxes, manual art, maps, notebooks, references, applied Christianity) so that, not only have students received definite ideas of the lives and times of biblical personages, but they have also connected biblical matter with current affairs in a very real way. This ideal of education has demanded normal training. In 1854 the Unitarians began to prepare their teachers in institutes. In 1864 John H. Vincent was a leader in a similar movement among the Methodists. In 1874 the Chautauqua began its work of training Sunday-school teachers that later broadened into several secular studies. Since 1880 normal instruction for Sunday-school work has been generally recognized. This instruction is given in departments of the schools, in institutes connected with the conventions and in courses conducted throughout the year. In 86 cities specialists are organized into faculties under deans to give lectures to teachers as do college faculties.

Organized Classes. Another idea that has proved popular and effective is that of the organized class. Such a class, whether of the teen age or adult department, with its own government, ways and means to stimulate interest and evoke suggestions for service to the church and community, has so proved its effectiveness that there are now 100,000 organized classes in America. The names **Baraca** (blessing) and Philothea (lovers of truth), given to a young men's and a young women's class respectively in the early nineties, have come to mean the most in this organized class movement, both because there are 9000 classes with a total membership of 1,000,000 in 32 denominations, enlisted under these names, and because through business method, social effort, Bible study, lectures, addresses, and prayer circles, all inspired by a carefully prepared propaganda, these classes have appealed and are appealing to groups of people who apparently have little in common.

Federation. Over 250 men are now employed to give all of their time to federating the activities of the Sunday school. They call conventions, establish institutes, open reading rooms and museums, in short, inspire all phases of the work as outlined by the International Sunday School Association. In this way the Sunday school is advancing educationally, socially, and religiously as well as numerically.

Roman Catholic Sunday Schools. The number and functions of the Roman Catholic Sunday schools in the United States depend to a certain extent upon the condition of the parochial schools, where the teaching of religion has the first place. Wherever there are parochial schools, the Sunday school is of secondary importance; but the need of religious instruction in the parishes which have no parochial schools was met in 1905 by an encyclical of Pius X, who decreed that all Catholic pastors, and generally all those who had the care of souls, should give religious instruction to boys and girls on Sundays, feast days, and other stated times of the year. Historically considered, Catholic Sunday schools are the descendants of the early Christian catechumenal and catechetical classes and schools and their successors in the Middle Ages. The Council of Trent (q.v.) confirmed and improved upon the previous decrees of Church councils in regard to the religious instruction of the young, and St. Charles Borromeo (q.v.), who is often called the pioneer of the modern Sunday school, founded in the archdiocese of Milan organizations for the religious education of boys and girls. In 1912 there were 5119 parochial schools in the United States, and in 1914 there were about 9000 churches without them, so that the decree of Pius X has made Sunday schools an official and practically universal means of religious instruction in the church in the United States. In 1915 there were between 1,500,000 and 1,600,000 children in attendance. The parish priest is superintendent by virtue of his office and has entire authority, subject to his ecclesiastical superiors, but he may appoint a representative. He is assisted by professional religious teachers, members of religious orders, and by laymen and women. Grading is based in general upon the requirements of preparation respectively for first confession, first communion, and for the instruction of those who have received their first communion. The ecclesiastical authorities have adopted to a certain extent the grading established in secular schools. They have also authorized textbooks for the assistance of teachers and a series of catechisms arranged according to the ages and capacities of the pupils.

In Canada each Catholic parish has a Sunday school, and in general it is subject to the same rules respecting authority, grading, and instruction as those which obtain in the United States. Owing to the protection which the educational rights of minorities in the Canadian provinces enjoy (see CANADA, *History*), parochial schools are well supported, and the Catholic Sunday school is relatively less important than in the United States. There are no authorized Sunday-school statistics.

In Great Britain Catholic Sunday schools are ordinarily established in connection with Catholic day schools. In many cases, however, where organization and facilities are lacking, the children are given catechetical instruction in churches, where graded questions are asked and explanations given. The Sunday schools have no definite official sanction, but are well attended.

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SUNDERBUNDS. See SUNDARBANS.

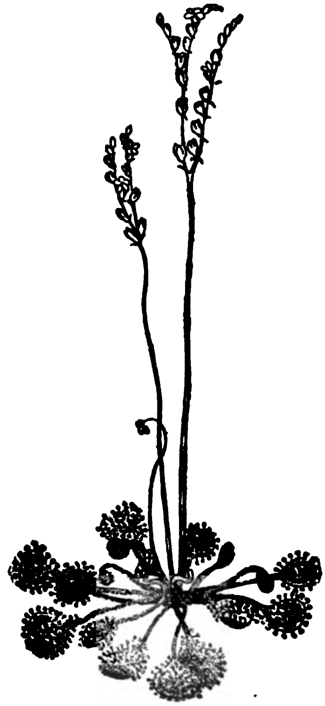
SUN'DERLAND. A seaport in the county of Durham, England, 14 miles northeast of Durham, at the mouth of the Wear (Map: England, E 2). It is one of the great coal-shipping ports of the world. Shipbuilding is an important industry. Machinery, glass, earthenware, chemicals, paper, ropes and chains, anchors, and other iron wares are extensively manufactured, and fishing is carried on to a considerable extent. In the vicinity are rich coal mines, of which the Pemberton, 2286 feet deep, is said to be the deepest in existence. On both sides of the river are extensive wet and dry docks, much of the area of which has been reclaimed from the sea. The harbor, defended by batteries, is formed by two great piers, one 650 yards and the other 590 yards in length. Sunderland is a well-built town with broad streets. There are a fine town hall, an assembly hall, handsome club houses, a large infirmary, and a spacious workmen's hall. The public park contains 70 acres. The borough was extended in 1867 and again in 1895; it includes the townships of Bishopwearmouth, Monkwearmouth, and Monkwearmouth Shore. The Monkwearmouth section dates from a monastery of the seventh century, in which the Venerable Bede spent most of his life. Pop., 1901, 146,565; 1911, 151,132.

SUNDERLAND, CHARLES SPENCER, third EARL OF (1674–1722). An English political leader. He was the second son of the second Earl of Sunderland, and became Lord Spencer on the death of his elder brother in 1688. In 1700 he married Lady Anne Churchill, second daughter of the Earl of Marlborough. In 1702, on the death of his father, Spencer succeeded to the title. Through the influence of Marlborough, Sunderland obtained several important posts, and became a member of the famous Whig Junta, which for a time controlled the whole government. In 1720 Sunderland brought about the establishment of the notorious South Sea Company (q.v.). When the crash came it was found that Sunderland had received a bribe of £50,000 from the company, and though he was acquitted by a party vote, he had to resign his offices. He retained, however, considerable influence until his death. Sunderland seems to have been a disagreeable and treacherous politician. He was a collector of rare books, and a patron of Addison and other men of letters.

SUNDERLAND, Jabez Thomas (1842–). An American Unitarian minister, born at Howarth, Yorkshire, England. He was educated at Madison (now Colgate) University, at the University of Chicago, and at the Union Baptist Theological Seminary of Chicago. Later he became a Unitarian, and was pastor of churches in the United States, Canada, and England. On commission from the British Unitarian Association he visited India in 1895–96, lecturing subsequently on religious conditions in that country. As Billings lecturer of the American Unitarian Association he visited countries of the Far East in 1913. From 1886 to 1895 he edited the *Unitarian Monthly*, and he wrote: *A Rational Faith* (1878); *What is the Bible* (1878); *The Liberal Christian Ministry* (1889); *The Bible: Its Origin, Growth, and Character, and Place among the Sacred Books of the World* (1893); *Liberal Religion in India* (1896); *James Martineau* (1905); *Oh, to be Rich and Young* (1910).

SUNDERLAND, Robert Spencer, second Earl of (1640–1702). An English politician. He was the only son of Henry Spencer, who was raised to the peerage in 1643. He was educated at Christ Church, Oxford, served as Ambassador at Madrid, at Paris, and at Cologne, and in 1679 was made a Secretary of State for the Northern Department and a member of the smaller inner cabinet with which King Charles II habitually conferred. Sunderland at first supported the Duke of York and then labored for the Exclusion Bill, which was to exclude the Duke from the succession. Thereby he lost the favor of Charles and his position in the Privy Council (1680). In 1682 he was restored to royal favor through the influence of the Duchess of Portland, mistress of Charles II, and the French Ambassador Barillon, and unscrupulously advocated the disgraceful French connection. He remained in office until the accession of James II, when his influence in the ministry became greater than ever. Although there is reason to believe he gave some encouragement to Monmouth in his rebellion, he managed to obtain the entire confidence of James, and in 1685 became Lord President and principal Secretary of State. In 1687 he privately conformed to the Roman Catholic church, and later professed this. Yet we find him in correspondence with the Prince of Orange, afterward William III. With masterly dexterity he contrived to deceive both his master and Barillon, keeping them in ignorance of events in Holland. When the Prince arrived in England, Sunderland and his wife went to Amsterdam, whence he wrote to the new monarch, claiming his favor and protection on the ground that he had all along been in his interest. In 1691 he was allowed to return to England, and in 1697 was made Lord Chamberlain. Popular indignation, however, soon compelled him to resign. He spent the rest of his days at Althorpe, where he died Sept. 28, 1702. Consult T. B. Macaulay, *History of England* (Boston, 1901).

SUN'DEW' (so called from the dewlike drops exuded, especially in the sunlight), *Drosera*. A beautiful and interesting genus of about 75 species of plants of the family Droseraceæ, several species of which are natives of American bogs, etc. A common species is the round-leaved sundew (*Drosera rotundifolia*). Its leaves all spring from the root, and spread out in a rosette, from the centre of which springs the flower stem or scape with a raceme of flowers all on one side. The leaves of this and the other species are fringed and beset in all parts with hairs, which bear at their extremity viscid glands, which fold up when irritated, imprisoning insects and digesting them through the action of enzymes secreted by the plant. Consult Charles Darwin, *Insectivorous Plants* (new ed., New York, 1900). See cut in article Carnivorous Plants.



SUNDEW (*Drosera rotundifolia*).

SUNDIAL. See Dial and Dialing.

SUN DOGS. See Halo.

SUNDSVALL, sųns'vȧl. A seaport in the Län of Vesternorrland, Sweden, 28 miles south by west of Hernösand, on the Gulf of Bothnia (Map: Sweden, F 5). It is known for its extensive lumber interests, and is engaged in shipbuilding and the manufacture of wood pulp, iron, and steel. Pop., 1901, 15,087; 1910, 16,854.

SUNERKOR. See Hamadryad.

SUN FEVER. See Heat Stroke.

SUN'FISH'. The name of a variety of fishes; also given by sailors to jellyfish. 1. In the United States a group of numerous and familiar fishes of streams and ponds, related to the bass, and forming several genera of the family Centrarchidæ (q.v.). All are of small size, 6 to 10 inches long, oval in shape, and much compressed. All are excellent eating. They are brightly colored, especially in the breeding season, and may be known by the black flap to the posterior edge of the gill cover. Their feeding and breeding habits are similar to those of the fresh-water bass (q.v.). See Plate of DARTERS AND SUNFISH; and consult Jordan and Everman, *American Food and Game Fishes* (New York, 1914).

2. One of the strange oceanic fishes of the family Molidæ, related to the Diodontidæ; especially *Mola mola*, which seems to be composed of a huge head with small fins attached. (See Plate of ROCKFISH, SUNFISH, ETC.) They reach a weight of 300 to 1500 pounds, are scaleless, dull in color, clumsy, and often lie inert like a huge gray blanket on the surface of the sea sunning themselves and bending with the movements of the waves. The young are more fish-like, and were long considered entirely separate. They are of no use as food. There are about six species, one of which (*Ranzania truncata*) is called "king of the mackerels." Consult Bashford Dean, *Fishes, Living and Fossil* (New York, 1895).

3. The threadfish (q.v.) (*Alectis ciliaris*).

SUN'FLOW'ER (probably so called from its yellow radiate disk), *Helianthus*. A genus of large herbs of the family Compositæ, containing numerous, mostly perennial, species, all natives of America. The common sunflower (*Helianthus annuus*), an annual, one of the most important species in cultivation, sometimes attains a height of 20 feet and produces flower heads from 1 to 2 feet in diameter. In temperate climates it ordinarily grows from 5 to 8 feet high. This species has become widely distributed throughout the United States as a weed. Another annual species, *Helianthus petiolaris*, is common in the west and the southwest. The sunflower was introduced into Europe about the middle of the sixteenth century. In Egypt, India, and southern Europe, especially in Russia, the plant is extensively grown for its seeds, which are eaten like nuts, and for their oil, which is used for culinary purposes. The oil is also used in the manufacture of varnishes on account of its drying properties, which, however, are inferior to those of linseed oil. It is also used in soap making and other manufactures. Sunflowers are cultivated somewhat in the United States and Canada for ornament, for forage, and for seed. On light, well-drained, well-tilled, and fertile soil a yield of from 30 to 50 bushels of seed per acre may be obtained. The preparation of the soil and its subsequent cultivation is similar to that for corn, but the distance between plants in the row should be from 12 to 16 inches. From 10 to 15 pounds of seed is required per acre. The heads are harvested shortly before they are thoroughly ripe to prevent loss of seed. Before storing they are carefully dried to prevent molding. The seeds are threshed out with flails. The average composition of the plant is water, 85.2 per cent; protein, 1.7; fat, 1.0; nitrogen-free extract, 6.2; crude fibre, 4.0; ash, 1.9. Of the seeds, water, 8.6 per cent; protein, 16.3; fat, 21.2; nitrogen-free extract, 21.4; crude fibre, 29.9; ash, 2.6. Of sunflower seed cake, water, 10.8; protein, 32.8; fat, 9.1; nitrogen-free extract, 27.1; crude fibre, 13.5; ash, 6.7.

The whole plant and the seeds have been used to a limited extent as a feeding stuff, especially when mixed with horse beans and corn fodder for making silage. The seed is frequently fed to poultry. The oil cake is fed especially in northern Europe to fatten animals.

There are a dozen or more species which are common in the United States, especially in the Ohio, Mississippi, and Missouri valleys, where they often become conspicuous by their abundance. The sunflower is the state flower of Kansas. *Helianthus tuberosus* is the Jerusalem artichoke.

SUNG, sōōng. One of the seven great Chinese dynasties. It was founded in 960 by Chao Kw'ang-yin, a descendant of a family of officials of the T'ang dynasty (618–907), who had risen to high military command. With the Empire rent with disorder, and the hordes of the Liao Tatars threatening on the north, the army concluded to raise their general, Chao, to the throne. He at once proceeded to repel the Liao and unify the Empire by reducing the petty states. He introduced many reforms, and for 16 years ruled with great wisdom and ability. The Liao, however, continued to encroach on Chinese territory, and in 1126, during the reign of the ninth Emperor, established their authority over all of North China, styling their dynasty the *Kin* or "Golden." The Sung fled south to Hangchow (q.v.), which continued to be the capital of the diminished Empire of the southern Sung. Nine emperors ruled here until 1279, when Kublai Khan and his Mongols overthrew both the Kin and the Sung, and established the Yuen dynasty in 1280. Notwithstanding the harassments and encroachments of invading armies, the Sung period was one of great prosperity and advance in civilization and culture.

SUNGA, sŭŋ'gȧ. See HUMPED CATTLE.

SUNGA'RIA, or **DZUNGARIA**. A name vaguely applied to a region of undefined extent in Central Asia. It belongs to China, and the name is generally restricted to the region lying north of the Tarim Basin in East Turkestan, between the Tian-Shan and Altai Mountains, and west of Mongolia (Map: China, E 2). It is chiefly of historical significance, deriving its name from the Sungarians, who attained their greatest power about the middle of the seventeenth century, when their kingdom embraced the territory between the Kuen-lun and the Altai Mountains, extending westward to Lake Balkhash. About 1670 the ruler of Sungaria entered into conflict with the Chinese, who completely overran the country. The Chinese were driven out in 1710 and for a short time the rulers of Sungaria were masters of Tibet. In 1759 the Chinese, after long campaigns, destroyed the reëstablished Sungarian Kingdom and made the country a part of their Empire, peopling it largely with colonists from China.

SUNG-KO-LIN-SIN. See SENG-KO-LIN-SIN.

SU'NIUM, DEMETRIUS OF. See DEMETRIUS OF SUNIUM.

SUNIUM PROM'ONTO'RIUM. See CAPE COLONNA.

SUNKEN BELL, THE (Ger. *Die versunkene Glocke*). A poetic play in blank verse by Gerhart Hauptmann (1896). It is a fairy drama, the chief human character of which is Heinrich, a master bell founder.

SUNLIGHT CURE. See HELIOTHERAPY.

SUNN. A plant (*Crotalaria juncea*) grown in India and some other warm climates for its fibre. See HEMP, SUNN; CROTALARIA, and illustrations on Plate of CRANBERRY, ETC.

SUN'NA (Ar. *sunnah*, custom, legal usage, tradition, from *sanna*, to establish a usage or law). In the original meaning among Moslems, the sayings and the example of Mohammed and his community, provided they are in accordance with the Koran, the meaning of which, however, is itself explained by the Sunna. As embracing traditional law, Sunna is divided into three parts: (1) what Mohammed did; (2) what he enjoined; and (3) what was done in his presence and not forbidden by him. The term is therefore (though incorrectly) used for the collections of moral and legal traditions known as *Hadith* (q.v.) traced to the prophet, which supplement the Koran, somewhat like the Mishna (q.v.), which supplements the laws of the Pentateuch. The Sunna not only comprises religious doctrines and practice, but also civil and criminal laws, and the usages of common life, the way to eat and to drink, to dress, and the like. For the credibility and canonicity of a tradition, it was originally necessary that it should have been *heard* by one truthful witness; but this law was much relaxed in later times. By the beginning of the ninth century a large number of individual collections known as *Musnads* had been produced by different theologians, but the first who sifted them critically, and without regard to any special theological system, was Buchari (810–887). His collection contains 7275 single traditions, 4000 of which, however, occur twice in the work. Muslim, a younger contemporary (817–873), supplemented Buchari with another collection, containing 12,000 traditions, again including 4000 repetitions. Besides these, there are canonical collections by Abu Daud (817–888), by Tirmidhi (830–914), a pupil of Buchari, and by Abu Maja (824–886), besides others that also enjoyed some measure of authority. The Sunna, as we have it in these collections, contains, broadly speaking, more truth than it is generally supposed to contain, and, critically used, is, besides the Koran, the most authentic source of a knowledge of Islam. A selection from the different collections (both canonical and otherwise), called *Mishkat Al Masabih*, has been translated into English by Matthews (Calcutta, 1809). The Arabic text of Buchari has been published by Krehl, *Le recueil des traditions musulmanes* (Leyden, 1862–68), and fragments of this work in German translation were embodied by Hammer-Purgstall in his *Fundgruben des Orients* (Vienna, 1810–19). Consult Ignaz Goldziher, *Mohammedanische Studien*, vol. ii (Halle, 1890).

SUNNITES, sŭn'īts (from Ar. *sunnah*, custom, legal usage, tradition, from *sanna*, to establish a usage or law). The orthodox sect in Islam. The term arose in distinction to several tendencies which early asserted themselves, but especially differentiates that section which denies the claim of the Shiites (q.v.) for the peculiar authority of Ali, as the sole legitimate successor of Mohammed. (See MOHAMMEDAN SECTS.) These Shiites fast developed their peculiar theological and constitutional theories, and so drove their opponents to an understanding of their own position; as they were content with tradition and with things as they were, they called themselves Sunnites, or Traditionalists. The differences rapidly developed into those of a political and ethnic character, the Shiites being found in the lands which were opposed to the Umayyads (see OMMIADS), as Arabia, where independence was characteristic, and in Persia, which only by force of arms had submitted to Islam. But the decision between the two parties was by no means immediately reached. The fall of the Umayyads was brought about by Persian Shiite influences (750), although the new Abbasid dynasty which was installed soon threw in its lot with the Sunnites. In general the geographic centre of the Arab power, Mesopotamia and Syria, remained in the control of this party. But the Shiites maintained the contest. The latter as liberals and theosophists possessed a strong following, especially among the cultured, and they often enjoyed immunity under free-thinking caliphs. The Empire was honeycombed with Shiite secret societies like the Assassins (q.v.), and Shiite dynasties arose in Egypt and at Bagdad. (See SHIITES.) But by 1100 Sunnism was master in southwestern Asia. This party was able to maintain itself during the Mongol invasions, and with the favor of the Ottoman Turks it remains as the predominant body in Islam. At the present time orthodoxy outnumbers all its opponents by 10 to one, and commands not only the whole Turkish Empire, but the millions of Moslems in Africa, India, China, Malaysia, and the Philippines.

Within this conservative and orthodox body, apart from outer foes, there early developed all kinds of theological strife. Rationalistic and liberal parties developed, which opposed, one after another, the original principles of Islam, such as its views of God, and of heaven and hell, its doctrines of predestination and of the literal authority of the Koran. On the other hand, the crass views of the fanatical mob opposed anything like philosophy, even though orthodox. Traditionalism was not fitted to meet the dialectic methods of its opponents, who had learned from the ancient schools of culture, and was ignorant of the use of philosophy in self-defense. But the champion of orthodoxy arose in Ashari (born 882). A member originally of the Mutazilite sect, which had gone to the extreme of rationalizing upon the faith and the Koran (see MOHAMMEDAN SECTS), he was led to the consciousness of this inconsistency, and openly abjured that heresy, henceforth devoting himself to the formulation of a scholastic philosophy in support of orthodoxy. This school encountered for long the opposition of the liberals and the ignorant, but about 1050 Ashari's triumph became evident. His philosophy was continued and popularized by Ghazali (q.v.), who established the pietistic principle of Sufiism, which may be compared to the Christian emotional principle of faith.

With reference to the head of Islam, Sunnism still as ever lacks a definite principle. When the caliphate of Bagdad came to an end in 1258, one of the Abbasids fled to Cairo and was recognized by Sultan Bibars as caliph under the name of al Mustansir. His descendants continued to hold the power of investing the Mamluk rulers with their authority. The last of these, Mutawakkit II, went with Selim I to Constantinople. At some time between 1522 and his death in 1538 he assigned his spiritual power and office to Suleiman II. Hence the Ottoman sultans claim the caliphate. But the fiction is so apparent that it is not universally recognized. It was never acknowledged in Morocco. Sunnism is not bound to the dynasty at Constantinople. Contrary, therefore, to the original theocratic constitution of Mohammed there has arisen a division between the spiritual and the political forces. Political power is wielded by the Sultan, but the spiritual rule is in the hands of the Ulema (q.v.) of Constantinople, a close corporation of lawyer theologians. Its chief, the Sheik el Islam, is appointed by the Sultan, but only out of that body, and he possesses large independent powers which the Sultan dare not invade. He is the chief spiritual person in orthodox Islam.

Within the Sunnite body exist four different schools of law, those respectively of the Hanbalites, the Hanifites, the Shafiites, and the Malikites (so named after their respective founders). The first code is recognized by the Wahabites (see WAHABIS); the second in Upper Egypt and north Africa; the third in Lower Egypt, southern India, and Malaysia; the fourth by the Turks and the Moslems of Central and northern Asia. These schools arose in the second and third centuries of the Hejira and represent so many different compositions between tradition and progressive law. They are at peace with one another now, and divide orthodox Islam among themselves, each people being allowed to live by its law, and each lawyer electing his choice. But in the Ottoman Empire there exists the contrast between this canon law and the secular law. The latter proceeds from the authority of the Sultan or is the ancient secular law of the land; the other, the religious law, is confined mostly to domestic matters, and it is one of the grievances of the orthodox that the legal authority of the religious community is thus put into abeyance by the secular arm. Here again the analogy may be drawn with the dispute which has prevailed in European Christendom between the canon and the civil law. Therefore, both in its past history and in its present condition, Sunnism is by no means to be regarded as a homogeneous body or practice. For literature, see MOHAMMEDANISM; MOHAMMEDAN SECTS.

SUN′NYSIDE′. A gabled stone house on the Hudson River near Irvington, N. Y., noted as the home of Washington Irving, and described in Irving's sketch entitled *Wolfert's Roost*.

SUN SPOTS. The name given to a phenomena consisting of variable dark spots upon the solar surface. Sun spots are treated at length under SUN. See TERRESTRIAL MAGNETISM.

SUN′STONE′, or HELIOLITE. A variety of aventurine, oligoclase, or feldspar, which when polished yields internal yellowish or reddish reflections emanating from crystals or flakes of iron oxide that are contained in the mass. The finest specimens, which show a brilliant play of colors, are found in Norway, although gem varieties occur in the United States at Crown Point, N. Y., and Media, Pa.

SUNSTROKE. See HEAT STROKE.

SUN WORSHIP. See NATURE WORSHIP.

SUN YAT-SEN, so͞on′ yät-sĕn′ (1866–). A famous Chinese revolutionary leader. He was born at Fatshan, near Canton. His parents took him as a boy to Hawaii, where he attended Iolani College. Later he graduated from the Hongkong School of Medicine, now part of Hongkong University (1892). For a year he practiced at Macao. Afterward he gave himself wholly to the project of driving the Manchu dynasty from China. As early as 1895 he attempted a revolt at Canton, which failed, and Sun alone succeeded in escaping. He fled to Kobe, Japan, and later to Honolulu and San Francisco. He was soon active the world over in organizing and educating Chinese abroad for his *Kao Lao Hwei*, or reform associations, and in raising and sending money to his agents in China, particularly General Hwang-hsing, for the coming Revolution. He was in constant danger of his life at this time because of the hostility of the Manchu government, and a reward of $50,000 was offered for his death. Finally the Revolution broke out in China in the fall of 1911, and was successful mainly because of the work of Dr. Sun in the years of preparation. He received his reward in his election as Provisional President of the Chinese Republic by the Assembly at Nanking. On Feb. 15, 1912, Dr. Sun resigned as President in favor of Yuan Shih-kai (q.v.), so as to induce the latter and his north China adherents to join the Republican cause. For this act Sun received a remarkable tribute from the Nanking Assembly. Difficulties in the new Republic soon arose from the opposition of the *Kuomingtang* (the south China party of Sun and Hwang-hsing) in the Parliament at Peking to the policy of President Yuan Shih-kai. Yuan finally expelled these members and later dismissed the entire Parliament. Dr. Sun retired to Japan, but it was believed that his continued active opposition to Yuan Shih-kai was shown in the rebellion of July, 1913, and in the revolt of the southern provinces in 1915–16. Consult: E. N. Bland, *Recent Events and Present Policies in China* (Philadelphia, 1912); Cantlie and Jones, *Sun Yat-Sen and the Awakening of China* (3d ed., New York, 1913); J. S. Thomson, *China Revolutionized* (Indianapolis, 1913). See CHINA, *Modern History*.

SUO′VETAURIL′IA (Lat., sacrifice of a boar, a sheep, and a bull, from *sus*, boar + *ovis*, sheep + *taurus*, bull). A Roman sacrifice of a boar, a ram, and a bullock, which was offered to Mars, in the lustrum, or purification of the people, on the Campus Martius at the Census, the Ambarvalia in May, the Amburbium in February, and other similar lustrations.

SUPAI, so͞o′pī. See HAVASUPI.

SUPAN, so͞o′pän, ALEXANDER (1847–). An Austrian geographer, born at Innichen, Tirol. Having studied at the universities of Graz, Vienna, Halle, and Leipzig, and taught at Laibach, he qualified as privatdocent at Czernowitz, Bukowina, and was made professor in 1880, but removed to Gotha in 1884 to assume the redaction of *Petermanns Mitteilungen*. The publication of its geographical literary reports, from 1885, is due to his initiative. He became a member of the International Polar Commission. He wrote: *Grundzüge der physischen Erdkunde* (1884; 4th ed., 1907); *Geographie von Oesterreich-Ungarn* (1889); *Deutsche Schulgeographie* (6th ed., 1903); and numerous contributions to the *Mitteilungen*.

SU′PERER′OGA′TION, WORKS OF (Lat. *supererogatio*, payment in addition). A class of good works which, in the Roman Catholic system, are described as not absolutely required as conditions to eternal salvation. Roman Catholics found this definition on the distinction between what they believe to be commanded and what they hold to be only counseled. (See EVANGELICAL COUNSELS.) For works of supererogation, as for all supernaturally good works, they hold that the assistance of God's grace is necessary; and they do not ascribe to them any merit, except that which arises from God's own free promise. A further consequence of this doctrine is that God may accept the superabundant works of one in atonement for the defective service of another; and hence, in the Catholic theory of indulgences (q.v.), along with what they regard as the infinite and inexhaustible treasure of the merits of Christ, they also regard, although in a degree infinitely inferior, the superabundant merits of the saints as forming part of that treasure of the church which is applied in the form of indulgences. The idea of such works is rejected by Protestants generally.

SUPERFICIES, sū′pẽr-fĭsh′ĭ-ēz (Lat., surface). At civil law, the hereditary and alienable right to maintain and use a building on land belonging to another. Unless a term be fixed in the contract, the right is perpetual. The owner of the land is technically owner of the building (*superficies solo cedit*); but practically the owner has no right except to an annual ground rent (*solarium*). Even when the ground rent has not been paid for several years, the right of the superficiary is not forfeited unless this be expressed in the contract. In the absence of such express agreement, the owner of the land can only attach and sell the superficiary right.

Historically, superficies was first established at Rome in public or municipal land. It was originally in the nature of a lease (*locatio conductio*), but it soon became a different thing, because the superficiary was recognized as having a possessory right (see POSSESSION) and could maintain actions *in rem*—advantages which the Roman lessee did not enjoy. In the later development of the Roman law superficiary right could be established on private land and also in a special story or floor of a building.

Superficies is analogous to emphyteusis (q.v.), but the rights of the superficiary are greater than those of the emphyteutist.

Mediæval jurists regarded superficies and emphyteusis as cases of divided ownership, analogous to the feudal tenures. The landlord had *dominium directum*, the tenant *dominium utile*. Some of the modern legislations recognize divided ownership in a different sense: the landlord is said to own the land, the superficiary the house or floor. See DOMINIUM; EMPHYTEUSIS; PROPERTY.

SU′PERFŒTA′TION (from Lat. *superfœtare*, to conceive anew when already pregnant, from *super*, above, over + *fœtare*, to breed, from *fœtus*, offspring), and SUPERFECUNDATION. The circumstance of two distinct conceptions occurring in the same woman at an interval of weeks or months, so that two fœtuses of different ages, and possibly the offspring of different fathers, may coexist in the uterus. True superfœtation takes place when a second ovule has been impregnated while the uterus already contains an ovum which has arrived at a considerable degree of development. By superfecundation is meant the impregnation, at or near the same period of time, of two separate ovules before the decidua lining of the uterus has been formed —believed by many to interpose an insuperable obstacle to subsequent impregnation. The possibility of this occurrence has been proved on occasion by the birth of twins bearing the stamp of fathers of different races, i.e., white and black. The question of superfœtation has given rise to much discussion, owing to its medico-legal importance. Against the possibility of this occurrence it is urged that ovulation is suspended when impregnation has taken place; that the decidua (afterbirth) so completely fills the uterine cavity that the passage of spermatozoa is impossible, and that their ascent is prevented by the mucus filling the cervix. It is now believed that none of these obstacles is insuperable.

The medico-legal aspect of the question may be summed up as follows: A woman may be unjustly suspected of conjugal infidelity when, delivery of a mature or premature child having taken place, she is (without having meanwhile seen her husband, or submitted to coitus), in the course of one, two, or three months, delivered of another child, either mature or premature. Cases of this kind may be explained, as indicated above, by twin pregnancy with expulsion of the fœtuses at an interval of several weeks or months; by the existence of bilobed uterus, the two cavities expelling their contents at different times; or by true superfœtation. When the children are of different race or color the fidelity of the female may be justly questioned. Consult: W. S. Playfair, *Treatise on the Science and Practice of Midwifery* (7th Amer. ed., Philadelphia, 1898); J. J. Reese, *Textbook of Medical Jurisprudence and Toxicology* (8th ed., ib., 1911); W. R. Smith, *Medical Jurisprudence* (London, 1913).

SUPERHEATER; SUPERHEATED STEAM. See STEAM; STEAM ENGINE; SHIPBUILDING, *Machinery*.

SUPE′RIOR. A city, port of entry, and the county seat of Douglas Co., Wis., adjacent to Duluth, Minn.; at the mouth of the St. Louis and Nemadji rivers, on three bays, inlets of Lake Superior, and on the Northern Pacific, the Duluth, South Shore and Atlantic, the Great Northern, the Chicago, Milwaukee and St. Paul, the Minneapolis, St. Paul, and Sault Ste. Marie, and the Chicago and Northwestern railroads (Map: Wisconsin, A 2). It is connected with Duluth by two railroad bridges and by a ferry. The city is the seat of a State Normal School, and among other features are a public library and St. Mary's Hospital. An excellent harbor, which has been enlarged and improved through national, State, and city appropriations, and good transportation facilities have contributed to Superior's commercial importance. In the year ending June 30, 1913, the total foreign trade was valued at $5,178,879, including exports to the amount of $4,785,986. (See DULUTH.) Wheat, corn, flour, lard, and other meat products, iron and steel, cement, and lumber compose the principal shipments. The various industries, according to the 1914 census, had an invested capital of $7,050,000, and a production valued at $11,663,000. There are lumber mills, foundries and machine shops, breweries, flour mills, boiler shops, iron works, manufactories of chairs and windmills, and shipbuilding.

Superior has adopted the commission form of government. For maintenance and operation, the city spent in 1913, $537,204, the chief items being: schools, $201,000; fire department, $96,000; police department, $48,000; and streets, $73,000. Pop., 1900, 31,091; 1910, 40,384; 1915 (U. S. est.), 45,285.

On the site of Superior Radisson and Groseilliers are supposed to have made their headquarters in 1661. Here in 1680 the famous explorer Du L'Hut established a trading post. Superior was first laid out in 1885.

SUPERIOR, LAKE. The largest and most northerly of the Great Lakes of North America, and the largest body of fresh water in the world (Map: America, North, K 5). It is situated a little to the northeast of the centre of the continent; its north shores are in Minnesota and the Canadian Province of Ontario, and its south shores in Michigan and Wisconsin. Its shape is nearly crescent, the horns extending southwest and southeast, while the large Keweenaw Peninsula reaches nearly to the centre of the lake from the middle of the southern coast. Lake Superior has a coast line of 1500 miles; its extreme length from east to west is 412 miles; its extreme breadth 167. Area, 31,200 square miles. Its mean elevation above sea level is 602 feet, and it lies 20 feet above Lake Huron, into which it discharges through the St. Mary's River (q.v.). It receives a large number of streams, but they are short, the basin of the lake being hemmed in by the watersheds of the Mississippi and of Hudson Bay. The principal stream entering it is the St. Louis River, which falls into the extreme west end of the lake, and is considered the farthest head stream of the St. Lawrence.

The shores of Lake Superior, except in the southeast, where there are sand dunes, are generally bold and rocky. On the Michigan shore are the celebrated sandstone cliffs known as Pictured Rocks, which are streaked by the red and yellow deposits of ferruginous waters. In many places, especially along the Canadian shore, there are precipitous cliffs of basalt rising directly from the water to a sheer height of from 300 to over 1000 feet, such as Thunder Cape on the northwest shore. The north shore is cut into deep bays surrounded by high cliffs, and forming good harbors, and it is lined with a number of high, rocky islands. In the greater part of the lake, however, the islands are few, the largest being Isle Royal, 45 miles long and 8 miles wide, belonging to Michigan. In general the country surrounding the lake is covered with pine forests.

Lake Superior is deeper than any of the other Great Lakes, its maximum depth being 1008 feet, so that the bottom lies 400 feet below sea level. The water is very clear, and so fresh as to be almost chemically pure. It is cold throughout the year to within a few feet of the surface, and in the deeper portions maintains a nearly uniform temperature of 39° F. The lake never freezes except in shallow water along the shores. The water level is subject to several sets of periodic changes, partly owing to changes in rainfall and evaporation and partly to the winds; a continued storm will sometimes raise the leeward level seven feet above the normal. Violent storms occasionally sweep over the lake, when waves may rise to about 15 or 18 feet.

The basin of Lake Superior is remarkable as being unrelated to those of the other Great Lakes. While the latter are river valleys scooped out of the softer strata of the ancient coastal plain lying northwest of the Appalachian plateau and skirting the Archean continent, Lake Superior lies almost wholly within the Archean region. The most recent investigators are of the opinion that this basin is in the western part, at least, a rift valley produced by graben faulting in the Superior upland. These uplands are a part of an extensive peneplain which truncates Archean and Algonkian igneous, sedimentary, and metamorphic rocks. The formation of the lakes themselves, however, is due to the obstruction of the valleys during the Glacial period. The country surrounding the lake is rich in minerals, and large veins of copper and iron ore traverse its bottom from the southern shore. Consult Agassiz, *Lake Superior: Its Physical Character, Vegetation, and Animals* (Boston, 1850), and Martin, "Progressive Development of Resources in the Lake Superior Region," in *American Geographical Society*, vol. xliii (New York, 1911). For commerce and navigation on the lake, see GREAT LAKES.

SU′PERPHOS′PHATE. An orthophosphate in which only a portion of the hydrogen of the orthophosphoric acid has been replaced by a basic radical. The most important superphosphate, agriculturally, that of lime, monocalcium phosphate ($CaO.2H_2O.P_2O_5$), is prepared by treating tricalcium phosphate ($3CaO.P_2O_5$) in the form of mineral phosphate, bone ash, bone black, etc., with sulphuric acid. It is also called acid phosphate. See MANURES AND MANURING.

SUPERPOSITION. See CONGRUENCE.

SUPERPOSITION. In architecture the systematic disposition of one feature or set of features or members over another; especially, in the classic and neoclassic styles, of one order over another. See ORDERS OF ARCHITECTURE; ROMAN ART.

SU′PERSE′DEAS (Lat., that you set aside). A common-law writ containing an order for a stay or suspension of legal proceedings. Under the common-law practice it is issued in a great variety of cases for the above purpose, and is sometimes used as a substitute for the common-law writ of *audita querela* (q.v.). Probably it is issued most frequently to stay execution, pending an appeal from a judgment. The person applying for the writ is required to give a bond to secure the other party against loss by reason of the delay. Several writs are said to operate as a supersedeas by implication, as in effect they operate as a stay, viz.: habeas corpus, certiorari, and writ of error. The practice of granting a stay by an order of the court has superseded the above practice in many jurisdictions.

SUPERSTITION (Lat. *superstitio*, excessive religious belief, superstition, possibly originally a standing over a thing in amazement or awe, from *superstare*, to stand above or over, from *super*, above, over + *stare*, to stand). This is a catchword currently employed to designate beliefs and usages not consonant with accepted notions of reality and possibility. Ethnologically the term is meaningless because from the point of view of this science our own conception of truth and possibility is but one of an indefinite number of such conceptions, just as from the modern geometrician's position three-dimensional space is but one of an indefinite number of mathematically tenable spaces. It might be argued that the modern Weltanschauung of Europe and America is distinguished from all others by its predominantly rationalistic character. But this would apply at best solely to the scientific portion of our cultural stock in trade, while our religious doctrines, our ethical and our æsthetic principles are conceivably, and indeed partly in fact, a matter of contempt and even horror to members of other races. Accordingly, it seems arbitrary and a matter of bias to exalt our own notions of fitness by abasing others to the level of superstitions.

On the other hand, it is entirely proper to merge superstitions so-called with the ethnological phenomena known as "survivals." It is simply an historical fact that among the ancient Assyrians, and indeed much later, it was part of the official State religion to prophesy as to the future from the flight of birds, the nature of dreams, human and animal abortions, and what not; and that such practices are no longer countenanced by the dominant religious bodies of Europe and America. Hence where such customs and the correlated beliefs persist, they may be regarded as survivals, as vestigial relics from a past when they were in full bloom.

Among these survivals perhaps the most persistent in rural districts is the belief in ghosts, and in the influence of the moon; crops should always be planted so that the increase of the moon will aid their growth, and conversely if it is desired to destroy brush or weeds, it should be done at the full of the moon so that they may shrink as she does. In parts of Europe the malignant and blighting effects of the evil eye are still feared; the caul and in the United States the horseshoe are still accepted, seriously or otherwise, as emblems of good luck. As examples of the many methods of divination, a few of which still survive, may be mentioned aëromancy, or divination by appearances in the air; alectoromancy, by a fowl picking up grains of wheat; aleuromancy, by wheat; axinomancy, by the axe or hatchet; belomancy, by means of arrows; bibliomancy, by the Bible; cartomancy, by playing cards; capnomancy, by smoke from an altar; catoptromancy, by mirrors; chiromancy, by the hand; cledonismancy, by certain lucky or unlucky words; clidomancy, by keys; coscinomancy, by sieves; dactylomancy, by suspended rings; gastromancy, by ventriloquism, or by a vial of water; geomancy, by geometrical figures; gyromancy, by walking in a circle; lithomancy, by precious stones, or pebbles; myomancy, by mice; onomancy, by letters forming the name of a person.

It is necessary to emphasize here that while there has been a demonstrable elimination of irrational elements, the rational elements of human nature are still so much weaker than the emotional that there is a constant danger for the springing up of new beliefs and practices with an irrational foundation. Even the provisional results of science, when interpreted as doctrines of absolute validity, degenerate into dogmas, so that modern critics are justified in speaking of a mechanistic and evolutionary mythology. See FOLKLORE; MAGIC; MAN, SCIENCE OF; MYTHOLOGY; RELIGION, COMPARATIVE.

SUPERVISOR (ML. *supervisor*, overseer, from Lat. *supervidere*, to overlook, oversee, from *super*, above, over + *videre*, to see). A popularly elected officer of a township or other local district in the United States. The name first appeared in New York in 1691. This officer is still the chief administrator of the town organization in New York, while all the supervisors of the county assembled in a board meeting constitute the chief county authority. The New York supervisor system exists in several Western States. In Michigan and Illinois, as in New York, there is a single supervisor for each township, while in Wisconsin and Minnesota there are three for each township. In some States the supervisor is not a member of the county board and his duties vary, as, e.g., in Michigan, where he is also tax assessor, and in Illinois, treasurer. See UNITED STATES, section on *Local Government*.

SUPPÉ, zụp′pȧ, FRANZ VON (1820–95). An Austrian composer of light opera, born at Spalato, Dalmatia. He studied at the Vienna Conservatory under Sechter and Seyfried. He was kapellmeister successively at the Josephstädter Theater, the Theater an der Wien, and from 1865 until the end of his career at the Leopoldstädter Theater. He was a prolific composer; the most important of his works include the operettas *Flotte Bursche* (1863); *Die schöne Galathea* (1865); *Leichte Kavallerie* (1866); *Banditenstreiche* (1867); *Fatinitza* (Vienna, 1876); *Boccaccio* (1879); *Das Modell* (posthumously, 1895). He also composed considerable instrumental and sacred music. He was one of the most popular and important of the world's light opera composers, and a musician of no little genius. Consult O. Keller, *Franz von Suppé, der Schöpfer der deutschen Operette* (Leipzig, 1905).

SUP′PLE-JACK′ (*Berchemia scandens*). An American twining shrub of the family Rhamnaceæ, which is found as far north as the Dismal Swamp in Virginia. It has oval leaves, small flowers, and violet-colored berries, and ascends to the top of the highest trees. The name is also given in the West Indies and tropical America to *Serjania lucida* and *Serjania trachygona*, shrubs of similar habit which belong to the family Sapindaceæ. The stems are used for walking sticks.

SUPPLEMENTARY PROCEEDINGS. Certain proceedings under codes and practice acts designed to discover property of a judgment debtor and apply it to the satisfaction of the judgment. Before such proceedings can be instituted execution in the judgment must be issued and returned wholly or partly unsatisfied. The order directs the debtor to appear and submit to an examination under oath as to his property. When the judgment creditor has reason to believe that there is property in the possession of third parties to which the judgment debtor is entitled, an order may be obtained for the examination of the third party. Most acts provide for the appointment of a receiver where property is found. Consult *New York Code of Civil Procedure*. See EXECUTION.

SUP′PLIANTS, THE (Lat. *Supplices*, Gk. Ἱκέτιδες, *Hiketides*). 1. The earliest of the extant plays of Æschylus, of uncertain date. With but slight plot or dramatic action it pictures the arrival of the 50 daughters of Danaüs on the shore near Argos, their prayer to the King of Argos for protection, the appearance of the ship bearing the 50 sons of Ægyptus, and their repulse by the King.

2. A tragedy by Euripides, produced about 420 B.C. Theseus and the Athenians, entreated by the mothers of the dead chiefs, after defeating the Thebans, oblige them to surrender the bodies of the slain Polynices and his allies, to whom they had refused burial. The funeral of the chiefs, the burning of Evadne on the pyre of her husband, Capaneus, and the patriotic and political references provide the interest lacking in the simple plot.

SUPPLY. See DEMAND AND SUPPLY.

SUPPORTERS (from Lat. *supportare*, *subportare*, to support, from *sub*, under + *portare*, to carry). In heraldry, figures placed on each side of an armorial shield. See HERALDRY.

SUPPOS′ITORY (Lat. *suppositorium*, from *supponere, subponere*, to put beneath, from *sub*, under + *ponere*, to put, place). A solid medicated compound intended to be introduced into the rectum, vagina, or urethra, either for the purpose of causing an evacuation of the bowels, or for its specific effect on inflamed mucous membrane. Suppositories are made in several shapes—conical, cylindrical, or spherical—and in sizes adapted to the orifice they are intended to enter. In consistency they are such that they remain solid at ordinary temperatures, but melt slowly at the temperature of the body. The basis of most suppositories is cocoa butter. With this are incorporated one or several ingredients, such as glycerin, carbolic acid, tannic acid, belladonna, morphine, opium, cocaine, and ichthyol.

SUP'PURA'TION (Lat. *suppurare, subpurare*, to form pus, from *sub*, under + *pus*, matter from a sore). A morbid process which takes place in animal tissues, resulting in the formation of pus. It is a frequent termination of inflammatory processes and is due to invasion of the inflamed tissues and their exudates by pyogenic organisms. (See Pus; Inflammation.) White blood cells escape into the neighboring tissue after passing through the walls of the blood vessels, and become pus cells. If they escape to the surface and there is an open wound, the wound is said to suppurate. If they are confined to a circumscribed area below the surface, the collection of pus cells and broken down tissue is called an abscess (q.v.). See Abscess.

SU'PRALAPSA'RIAN. See Infralapsarian.

SU'PRARE'NAL (from Lat. *supra*, above + *renalis*, relating to the kidneys, from *renes*, kidneys) **CAPSULES.** The suprarenal capsules are two small, flattened, glandular bodies of a yellowish color and crescentic shape, situated, as their name implies, immediately in front of the upper end of each kidney. They are also called the suprarenal bodies or the adrenals. The suprarenal bodies are subject to inflammation, to atrophy, and to invasion by malignant processes, but all of these occurrences are extremely rare. The only morbid process that occurs with any frequency is tuberculosis. This process is the causative factor in the production of Addison's disease (q.v.), a rather rare and usually fatal affection characterized by anæmia, languor, feebleness of the heart's action, irritability of the stomach, and bronzing of the skin. There are several hæmostatic preparations of the capsules called variously adrenalin, adnephrin, epinephrin, suprarenin, suprarenalin, etc. These suprarenal extracts are used largely in eye, nose, and throat surgery, to control bleeding, in locally applied dilutions of one in 5000 or 10,000 parts of normal salt solution. Internally they are of value in hæmophilia, tuberculosis with hemorrhages, pneumonia, and asthma. The dried and prepared suprarenal substance of animals constitutes a powerful and valuable astringent and hæmostatic. See Organotherapy; Secretions, *Internal*.

SUPRARENAL EXTRACT. See Suprarenal Capsules.

SUPREM'ACY, Royal (Lat. *supremus*, highest, superlative of *superus*, high). A phrase specifically applied to the relation of the sovereign of England to the established church of that country. During the Reformation the supremacy of the Pope was abolished in England, and the Act passed in 1534 declared the King to be the "only supreme head on earth of the Church of England." The government at the same time explained that the intention was merely to recognize in the sovereign a governor without spiritual jurisdiction, and not to "take any power from the successors of the Apostles that was given them by God." Under Queen Mary this Act of Supremacy was repealed in 1554, but this repeal was itself repealed by Queen Elizabeth in 1559, who, however, did not make use of the words "supreme head." In her injunctions she explained the supremacy of the crown to be "that which is and was of ancient time due to the Imperial crown of this realm, i.e., under God to have the sovereignty and rule over all manner of persons born within those her realms of what estate either ecclesiastical or temporal soever they may be so as no other foreign power shall or ought to have any superiority over them." The governing and visitorial power of the sovereign, under the safeguard of an organized court of justice, has since been continuously recognized by the Church of England. By successive statutes an oath as to royal supremacy was appointed to be taken by the holders of public offices along with the oaths of allegiance and abjuration. A royal supremacy similar in character is a prerogative of the Czar of all the Russias, also of the Protestant princes of Germany, and of the sovereigns of Holland, Denmark, Norway, and Sweden.

SUPREME COURT. In Great Britain the Supreme Court of Judicature was constituted in the year 1873. It is a court founded upon the consolidation of the High Court of Chancery in England, the Court of Queen's Bench, the Court of Common Pleas at Westminster, the Court of Exchequer, the High Court of Admiralty, the Court of Probate, the Court for Divorce and Matrimonial Causes, and the London Court of Bankruptcy. The Supreme Court is divided into two permanent divisions, His Majesty's High Court of Justice and His Majesty's Court of Appeal. The High Court in turn is now divided into three subdivisions, viz., the Chancery Division, the King's Bench Division, and the Probate, Divorce, and Admiralty Division. The judges of the High Court are the Lord Chancellor, the Lord Chief Justice of England, the Master of the Rolls, the President of the Probate, Divorce, and Admiralty Division, and twenty-two puisne judges. The Court of Appeal consists of the Lord Chancellor, who presides over the court, the Lord Chief Justice of England, the Master of the Rolls, the President of the Probate, Divorce, and Admiralty Division (these acting ex officio), and five Lords Justices of Appeal. This court usually sits in two divisions, one of which hears appeals from the King's Bench and Probate, Divorce, and Admiralty Divisions, and the other from the Chancery Division. See Court.

SUPREME COURT, Master of the. See Master of the Supreme Court.

SUPREME COURT OF THE UNITED STATES, The. The Supreme Court of the United States is the head of the national judiciary. Art. III, Sec. 1 of the Constitution provides that "the judicial power of the United States shall be vested in one Supreme Court, and in such inferior courts as the Congress may from time to time ordain and establish." The Supreme Court is thus a constitutional court, while the others are statutory. Though the Constitution provides for a Supreme Court, it leaves its organization and membership for congressional supervision. The first Act in respect thereto was passed at the first session of the United States Congress, approved by President Washington Sept. 24, 1789; it directed that the court should consist of a Chief Justice and five associate justices, any four of whom should make a quorum. This act not only made provision for the Supreme Court, but created the inferior courts of the United States and organized its entire judicial system.

The Constitution (Art. III, Sec. 2) declares that "the judicial power shall extend to all cases, in law and equity, arising under this Constitution, the laws of the United States, and treaties made, or which shall be made, under their authority; to all cases affecting ambassadors, other public ministers, and consuls; to all cases of admiralty and maritime jurisdiction; to controversies to which the United States shall be a party; to controversies between two or more States; between a State and citizens of another State; between citizens of different States; between citizens of the same State claiming lands under grants of different States, and between a State, or the citizens thereof, and foreign States, citizens, or subjects." And also that "in all cases affecting ambassadors, other public ministers, and consuls, and those in which a State shall be party, the Supreme Court shall have original jurisdiction. In all the other cases before mentioned, the Supreme Court shall have appellate jurisdiction, both as to law and fact, with such exceptions and under such regulations as the Congress shall make." The original jurisdiction, conferred by the Constitution, cannot be taken away by Congress, although that body may prescribe the procedure by which that jurisdiction is to be exercised; but in respect to the appellate jurisdiction both the procedure and its extent are matters of congressional determination, and Congress has at times made changes in each.

The appellate jurisdiction may be separated into two divisions: one over State courts; the other over the inferior Federal courts. With respect to the former the Supreme Court reviews the final judgment rendered in any case by the highest court of the State to which the case under State practice can be carried. Up to 1891 it had, generally, jurisdiction to review the proceedings in any case which had passed to final judgment in such inferior courts, with a limitation in some cases to a certain amount in controversy. By the Act of 1891 courts of appeal were established, one in each circuit, and were given final jurisdiction in certain cases, such as revenue, admiralty, patent, etc. But the Supreme Court may still by certiorari, if it sees fit, bring any of these cases from a court of appeals before it for review. This Act did away with the limitation as to amount in controversy. In addition the Supreme Court is given power to issue writs of prohibition and all other writs necessary for the exercise of its jurisdiction and agreeable to the principles and usages of law. Thus the Supreme Court has complete supervision and control over all the inferior courts of the United States.

Early there arose two parties in the country: one believing that the new government was but a continuance of the old confederacy—a league of States, the States remaining dominant, and the national government serving only as a limited agency for transacting matters of general importance; the other that a new nation was created, supreme, with powers of a nation, the States being simply parts. By one party the provisions of the Constitution were strictly construed (see STRICT CONSTRUCTIONISTS), no power was vested in the national government except that expressly named. The other believed the Constitution was to be so construed as to give vigor and efficiency to the nation. The question was finally settled by the Supreme Court, which has always spoken for the nationality of the United States. A brief reference to some of the leading cases may indicate its action, and the effect thereof. In Chisholm, executor, *v.* Georgia, 2 Dall. 419, decided Feb. 18, 1793, the court (considering those provisions of the Constitution which extend the judicial power of the United States to controversies "between a State and citizens of another State," and give to the Supreme Court original jurisdiction of controversies to which a State is a party) held that an action might be maintained against a State by a citizen of another State. The national idea was not yet strong, and the proposition that a sovereign State could at the instance of an individual and without its consent be brought to the bar of a court and compelled to defend an action against it startled many. As a consequence the Eleventh Amendment was adopted, which in effect forbids an action in the Federal courts against a State by an individual.

John Marshall became Chief Justice in January, 1801, and remained in office for 34 years. It was a great constructive period, and by those decisions which declared the relative powers of the nation and the State was disclosed the full significance of the Constitution as an instrument expressing the creating of a new nation and not an article of confederation between States. Not merely were these relative powers declared, but the value of the Supreme Court in determining the extent of such relative powers and to pass upon acts of State and nation were made apparent. In Marbury *v.* Madison, 1 Cranch, 137, decided Feb. 24, 1803, it was held that an Act of Congress repugnant to the Constitution was void and that it was the function of the court to ascertain in cases properly before it whether such repugnancy exists. This power of the courts though often criticized, especially in recent years, has never been shaken. According to an estimate made by Dr. Blaine F. Moore, the Supreme Court between 1790 and 1912 declared unconstitutional 33 statutes of Congress, 223 State statutes and 23 municipal ordinances. In the same period there were 185 decisions sustaining statutes of Congress, 646 sustaining State statutes, and 73 sustaining municipal ordinances.

The next important decision following Marbury *v.* Madison was M'Culloch *v.* Maryland, 4 Wheat. 316, in which the question was presented of the power of Congress to charter a national bank. The Constitution gives in terms no such power, or any power to create corporations, and advocates of strict construction contended that Congress could not create a corporation for any purpose. The court, upon the authority of that clause which, following the clauses making express grants to Congress, empowers that body to "make all laws which shall be necessary and proper for carrying into execution the foregoing powers," held that, as a bank was a proper and convenient agency for carrying on the fiscal affairs of a government, there was power in Congress to create a banking corporation; that the word "necessary" was not to be construed in a strict and narrow sense, but—viewing the Constitution as an organic instrument, which from the very necessities of the case used general terms in giving to that government the power essential for its being—to be taken broadly and liberally, and declared what has become axiomatic in constitutional law: "Let the end be legitimate, let it be within the scope of the Constitution, and all means which are appropriate, which are plainly adapted to that end, which are not prohibited, but consistent with the letter and spirit of the Constitution, are constitutional."

This decision laid the foundation of what is known as the doctrine of implied powers, well appreciated when we recall that under a grant of power stated in the few words "to establish post offices and post roads" the great postal system of the United States has been built up. At the same term was decided the case of the Trustees of Dartmouth College *v.* Woodward, 4 Wheat. 518, in which it was held that the charter of a private corporation granted by a State created a contract whose obligations the State could not impair, because of that provision of the Federal Constitution which forbids a State to pass any law "impairing the obligation of contracts." (See DARTMOUTH COLLEGE CASE.) Popular disapproval of this decision is indicated by the fact that practically all of the States subsequently enacted amendments to their constitutions reserving the power of repeal, alteration, and amendment of all corporate grants.

Martin *v.* Hunter, 1 Wheat. 304, and Cohens *v.* Virginia, 6 Wheat. 264, the latter decided at the February term, 1821, settled the power of the Supreme Court to review, and if necessary set aside, the proceedings of a State court in a case in which a Federal right was asserted by the defeated party. Again, in Gibbons *v.* Ogden, 9 Wheat. 1, decided in 1824, the supreme power of the Federal government over the navigable waters of the United States was affirmed. In that case Robert Fulton, the inventor of the steamboat, and his associate, Robert R. Livingston, obtained from the State of New York the grant of an exclusive right to navigate with steamboats the waters within the jurisdiction of that State. Gibbons claimed a right under national authority to navigate with his steamboats the same waters, and hence the litigation. The Constitution having granted to Congress the power to "regulate commerce with foreign nations and among the several States," it was held that that power could not be infringed upon by any action of a State and that a State could not interfere with such commerce even when carried upon waters wholly within its own territory. Upon that decision rests freedom of commerce between the States. In this connection the case of "The Genesee Chief," 12 How. 443, decided in 1851, may be noticed. In that case it was held that the English rule that the jurisdiction of admiralty ended with tide waters was inapplicable, and that in the United States such jurisdiction, which by the Constitution is vested in the Federal courts, extends to all the navigable waters of the Republic. Thus the control of the Great Lakes and all the navigable rivers of the United States, whether within or without the limits of a State, is vested in the national government. In Osborn *v.* United States Bank, 9 Wheat. 738, it was held that a State had no power to tax one of the branches of the United States Bank; that the bank was one of the agencies and instrumentalities of the national government, removed from the sphere of State taxation. From that decision comes the rule exempting all agencies and instrumentalities of the national government from State taxation except so far as permitted by Congress. This is seen in respect to United States bonds, national banks, etc. Conversely, later, in The Collector *v.* Day, 11 Wall. 113, decided December, 1870, it was held that Congress could not impose an income tax on the salaries paid to State officials.

Chief Justice Marshall was succeeded by Chief Justice Taney, a strict constructionist. But the court still affirmed the nationality of the United States. In Ableman *v.* Booth, decided in 1858, 21 How. 506, a prisoner in custody of the United States authorities was held not to be subject to discharge by State process. In the "Dred Scott Case," decided in 1856, 19 How. 393, the nationality of the United States was asserted, though not satisfactorily to the friends of human freedom, in that it decided that the recognition by the Constitution of slave property carried with it the protection of that property in all the territories of the nation.

When the Civil War ended and Chief Justice Taney had been succeeded by Chief Justice Chase a new series of cases arose. Some stringent laws had been passed by Congress and by some States against participants in the rebellion. Test oaths were prescribed which prevented many who had taken part with the South from pursuing their professions, but in Cummings *v.* Missouri, and ex parte Garland, decided in 1866, 4 Wall. 277 and 333, such test oaths were adjudged invalid as ex post facto acts. At the same time, in ex parte Milligan, 4 Wall. 2, it was held that a military tribunal, sitting in Indiana, a State in which there had been no rebellion, had no jurisdiction to punish a citizen, in no way connected with the army, for an offense against the government. In Texas *v.* White, 7 Wall. 700, decided in 1868, it was held that States in rebellion did not lose their existence or identity, Chief Justice Chase making the declaration that this was "an indestructible union composed of indestructible States." Soon after the war the Fourteenth Amendment to the Federal Constitution was adopted, which prohibited the States from depriving any person of life, liberty, or property without due process of law, and from denying to any one the equal protection of the law. It was claimed by many that this operated to prevent the grant by a State of any special privileges, but in the Slaughter House Cases (q.v.), 16 Wall. 36 (1872), restrictions on the butchering business in New Orleans were held to be valid. In 1890 came Leisy *v.* Hardin, 135 U. S. 100, a case which held that a State cannot forbid the sale of liquor in original packages imported from other States. This decision and those following it gave rise to Congressional statutes known as the Wilson Act and the Webb-Kenyon Act, as a result of which the States may now exercise effective control over the liquor traffic. In 1895, in the Income Tax Cases, 82 U. S. 429, it was held that the constitutional provision requiring direct taxes to be apportioned among the States according to their population rendered invalid a tax which was not so apportioned on incomes derived from real estate and as the direct product of personal property. This decision led to the passage of the Sixteenth Amendment ratified in 1913 which provides that Congress may levy taxes on incomes without such apportionment among the several States. In the Insular Cases, 128 U. S. 1, and succeeding cases arising out of the conquest of Porto Rico and the Philippines, the court considered the power of Congress to govern territories acquired by war or treaty, and affirmed to the largest extent the national power of the Republic, holding that a number of the important limitations on congressional action were not applicable to territory not incorporated by Congress into the United States. During recent years important decisions of the court have dealt with congressional and State regulation of commerce and with laws passed by the States in the exercise of police power. Generally these decisions have sustained the application of previously established principles. The court has tended strongly towards extension of Federal control over interstate commerce and restricting the States in any action which interferes with the freedom of such commerce. It has on the whole been favorable to the rapidly increasing restraints the States have imposed upon individual action for the promotion of the general public welfare.

In 1801, the first year of Chief Justice Marshall's term, only 10 cases were filed in the court; from 1875 to 1880 there were 1953, or about 390 a year. While the Act of 1891 diminished the number of cases that could come to the court, yet 401 cases were filed in 1900 and 383 in 1901. During the October, 1914, term, the court rendered opinions in 272 cases and decided without opinion 222 cases.

As heretofore stated, the court at first consisted of six members; it never has had at any time over 10, and now has but nine. The chief justices and their States have been: John Jay, New York; John Rutledge, South Carolina; Oliver Ellsworth, Connecticut; John Marshall, Virginia; Roger B. Taney, Maryland; Salmon P. Chase, Ohio; Morrison R. Waite, Ohio; Melville W. Fuller, Illinois; Edward D. White, Louisiana. Associate justices: William Cushing, Massachusetts; James Wilson, Pennsylvania; John Blair, Virginia; James Iredell, North Carolina; Thomas Johnson, Maryland; William Paterson, New Jersey; Samuel Chase, Maryland; Bushrod Washington, Virginia; Alfred Moore, North Carolina; William Johnson, South Carolina; Brockholst Livingston, New York; Thomas Todd, Kentucky; Joseph Story, Massachusetts; Gabriel Duval, Maryland; Smith Thompson, New York; Robert Trimble, Kentucky; John McLean, Ohio; Henry Baldwin, Pennsylvania; James M. Wayne, Georgia; Philip P. Barbour, Virginia; John Catron, Tennessee; John McKinley, Alabama; Peter V. Daniel, Virginia; Samuel Nelson, New York; Levi Woodbury, New Hampshire; Robert C. Grier, Pennsylvania; Benjamin R. Curtis, Massachusetts; John A. Campbell, Alabama; Nathan Clifford, Maine; Noah H. Swayne, Ohio; Samuel F. Miller, Iowa; David Davis, Illinois; Stephen J. Field, California; William Strong, Pennsylvania; Joseph P. Bradley, New Jersey; Ward Hunt, New York; John M. Harlan, Kentucky; William B. Woods, Georgia; Stanley Matthews, Ohio; Horace Gray, Massachusetts; Samuel Blatchford, New York; Lucius Q. C. Lamar, Mississippi; David J. Brewer, Kansas; Henry B. Brown, Michigan; George Shiras, Jr., Pennsylvania; Howell E. Jackson, Tennessee; Edward D. White, Louisiana; Rufus W. Peckham, New York; Joseph McKenna, California; Oliver W. Holmes, Massachusetts; William R. Day, Ohio; William H. Moody, Massachusetts; Horace H. Lurton, Tennessee; Charles E. Hughes, New York; Willis Van Devanter, Wyoming; Joseph R. Lamar, Georgia; Mahlon Pitney, New Jersey; James C. McReynolds, Tennessee. Consult: B. R. Curtis, *Jurisdiction, Practice, and Peculiar Jurisprudence of the Courts of the United States* (2d ed., Boston, 1896); H. L. Carson, *History of the Supreme Court of the United States, with Biographies of all Justices* (2 vols., Philadelphia, 1902); B. F. Moore, *The Supreme Court and Unconstitutional Legislation* (New York, 1913). See CONSTITUTION OF THE UNITED STATES; COURT; FEDERAL GOVERNMENT.

SUQUAMISH, sụ-kwŏm′ĭsh. See SALISHAN STOCK.

SURABAYA, sōō′rȧ-bä′yȧ. The most populous residency in Java. Area, 2091 square miles (Map: East Indies, D 7). The soil is fertile and produces an abundance of rice, coffee, sugar cane, indigo, and tobacco. Capital, Surabaya. Pop., 1905, 2,875,091.

SURABAYA, or SOERABAYA. The largest city in Java, and the capital of the Residency of Surabaya, situated in the eastern part of the north coast, at the mouth of the Brantas River (Map: East Indies, D 7). It has a good harbor and strong fortifications and is the military and naval headquarters of the Dutch East Indies. The houses are generally separated by gardens. Simpang, the suburb, contains the home of the Resident and a large hospital. The shipbuilding industry is important. The trade in rice, coffee, cotton, sugar, tobacco, and coconuts is very extensive. Pop., 1905, 150,198, of whom 8063 were Europeans.

SURAKARTA, sōō′rȧ-kär′tȧ. A residency in the central part of Java, between Samarang and Surabaya (Map: East Indies, D 7). Area, 2404 square miles. The residency is one of the so-called independent states and is governed by a native emperor, who is subsidized by the Dutch and wholly under their control. Capital, Surakarta. Pop., 1905, 1,621,404.

SURAKARTA, or SOERAKARTA. The capital of the Residency of Surakarta, Java, on both banks of the Pepé River and on the railway between Samarang and Surabaya (Map: East Indies, D 7). It is the residence of the native prince, whose palace is directly opposite the great fort called Vastenburg in the middle of the city. Pop., 1905, 118,378.

SURAT, sōō-rät′. The capital of a district of the same name, Bombay, British India, 166 miles by rail north of Bombay, at the mouth of the Tapti, in the Gulf of Cambay (Map: India, B 5). The town is surrounded on the landward side by a brick wall. It has numerous mosques and several Hindu and Parsi temples and the palace of the former Nawab of Surat. The Tapti, owing to a sand bar, affords entry only to small vessels, and the commerce of Surat, which from the sixteenth century to the eighteenth century was very extensive, has been steadily diverted to Bombay. Surat has a castle dating from 1540, centrally situated on the river front. The city rose into importance as the spot whence the Mohammedans of Hindustan embarked on their pilgrimage to Mecca. In 1612 the English East India Company established a factory here, which for some time was their principal trading station in India. Pop., 1901, 118,364; 1911, 114,868.

SUR'BITON. A town in Surrey, England, on the Thames, mainly residential, 13 miles southwest of London. Surbiton Common witnessed the last stand of the Royalists in the Civil War. Pop., 1901, 15,019; 1911, 17,717.

SURDS. See IRRATIONAL NUMBER.

SURESNES, sụ'räN'. A town of the Department of Seine, France, at the foot of Mont Valérien, on the left bank of the Seine, 7½ miles west of Paris (Map: France, N., A 2). In 1593 a conference was held here which resulted in the adoption of Catholicism by Henry IV. Pop., 1901, 11,225; 1911, 15,765.

SURETTE, sōō-rĕt', THOMAS WHITNEY (1862–). An American organist and composer. He was born in Concord, Mass., and studied music under Arthur Foote and J. K. Paine. In 1883 he became organist in his native town, and in 1894–96 was organist and choirmaster of Christ Church, Baltimore. In 1896 he became interested in the University Extension movement, and devoted most of his time to lecturing under its auspices on musical subjects. His compositions include an operetta, *Priscilla* (1899), an opera, *Cascabel* (1899), a ballad for chorus and orchestra, *The Eve of St. Agnes*. He also wrote *The Development of Symphonic Music* (1915).

SURETY INSURANCE. See INSURANCE.

SURETYSHIP (from *surety*, from Fr. *sûreté*, from Lat. *securitas*, freedom from care). The engagement by which one person becomes legally bound to another for the liability of a third. It therefore involves three parties: the creditor, the principal debtor, and the surety. The distinction between this term and another which is often used interchangeably with it has been pointed out under GUARANTY (q.v.), and need not be repeated here.

It is generally held that surety agreements are subject to the ordinary rule of interpretation that a written contract is to be construed strongly against the party executing it. This will always be enforced when it appears that the language was chosen by the signer, whether he enters into the contract for his own benefit or for the benefit of a third person. Another important rule is that such contracts shall be interpreted so as to give effect to all of their provisions if possible.

After the contract is made it is the duty of the creditor not to enter into any binding engagement with the principal, modifying that contract, without the assent of the surety. The law favors the surety and protects him with much jealousy. Accordingly, if the creditor varies the terms of the original contract or changes securities put into his hands by the principal debtor, or discharges a cosurety, or gives time to the principal debtor, or negligently causes a loss to the surety, the latter will be discharged unless he has assented to this conduct of the creditor. If, however, the principal debtor or a cosurety is discharged from liability by operation of law, as by a discharge in bankruptcy, the surety still remains bound. In a true instance of suretyship, as distinguished from guaranty, the surety is liable even if the obligation of the principal debtor is void or voidable, as in the case of an infant.

The rights of the surety may be considered under three heads. First: Against the principal debtor. As soon as the debt becomes due, the surety is entitled to call on him for exoneration. This relief is obtainable in a court having equitable powers, it being unreasonable that the surety should have such a cloud hanging over him. If the surety has been compelled by the creditor to pay the debt, he is entitled to call on the principal for reimbursement; for the money paid by him was paid for the principal's use. Second: Against the creditor. As soon as the debt becomes due the surety may demand that the creditor sue the principal and collect the debt from him. In some of the United States the surety is discharged from liability if the creditor does not sue the principal upon the surety's request. One who is surety for the honesty or good conduct of an employee is entitled to have the employee discharged from service for serious defaults or breaches of duty, or to be freed from his suretyship. As the surety has assumed a primary obligation the creditor may sue him without first exhausting his remedies against the principal debtor, and even a demand on the latter is generally unnecessary. Furthermore, as the obligation is primary it is not a promise to pay the debt, default, or miscarriage of another and hence need not be in writing under the Statute of Frauds. Another and very important right of the surety is to have the benefit of all securities which the creditor holds against the principal. This is known as the right of subrogation (q.v.). Third: Against cosureties. It often happens that one surety is compelled by the creditor to pay the whole debt, and that the debtor is worthless. In such a case the unlucky surety is entitled to call upon his cosureties for contribution. Consult authorities cited under GUARANTY. See SUBROGATION.

SURFACE (OF., Fr. *surface*, from Lat. *superficies*, upper side, surface, from *super*, above + *facies*, form, figure, face). The boundary between two portions of space. As a point in a plane is determined in general by two intersecting lines, so a point in space is in general determined by three intersecting surfaces. These surfaces may be plane, quadric, or of higher order according as their equations are of the first, second, or higher degree in the linear coördinates of the system. Thus in Cartesian coördinates (see COÖRDINATES) the general equation of the first degree in x, y, z, or $ax + by + cz + d = 0$, is represented by a plane. The general equation of the second degree in x, y, z, or $ax^2 + by^2 + cz^2 + 2fyz + 2gzx + 2hxy + 2kx + 2my + 2nz + d = 0$, is represented by a conicoid, or surface of the second order, also called a quadric surface. By a suitable transformation of coördinates the general equation of the second degree may be transformed into one or the other of the forms (1) $Ax^2 + By^2 + Cz^2 = D$ or (2) $Ax^2 + By^2 = Cz$. Surfaces having the symmetric equation (1) are symmetric with respect to the origin as a centre and are called central quadrics. Noncentral quadrics are included in equation (2). If $A = B = C$, equation (1) takes the form $x^2 + y^2 + z^2 = K\ (= r^2)$, the equation of the sphere (q.v.). The general equation (1) represents either an ellipsoid (q.v.) or an hyperboloid. If $D = 0$, and A, B, C are not all positive, equation (1) represents a conical surface whose vertex is at the origin. Equation (2) is represented by the surface of a paraboloid (q.v.).

A surface through every point of which a straight line may be drawn so as to lie entirely in the surface is called a ruled surface. Any one of these lines which lies on the surface is called a generating line of the surface. The cylinder, cone, hyperboloid of one sheet, conoid (q.v.), and the hyperbolic paraboloid (see Paraboloid) are ruled surfaces. There are two distinct classes of ruled surfaces, those on which the consecutive generators intersect and those on which they do not. The former are called developable and the latter skew surfaces.

If the degree of the equation $f(x, y, z) = 0$ is higher than the second, the surface representing it will be of an order higher than the second. In discussing the properties of such surfaces, especially the nature of the surface in the vicinity of any given point, the equation of the tangent plane at that point is necessary. This plane is the locus of all tangent lines through the given point, and will meet the surface of the nth order in a curve of the nth degree, since each straight line meets this curve in n points. The point of contact of the plane with the surface will be a singular point on the curve. (See Curve.) The section of any surface by a plane parallel and indefinitely near to the tangent plane at any point is a conic and is called the indicatrix at the point. Thus points of a surface are called elliptic, parabolic, or hyperbolic, according as the indicatrix is an ellipse, parabola, or hyperbola. If every straight line through a point (x', y', z') of a surface meets the surface in two coincident points, the point (x', y', z') is called a singular point. If the tangent lines at any point form a cone the point is called a conical point; if they form two planes the point is called a nodal point. Similar to the envelope of a family of curves, the envelope of a family of surfaces is the locus of the ultimate intersections of a series of surfaces produced by varying one or more parameters (q.v.) of an equation. The curve in which any surface is met by the consecutive surface is called the characteristic of the envelope. Every characteristic will meet the next in one or more points, and the locus of these is called the edge of regression or cuspidal edge of the envelope. The conditions for convexity and concavity, different orders of contact, and various other properties are best obtained from works on analytic geometry.

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SURFACE, Joseph. A sentimental, plausible hypocrite in Sheridan's *School for Scandal.*

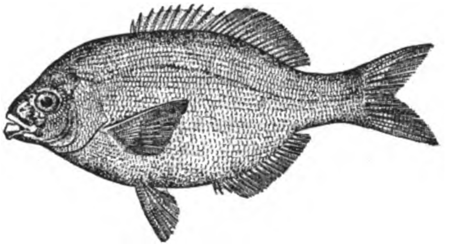
SURFACE TENSION. The property by virtue of which the surface of a liquid tends to contract to a minimum area. It is measured in ergs per square centimeter. See Absorption; Capillarity.

SURF BIRD. A remarkable plover-like bird (*Aphriza virgata*) widely distributed on the coasts and islands of the Pacific Ocean, and common along the entire west coast of North America. It is about 9½ inches long, dark ashy brown above, white beneath, everywhere more or less spotted, streaked, or barred with black. The feet are like those of a sandpiper, but the bill is plover-like, short and thick. The wings are very long and acute, reaching beyond the end of the tail when folded. It is clearly related to the turnstone (q.v.).

SURFBOAT. See Lifeboat; Life-Saving Service.

SURF DUCK, or Surf Scoter. See Scoter.

SURF FISH. A fish of the suborder Halconoti and family Embiotocidæ, related to the percoids. Many species occur on the Pacific coast of the United States, where they inhabit bays and the surf on sandy beaches. They are small, oval-oblong, compressed, and often very handsome, with stripes, spots, and effusions of various colors. Their flesh is not very highly regarded. The fact of greatest interest connected with them is that they are viviparous. One of the largest and most useful of the family is the "alfiona" (*Rhacochilus toxotes*).



A SURF FISH, THE ALFIONA.

SURF SMELT. A small, firm-fleshed, and fat smelt (*Hypomesus pretiosus*) of the coast of California and northward, valued as food. It spawns in the surf, and is netted in great quantities. See Plate of Whitefish, Smelts, etc.

SURGEON, Contract. See Contract Surgeon.

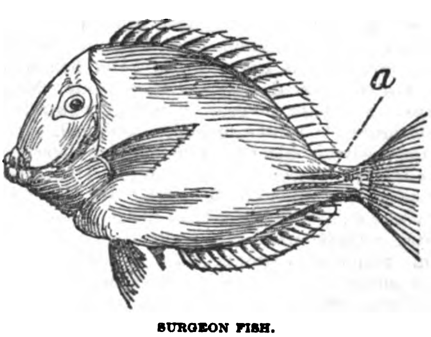
SURGEON, Military and Naval. The titles of assistant surgeon, surgeon, deputy surgeon-general, and assistant surgeon-general, once used to designate officers in the medical department of the United States army, were discontinued under the Act of 1908, and the titles for all medical officers, except the surgeon-general of the army, became the military rank followed by the words Medical Corps, e.g., captain, Medical Corps. The title surgeon, however, was retained to designate the duty to which assigned, e.g., the senior medical officer of a territorial department of a tactical division is known simply as the department or division surgeon. In the Dental Corps, also, the terms dental surgeon and acting dental surgeon were retained. A civilian physician, temporarily employed, is known as a contract surgeon. Officers in the Medical Corps of the United States army are first commissioned as first lieutenants; after three years' service they automatically become captains after examination. No person can receive an appointment unless he shall have been examined and approved by an Army Medical Board. The applicant must be between 22 and 30 years of age, must be a citizen of the United States, must have a satisfactory general education, must be a graduate of a reputable medical school legally authorized to confer the degree of doctor of medicine, and must have had at least one year's hospital training, including practical experience in the practice of medicine, surgery, and obstetrics, or the equivalent of this practice after graduation.

Medical Reserve Corps. This was established by Act of Congress dated April 23, 1908, for the purpose of securing a reserve corps of medical officers, available for military service. They rank as first lieutenants and are appointed by the President, from graduates of reputable schools of medicine, after a prescribed examination. They must be between 22 and 45 years of age. They receive pay only when called into active service, which is voluntary, but in case of failure to respond their commissions are forfeited. They are not entitled to retirement or promotion. From this corps are obtained the large majority of regular medical officers under the provisions of the Act of 1908.

The titles of most of the medical officers of the navy still include the word "surgeon." The titles, with rank, are as follows: surgeon-general (rank of rear admiral); medical director (rank of captain); medical inspector (rank of commander); surgeon (rank of lieutenant commander); passed assistant surgeon (rank of lieutenant); assistant surgeon (rank of lieutenant, junior grade); acting assistant surgeon (Medical Reserve Corps), dental surgeon, acting assistant dental surgeon, and assistant dental surgeons all have the rank of lieutenant, junior grade.

The Royal Army Medical Corps of Great Britain is a distinct branch of the service, under its own headquarters organization. Members of the corps are trained for military as well as medical emergencies. The Sanitary Troops of Germany and France are organized on similar lines to the United States, differing in details due to general army organization. See Army Organization; Hospital Corps and section *Army*, under the different countries; Medical Department, U.S.A.; Medical Department, U.S.N.; Surgery, Military.

SURGEON FISH (so called from the lancet-shaped spine), or Sea Surgeon. One of a family (Teuthididæ) of tropical Oriental fishes, of which about 80 species are recognized, and which feed upon seaweeds. Those best known are of the genus *Teuthis*, called "barberos," "lancet fishes," "tangs," and so on, and characterized by the possession of a long, sharp, lancet-like spine on each side of the caudal peduncle. The spine is movable and shuts into a groove along the side of the tail.



SURGEON FISH.
a, position of the lancet and its sheath.

SURGERY (Fr. *chirurgie*, surgery, from Fr. *chirurgien*, surgeon, from Lat. *chirurgus*, from Gk. χειρουργός, *cheirourgos*, surgeon, handicraftsman, from χείρ, *cheir*, hand + ἔργον, *ergon*, work). The treatment of disease and the correction of deformity or defect by manual and operative procedures, with or without the use of drugs. This branch of medical science is subdivided: (1) According to the nature of the procedure employed, into general surgery, which deals with all manner of cases; orthopedic surgery, which pertains to the correction of deformity; plastic surgery, which involves the building up of tissues and the restoration of lost parts, principally by the transfer of tissue. (2) According to the region involved, into intracranial or brain surgery; ophthalmic or eye surgery; aural or ear surgery; abdominal or visceral surgery, et cetera. Many factors have contributed to the development of surgery. Among these may be mentioned the gradual accumulation of knowledge concerning anatomy and physiology; the discovery of the circulation of the blood; the perfection of the microscope; and the attainment of skill in the invention and manufacture of instruments and apparatus. The discovery of anæsthesia and antisepsis, by eliminating much of the pain and danger for the patient, and by lessening the difficulties and inconveniences for the surgeon, has broadened the scope of surgery so that many patients who formerly would have been treated solely with plasters and potions are now subjected to surgical intervention. Surgery, therefore, as practiced to-day, is the product of evolution to which all the ages have contributed.

HISTORY

Ancient. The surgery of antiquity, although limited in scope and crude in practice, foreshadowed much that is familiar to-day. The lack of knowledge of anatomy, physiology, and other departments of medical science, and the inferior equipment in point of instruments and apparatus, did not deter the ancients from the performance of many daring feats of surgery. The ancient Egyptians (as related in the *Papyrus Ebers*, 1552 B.C., and in other records) are said to have performed with success and dexterity many operations, notably, castration, lithotomy (removal of calculi), amputations, and various operations upon the eye. The Hindus, like the Egyptians, were familiar with surgical practices, such as the treatment of fractures, the removal of calculi, etc. Indeed, the ancient Hindus are credited with having originated plastic surgery thousands of years ago. It is recorded that a certain Hindu ruler imposed upon the inhabitants of a conquered city the punishment of cutting off the nose, none escaping save infants and players upon wind instruments. The prevalence of this disfigurement called forth efforts upon the part of the inhabitants to repair the defects thus caused. The tile makers, a more or less despised class, were the first to meet with success in this art. Presumably these artisans were inspired to undertake such work because of their familiarity with cements and different processes of repair calling for adhesion.

The surgery of the early Greeks seems to have been largely that of the battlefield and, like medicine, to have been derived from the ancient Egyptians. It was purely empirical and was practiced largely by the priesthood or by head shavers and embalmers delegated by the priests, who were themselves averse to the shedding of blood. This sacerdotal or guild medicine and surgery prevailed until the time of Hippocrates (q.v.). The studies, practice, and writings of Hippocrates embraced surgery as well as medicine, though he gave to the world no landmark in surgical procedure. The ancient Romans contributed little to either medical or surgical science. According to Pliny, they believed the dignity of the Roman did not permit him to make a profession of medicine, which they were accustomed to associate with the bleeders, head shavers, and similar representatives of the sacerdotal medicine and surgery of the Greeks. Little definite progress, indeed, marked the evolution of surgery until the rise of the Alexandrian school. During this period (233–30 B.C.) surgery was placed upon a basis of diagnostic precision and operative daring as a consequence of the study of human anatomy. For the first time in the history of the world superstition was overcome to such an extent that Herophilus, the founder of the study of human anatomy, and others of this school, dissected the human body without interference.

Mediæval. Mediæval surgery embraced the long period which elapsed from the decadence of the Alexandrian school to the beginning of the sixteenth century. Three men are said to have brought the whole surgery of the ancient world to a focus in their writings during this time. Cornelius Celsus (25 B.C.–50 A.D.), Claudius Galen (131–201 or 210 A.D.), and Paulus of Ægina (c.625–690 A.D.), virtually shaped the destiny of surgery throughout the Middle Ages. Byzantine and Arabian medicine helped to foster surgery, and during the latter part of this period European countries, with Italy in the forefront, began to make their impress upon medical and surgical thought, adding many illustrious names to the list of distinguished surgeons. It was during this period that a distinct separation of medicine and surgery began to be noted. The priests and monks, who were likewise the physicians, being averse to the shedding of blood, shrank from the surgical treatment of their charges. Growing out of this attitude, which was brought over from ancient to mediæval times, and likewise in response to the customs imposed upon the priesthood of shaving the head and of being bled at regular intervals, there developed the craft known as barber surgeons. The first duty of these individuals was the shaving and bleeding of the priests and monks; they also assumed the task of administering surgical treatment to all who asked. In France, however, about the middle of the thirteenth century, a new order of surgeons arose—ambitious young men who sought to dignify their calling. Members of this new fraternity were known as surgeons of the long robe, in contradistinction to the barber surgeons, who were known as surgeons of the short robe. Great rivalry, quite naturally, marked the history of these two orders of surgeons. The guild of surgeon barbers underwent gradual evolution, becoming in time the corporation of barber surgeons, composed of representatives of the orders of both the long robe and the short robe. Not only did this organization flourish in point of numbers, but its members were accorded military prestige and court favor throughout Europe. Thus, in England, in 1461, Edward IV granted a charter to the Corporation of Barber Surgeons, and the charter of the surgeons of London was confirmed by Henry VIII.

Reconstruction. The reconstruction period of surgery, embracing the sixteenth, seventeenth, and eighteenth centuries, received the benefit of many important discoveries bearing directly upon surgical practice which were made before surgery was thoroughly emancipated from the stigma of its humble origin, and from the ignorance, superstition, prejudice, and intolerance which hindered progress in all directions during the Middle Ages. Much of the credit of the final emancipation belongs to Ambroise Paré (1510–90), often called the father of modern surgery, who was a member of the Corporation of Barber Surgeons. He was apprenticed to a barber surgeon when, as a youth, he went to Paris. He soon entered the great hospital, the Hôtel Dieu, already the Mecca for ambitious physicians, and was there afforded abundant opportunity for the development of the ability and originality which reflected so much credit upon his guild. When Paré successfully employed the method of ligating arteries in order to control hemorrhage, thus eliminating the old method of searing the bleeding part with the red-hot iron (the actual cautery), he literally inaugurated a new era in surgical practice, of which the control of bleeding is a prime requisite.

It was during this reconstruction period that William Harvey (1578–1657) discovered the circulation of the blood, thus placing anatomy, physiology, and surgery on a different and more secure basis. Antony van Leeuwenhoeck, the Dutch lens maker and naturalist (1632–1723), still further revolutionized scientific investigation by making a lens powerful enough to reveal the hitherto unseen forms of life and the minute structure of matter. His contribution to the evolution of the microscope (q.v.) made possible the discovery by Sir Robert Hooke (1635–1703) of the cellular structure of plants, and by Marcello Malpighi (1628–94) of the cellular composition of the blood and of other details of minute structure, thus paving the way for the brilliant investigators of the nineteenth century, who still further revolutionized surgical practice by discoveries in bacteriology, pathology, etc.

The latter part of the reconstruction period of surgery was particularly prolific of men whose achievements tended finally and firmly to place surgery on a plane equal in all respects with that occupied by medicine—France and England being unquestionably in the lead. To Peyronie (1678–1747), of Montpellier, is given the credit for having finally effected the separation of the surgeons from the barbers in France, and for wielding a powerful influence in furthering the welfare of his profession in general. Petit, Brasdor, Desault, and a host of others contributed to the advancement of surgery in France during the latter part of this period. In England the names of such men as William Cheselden, Alexander Munro, Sir Percival Pott, William and John Hunter, and many other familiar names, appear upon the honor roll of this brilliant era. In Germany, Heister; in Austria, Mohrenheim; in Italy, Scarpa; in Spain, Gimbernat—all were among the distinguished representatives of surgery in their respective countries. In America, during this period, especially during the latter part, a number of surgeons left their impress upon coming generations of surgeons, chiefly as teachers in different medical schools.

Modern. The era of modern surgery may be said to begin with the nineteenth century—a century of epoch-making surgical discoveries and accomplishments. The surgeons of the beginning of this century were hampered, it is true, by a total lack of knowledge concerning many essentials which are matters of common information and practice to-day. They knew little more than their mediæval and ancient predecessors concerning the causes of danger from surgical operations. The true significance of surgical shock was unknown to them, and post-operative sepsis was an enigma. They lacked many of the instruments of precision, such as the fever thermometer and the hypodermic syringe, now familiar to every layman. Yet it has been said, and doubtless truthfully, that more progress has been made in surgery since the year 1800 than in twenty centuries preceding that date.

The first epoch-making event of the nineteenth century was the performance of ovariotomy in the treatment of ovarian disease, this surgical feat having been accomplished by Ephraim McDowell, of Kentucky, in 1809. While it is recorded that jealous males many centuries before were wont to subject the females of their ménage to castration, and while ovariotomy had been accidentally or incidentally performed by surgeons of the eighteenth century (Houston, of Glasgow, in 1701, and Laumonier, of Rouen, in 1781), McDowell was the first intentionally to perform the operation for the specific purpose of curing disease of this organ. When this feat of surgical practice became known and credited, the abdominal cavity was no longer terra incognita, to be explored only in cases of dire necessity. It then became the field of observation by the skillful surgeons who in different countries emblazoned their names upon the surgical Hall of Fame in the preanæsthetic period of modern surgery. Nathan Smith, of Massachusetts, who performed ovariotomy in 1821, without knowing of McDowell's work; Valentine Mott, of New York, who ligated important blood vessels in the treatment of aneurysm, among many other achievements; J. Marion Sims, of Alabama and New York, who is called the founder of modern gynæcology; Samuel D. Gross, of Philadelphia, a great surgeon and a great teacher; and a long list of others might be mentioned among forceful surgeons. In Great Britain, Sir Astley Cooper, Sir Charles Bell, James Syme, and a brilliant coterie of surgeons were making their impress upon the surgical world during this prolific period. In France, Germany, and Italy—in fact throughout the civilized world—the seed was being sown for the abundant harvest of surgical endeavor which followed the introduction of anæsthesia.

The discovery of anæsthesia (1842–47) (q.v.) and the perfection of the various methods of rendering one insensible to pain conferred a blessing upon humanity which is not confined to the patients alone, but which is shared by the surgeon and all concerned in the performance of surgical operations. Major surgery and much of what we now call minor surgery were practically impossible in the preanæsthesia days, as the patients could not endure the pain and neither the surgeon nor his attendants could stand the strain of prolonged and difficult operative procedures. With the discovery of anæsthesia the barrier to progress was removed so far as the possibility of the actual operation was concerned. There still remained, however, the old-time bugbear—hospital gangrene, septicæmia, pyæmia, tetanus—one or more of which could always be reckoned with to nullify, to a greater or less degree, the surgeon's work. It was not until Pasteur (1822–1895) (q.v.), the French physician-chemist, evolved his germ theory and gave to the world his discovery that fermentation is caused by microörganisms, that surgery was finally and fully developed into what has been called "the seeing portion of the healing art."

When Sir Joseph Lister, in 1867–68, applied the discoveries of Pasteur to surgery, and formulated his theory concerning sepsis and antisepsis, the last obstacle to progress was removed. With the pain and inconvenience of the actual surgical procedure nullified, and with the danger of post-operative infection reduced to a minimum, surgery entered upon a new era of triumphs, the period of modern surgical science. Every part of the body has been brought within the domain of this new surgery. Not a tissue, not an organ, not a cavity of the body is now exempt. Surgical practice has undergone many changes, in general, as well as in specific details. Specialism has developed to a pronounced degree, until the field of general surgery is now subdivided into regional surgery, surgery of the brain, the eye, the ear, the chest, the abdomen, and other special regions. A further specialism concerns itself less with regions of the body than with diseases, a notable example of which is cancer.

Perfection of technic has been very greatly facilitated of late years by the more rational attitude of the public in general and of lawmakers in particular with reference to securing material for the dissecting room, the autopsy, and the surgical laboratory. Happily, enlightened sentiment no longer makes body snatching a necessity, nor does it permit of such demonstrations against the dissection of the human body as the Doctors' Mob of 1788, which raged for two days in New York, despite the efforts of civil and military authorities to quell it. State control of the disposition of the bodies of certain classes of persons dying unclaimed has contributed largely to the improvement of medical education, in consequence of which surgery, along with medicine, has received a decided impetus.

The surgery of the twentieth century, as may be seen from the foregoing brief historical review, is the product of evolution, the factors involved being many and diverse, some very old, and some hardly older than the century.

SCOPE

Purposes. The purposes of surgery have been modified and its domain greatly extended as the result of the epoch-making discoveries chronicled above. Surgery is now resorted to for purposes of: (1) diagnosis (exploratory laparotomy; intracranial exploration or exploratory craniotomy; excision, under certain circumstances, of tumor or other tissue for microscopic examination, etc.). (2) The correction of deformity or defect. (3) The cure of disease.

(4) The amelioration of suffering. (5) The prolongation of life.

Diagnostic. In diagnosis surgery is frequently called into requisition. With the general progress in medicine and surgery which has marked the last quarter century, modern methods of diagnosis—chemical, bacteriological, physical, and electrical—have brought us into intimate acquaintance with body cavities which were formerly but rarely explored and but little understood. This is particularly true of the abdominal cavity. The surgeon, by means of the various methods mentioned, is enabled to predict, with a fair degree of accuracy, what will be revealed by operation. In many cases, however, it is impossible, by any external diagnostic methods, to ascertain the exact conditions to be dealt with, and to determine the remedial measures to be employed. In such cases exploratory operation is indicated, not always as a last resort, but often as an early means of making an absolutely correct diagnosis. This is particularly true with reference to the abdomen. The most telling arguments in favor of opening the abdomen and seeing and feeling the actual condition are cases of cancer of the abdominal or pelvic organs, in which patients have been allowed to go untreated, or to be incorrectly treated (in consequence of mistaken diagnosis), until it is too late for curative surgical intervention. It is sometimes necessary, likewise, to resort to exploratory craniotomy in cases of obscure brain lesions, it being impossible, in some instances, to make an absolute diagnosis of abscess or tumor of the brain by other means. In the case of an external tumor, as of the breast, particularly in the early stage of development, it is impossible to determine positively whether such tumor is of benign or malignant (cancerous) nature until a section is removed and studied under the microscope. The microscopical examination in such cases should be made at the time, in order that, if the growth is found to be malignant, it may be immediately extirpated, thus obviating the danger of disseminating cancer cells.

Corrective. In the correction of deformity the orthopedic surgeon has a very wide and beneficent field of usefulness. Orthopedic operations were undertaken centuries ago, but, like all other branches of surgery, its greatest achievements belong to the period since the discovery of anæsthesia. Clubfeet, bowlegs, curved and otherwise deformed spines, congenitally dislocated hip joints, harelips, cleft palates, and many other deformities, which years ago were allowed to go uncorrected, now receive attention during the formative period of life, when nature has ample opportunity to finish the work of correction begun by the surgeon. Many persons thus reach adult life with so little evidence of their early deformity that they may be considered normal adults in every sense of the term.

In the correction of defects which are the result of accident or disease (in contradistinction to the deformities which are of congenital origin, or born with the individual) plastic surgery is called into requisition. This branch of surgery, too, as we have already seen, is not new, though it has been markedly extended and amplified since the modern era was inaugurated. Some surgeons, not content with employing plastic methods in the repair of defects caused by accident, have entered the field of cosmetic surgery, the purpose of which is to improve upon the work of nature in response to the vanity of the subject. There are cases, however, in which such deformities as crumpled ears, markedly humped or saddleback noses, and other conditions through which the individual suffers inconvenience and embarrassment, are sufficient to warrant recourse to plastic surgery. The most important work in this field, however, consists in the correction of defects which result from accident or disease. Sometimes, following injury or burns, scar tissue forms to such an extent as to cause deformity and to interfere with the use of the organ or part involved. By dissecting out the cicatricial tissue and filling in the defect with a flap from some other portion of the patient's body, the contour of the disfigured part may be greatly improved and its usefulness restored. Sometimes tumors are so situated that their complete removal leaves a marring defect. By means of autoplastic or heteroplastic skin grafts or flaps this may be so completely overcome that no evidence of the defect remains. Lupus (tuberculosis of the skin), cancer, and other diseases may cause such deformity as to necessitate, or at least to render advisable, the utilization of plastic surgery. In advanced cancer, when it is no longer possible thoroughly to eradicate the disease, it is possible to remove all superficial evidence and then resort to palliative repair, thus possibly keeping the disease confined, at least for a time, to the deeper structures. For example, cancer may involve the nose, extending into the bones of the cheek and jaw, so that the removal of all macroscopical evidence of the disease would entail the removal of practically the entire half of the face. It is possible, in such instances, to remove all superficial manifestation of the disease and to fill in the defect by plastic flaps, leaving the patient far more comfortable and more presentable for the remainder of life than would have been the case without the plastic intervention. Such patients may live for months with irremovable cancer, all the while oblivious to the fact that they have not been entirely cured of this affection, and may die from some disease in no way associated with the cancer. There is, perhaps, no phase of plastic surgery more beneficent than that which deals with the plastic and palliative repair in cases of malignant disease.

Curative. In the cure of disease surgery is employed in such a diversity of ways and for so many conditions that every part of the body, literally "from the crown of the head to the tip of the toe," is amenable to treatment by operative measures.

As the osseous system of the bony framework of the body has long been the subject of surgical experimentation in the correction of deformities and abnormalities, so also has it received attention in the cure of diseases involving its integrity. Thus, in the treatment of sarcoma, tuberculosis, osteomyelitis, and of bone affections, great progress has been made. Sir Arbuthnot Lane of London, who originated the valuable procedure known as bone plating; Dr. John B. Murphy of Chicago, who has contributed excellent work to the technic of arthroplasty, or the plastic surgery of the joints; Dr. Fred A. Albee of New York, who has contributed to the surgery of the spine by his work on bone transplantation and osteoplasty in the treatment of certain affections of the spine; and many others working along similar lines have blazed new trails or shed new light upon paths previously explored.

The brain, which in former times it was considered a sin to "cause to sleep," is now with impunity not only rendered inactive for the time by anæsthetics, but is subjected to inspection and operation just as any other part of the body. Tumors are removed, abscesses evacuated, blood clots and other obstructions to the vessels cleared, and many other operations performed upon all parts of the brain. The spinal cord, too, is subjected to surgical treatment. It is also utilized for purposes of spinal analgesia, the patient being rendered insensible to operations in certain localities of the body without being rendered unconscious. This is accomplished by injecting into the spinal canal given quantities of certain analgesic agents, such as cocaine, novocain, and stovaine. The peripheral nervous system, like the brain and spinal cord, is amenable to surgical treatment in the relief of affections of the nerves themselves or in the course of the surgical care of other diseases. In severe neuralgias, such as facial and supraorbital neuralgia, injections of alcohol or other substances into or near the nerves involved will sometimes give relief. Cutting nerves and dissecting out parts of the nerves or the ganglia from which they arise will likewise relieve intractable cases of neuralgia. In some cases of advanced cancer, when little more can be done surgically, great relief can be given by cutting nerves pressed upon by the malignant growth.

The vascular system, including the heart, has been brought within the domain of experimental and practical surgery, with the result that many cases which in former years would have been considered impossible of surgical treatment are now promptly subjected to such measures. A large amount of interesting and valuable experimental work upon animals has been conducted by Dr. B. Merrill Ricketts of Cincinnati, Dr. Alexis Carrel of the Rockefeller Institute, New York City, and others, all looking to the application of principles and technic to the surgery of the human vascular system. A large proportion of the practical surgical work upon the heart deals with injuries to this organ, the majority of these being stab or gunshot wounds. It is estimated that from 25 to 35 per cent of patients subjected to operation recover. A larger percentage of cases of milder severity result in recovery after operation. Contusions and ruptures of the blood vessels, and wounds made by sharp weapons or bullets, are treated by ligation, removal of clots, or other accumulations of blood (hæmatomas) and ligation of both ends of the vessel or repair by anastomosis. Clots or thrombi and emboli (composed of air cells, bacteria, or fat), causing obstruction of the vessel involved, require surgical removal. Aneurysm (q.v.) has been given a great deal of attention with regard to treatment by surgical means, many operations having been devised. The ligation of arteries for the control of hemorrhage has played an important part in surgical practice since Ambroise Paré introduced it in the sixteenth century. With the discovery of the circulation and the development of knowledge concerning the part played by the blood in the nourishment of normal, as well as abnormal, tissue the method of ligating arteries increased in scope. It then came to be applied, not only for the control of hemorrhage occurring as the result of accident or surgical procedure and for the treatment of aneurysm, but for the purpose of causing atrophy or shrinkage of organs or other parts of the body under certain circumstances and to lessen the nutrition of inoperable or irremovable new growths, thus checking further development and perhaps causing disappearance. The last-named use of the ligature has given rise to the term "starvation ligature." The procedure has been applied to the uterus, ovaries, testes, spleen, thyroid gland, tongue, and other organs. The method has been found particularly useful as employed by the late Dr. R. H. M. Dawbarn of New York City in the treatment of irremovable tumors of the head and face and by Dr. William Seaman Bainbridge of New York City in the treatment of advanced cancer of the pelvic organs.

The respiratory system, like the nervous and vascular systems, has been a prolific field for surgical investigation. The history of the surgery of this particular part of the body has been entirely rewritten within the last few years in consequence of the researches of Sauerbruch, Willy Meyer, Meltzer, Elsberg, Ricketts, and others who have devised means of operating upon the lungs and other thoracic viscera without collapse of the lungs. This is accomplished by various kinds of apparatus, all designed for maintenance, during operation, of the necessary differential air pressure, i.e., the maintenance of the normal intrapleural negative pressure, or compensating for this by increasing the pressure of the inspired air. The two methods are called the hypoatmospheric and the hyperatmospheric methods. The Sauerbruch pneumatic cabinet, which was the first successful apparatus for this, belongs to the former class, maintaining a negative pressure of about eight millimeters of mercury. The Meyer universal differential cabinet provides for increase or decrease of pressure. Meltzer's intratracheal insufflation method provides for intrapulmonary positive pressure and is relatively simple. By employing one of the numerous methods for securing the required differential air pressure it is possible to treat injuries or diseases of the lungs and pleura by surgical means.

The scope of the surgery of the gastrointestinal tract has been markedly widened since the introduction of anæsthesia and antisepsis. Conditions which a few years ago were considered amenable only to rest, diet, and medication are now subjected to surgical treatment. Ulcers and tumors are exsected from any portion of the gastrointestinal tract. Injuries are repaired, adhesions resulting from inflammatory processes broken up, portions of the tract which are angulated or otherwise distorted as a result of adhesions are made free and restored to normal function. Under certain circumstances it is considered justifiable and feasible to remove portions of the stomach and intestine, as for ulcer or cancer. Not infrequently a malignant involvement of the intestine is so extensive as to necessitate the removal of several feet of gut. In such event the severed ends are disposed of by end-to-end anastomosis or by tying off one end and uniting the other, by end-to-side anastomosis, with another portion of intestine. Especial attention has been directed to the surgery of the intestine of late years in connection with a condition to which Sir W. Arbuthnot Lane of London has applied the term "chronic intestinal stasis."

The biliary system (liver, gall bladder, and appendages) has called forth considerable consideration, and more radical procedures are now employed than were thought possible. An example of this may be noted in the tendency to remove the gall bladder, in the presence of gallstones, rather than to remove the stones and drain. Prof. Hans Kehr of Berlin, among others, has long practiced cholecystectomy, except in cases with small stones and in certain other conditions. Many surgeons advocate this procedure as a prophylactic measure with regard to cancer of these organs.

The genitourinary system (kidneys, bladder, and organs of reproduction) involves a very large number of operative procedures. The surgery of the female generative organs (uterus, ovaries, Fallopian tubes, etc.) is a field in which wonderful achievements have been recorded. The present trend in the surgical treatment of these organs is towards conservatism. The tendency to sacrifice all ovarian and uterine tissue, unless actually diseased, is much less marked than a few years ago. This attitude is in part the result of what has been learned of late years concerning the influence of these organs upon development, health, and the maintenance of general mental and physical equilibrium.

A comparatively new and very important phase of surgery is concerned with the treatment of conditions resulting from disordered function of the ductless glands and other organs having an internal secretion (endocrinous glands). The pineal and pituitary glands (in the brain), the thyroid, parathyroids, and thymus glands (in the neck), the pancreas, the suprarenal bodies, the liver, the spleen, the sexual glands (ovaries and testes), and other structures are now classed among the organs of internal secretion. The functions of these, as regards internal secretions (hormones), are supposed to be so interrelated that complete differentiation is impossible. The thyroid, however, has been called "the monitor" of the entire endocrinous system and seems to be concerned so generally and extensively with the physiological as well as the pathological processes of the body that surgical attention has been directed towards it very widely of late. Theodor Kocher of Bern, one of the leaders of the surgical profession, is well known through his operations on the thyroid gland.

Ameliorative. In the amelioration of suffering surgery is often employed where it is no longer hoped to effect a cure. Palliative methods are employed more extensively in the relief of cancer than of any other disease. The limit of operability of this malady has been greatly extended by modern methods. When it is not possible to remove all the disease and to effect, by its removal, a cure, suffering may be relieved and the patient rendered otherwise more comfortable by the cutting of nerves that are pressed upon by the tumor masses, by the removal of such portions of the malignant growth as impinge upon other organs, causing pain or impaired function, and by clearing up ulcerating areas and skin grafting. Sometimes very large areas of degeneration may be cleared up, especially with the aid of certain forms of electricity (fulguration, after the method of De Keating-Hart), and the surface covered with grafts from other portions of the patient's body, from other persons, in rare instances from the dead, and with egg membrane or other tissues. No matter how short the remaining span of life, whether weeks, months, or years, the chances are that the patients with irremovable cancer may be rendered more comfortable by these palliative operations.

Prolongation of Life. In the prolongation of life, aside from that which comes with the cure of disease, surgery may often be successfully employed. A specific illustration of this may be found in the method of ligating arteries which supply malignant neoplasms of certain regions, notably the face and neck, supplied by the carotid arteries, and the pelvic organs (uterus and ovaries). Obstructions in the air passages and in the gastrointestinal tract which are of sufficient degree to endanger life or to render life all but unbearable may be sufficiently relieved by surgical intervention, and may enable the individual to continue life for a time in a fair degree of comfort.

METHODS

Equipment. Surgical equipment has undergone an interesting metamorphosis with the general dissemination of knowledge, with the development of mechanical skill, and with the evolution of surgical science. This applies to instruments, apparatus, hospital and operating-room construction and equipment, and to all the paraphernalia concerned in the operative treatment of disease. The refinements of technic have made necessary the most skillfully constructed instruments, light, durable, and capable of thorough sterilization. A uniform requirement of modern surgical instruments is that they be so constructed and of such material as to permit of sterilization in all parts. For this purpose simplicity of mechanism is to be desired. Metals capable of withstanding the necessary degrees of heat and the action of antiseptic fluids are employed in all surgical instruments. The evolution of the operating table has kept pace with that of instruments. Instead of wood, sometimes combined with leather or heavy fabrics, as of old, the operating table to-day is made entirely of metal or metal combined with glass. All pads and pillows are detachable, and covered with sterile linen when in use. A properly constructed table may be kept thoroughly clean and polished in all its parts. Pans and other vessels employed in connection with the operation are of enameled ware or material not affected by heat and antiseptic fluids. The surgeon of to-day, fully comprehending the significance of sepsis and antisepsis, operates, whenever possible, in the most up-to-date operating room or surgical amphitheatre. If, however, the proper precautions are observed, particularly with regard to the immediate field of operation, entirely successful surgical work may be done in private houses, with improvised facilities.

The properly appointed hospital operating room contains as little wood as possible, no draperies, carpets, or other dust and germ holding appurtenances. Walls, floors, and furniture must be capable of washing by whatever method may be desired in the individual case. Various methods have been devised for flushing out operating rooms after each operation. Many of the most modern hospitals have eliminated all corners and sharp turns in the effort to facilitate cleanliness. Ample facilities for sterilization of hands, instruments, dressings, etc., are provided. The surgeons and all operating-room attendants who come in contact with the patient and the sterilized operating-room appointments are provided with sterile caps and gowns, and in some operations the surgeons, as well as the patient, are given the further protection of the sterile masks and rubber gloves worn by the operators.

Technic. Preparation for operation concerns the operating room and all its appurtenances, the surgeon and attendants, and the patient, and varies with the nature and severity of the surgical intervention. In emergency surgery it is often impossible to wait for the preliminary precaution otherwise adopted. In such cases the rules of asepsis must be conformed to as nearly as possible according to the urgency and severity of the condition demanding surgical treatment. Under all ordinary circumstances, however, the operating room and surgical equipment are ordered to suit the requirements of the individual case, and all instruments, dressings, gloves, caps, gowns, etc., are sterilized and ready for use before the operation is begun. The methods of sterilization vary according to the preference of the surgeon. As a rule, however, instruments are sterilized by boiling for 15 minutes in a 1 per cent solution of sodium bicarbonate. The trays upon which the instruments are conveyed to the operating table as they are needed are thoroughly washed in a 0.2 per cent solution of bichloride of mercury and then lined with sterile towels. All the basins and other vessels employed during the operation are sterilized by washing in a 0.2 per cent solution of bichloride of mercury. All dressings, towels, sheets, caps, gowns, and masks are sterilized by exposure to steam at 250° F. for one hour, especially constructed apparatus being devised for the purpose. Suture and ligature materials, which are manufactured under careful supervision and placed upon the market in sterile form, are subjected to further sterilization immediately before being used. The hands and forearms of surgeons and attendants are carefully prepared immediately before operation by thorough washing with soap and water, then alcohol (according to the preference of some operators), followed by a 0.1 per cent solution of bichloride of mercury. Some surgeons prefer to do all operative work with sterile rubber gloves; others reserve gloves for septic cases, in which there is danger of infection for the operator.

The preparation of the patient is preliminary and immediate and varies with the nature of the operation and preference of the surgeon. It is generally considered advisable, when an inhalation anæsthetic (ether, chloroform, nitrous oxide, and various combinations and sequences of these with other agents) is to be employed, to begin 24 hours beforehand to clear out the alimentary tract. This prevents nausea and vomiting before and after the operation or renders these disagreeable accompaniments less apt to occur. Twelve hours before operation the skin over the field of operation is prepared by thorough scrubbing, shaving, and covering with a soap poultice. Immediately before operation it is again scrubbed, and sponged off with alcohol and bichloride of mercury solution. It may be dried thoroughly and painted with tincture of iodine just before operation. Some surgeons use only tincture of iodine on the skin, depending upon two coats painted over the field of operation. Under certain circumstances it is deemed advisable to give preliminary medication to prepare for the anæsthetic. This varies with the needs of the patient, the anæsthetic to be given, and, to some extent, with the preference of the surgeon. The selection of the anæsthetic, likewise, is both a matter of necessity and of preference. For minor operations many surgeons and patients prefer local anæsthesia or analgesia, and some surgeons claim excellent results with major operations performed under this form of anæsthesia. In certain cases, in which local and general anæsthesia are contraindication, spinal analgesia may be employed. By far the larger number of all operative procedures, however, are performed under some method of general or inhalation anæsthesia. A great deal of experimental and clinical work has been carried on with the idea of minimizing the dangers and discomforts which accompany or follow surgical intervention. Dr. George W. Crile of Cleveland has suggested an excellent method of preparing the patient for the anæsthetic and the operation by what he calls "anoci association" which is a combination of suggestive therapy and local and general anæsthesia. Dr. James T. Gwathmey of New York City, by combining the essence of orange with the ether or other inhalation anæsthetic, eliminates or lessens the dread of the anæsthetic so often experienced and the accompanying and postoperative nausea, vomiting, and other disagreeable phenomena. Of late rectal anæsthesia has been employed by a number of surgeons. See ANÆSTHESIA.

The ethics of the operating room safeguard the patient in every way possible. Not only is the patient of the present time given the benefit of the most modern diagnostic methods; of the most careful preparation, on his or her own part as well as that of the surgeon, the attendants, the instruments, and all apparatus employed in the course of the surgical procedure; of the most advanced methods of anæsthesia and antisepsis; of the highest degree of technical skill; and the most careful aftercare, but the law and the higher ethics are both applied in the operating room for the protection of the patient. In some of the United States it is illegal for a surgeon to operate in the presence of laymen not concerned in the execution of the operation, thus protecting sensitive individuals from the gaze of the curious. In all States and in most countries the actual operation must be done by a qualified surgeon or under the immediate supervision of one, who assumes all responsibility in the eyes of the law. It is not permissible in teaching institutions and in well-regulated hospitals for male and female patients to be brought into the operating room at the same time. Undue levity and other manifestations of carelessness or indifference are entirely excluded. The patient and his friends and relatives are thus spared the feeling that there may be any manifestation of disrespect which would be offensive to those unfamiliar with the usual operating-room procedures, and who may therefore be unduly sensitive in such a matter.

With surgery robbed of its terrors by anæsthesia, of its dangers through antisepsis and skill, and of its discomforts by perfected hospital and operating-room equipment and management, the present is full of achievement and the future of promise in the matter of the surgical treatment of deformity, defect, injury, and disease. See AMPUTATION; HERNIA, and also illustration under BANDAGE.

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SURGERY, COSMETIC. See COSMETICS.

SURGERY, MILITARY. Military surgery is the specialized application of the principles of traumatic surgery, under military conditions, to wounds of war. In its wider connotation it includes the collection and transportation of wounded, the administration and control of mobile and stationary hospitals, hospital trains and ships, and the command of sanitary troops. Although the ancient history of surgery is legendary, even in the earliest armies there were those who treated the ills and bound the wounds of warriors. The only surgery of the Greeks pictured by Homer (1000 B.C.) was that of the battlefield. As mediæval surgical practice was in the hands of the religious orders until forbidden by the Council of Tours (1163 A.D.) the wounded of armies were left to the care of monasteries. It was only after this proscription that military surgery in Europe began to take form. In the following centuries development in surgical practice arose chiefly from methods applied to wounds in battle. The clinical description of hospital gangrene by Paracelsus, in the early sixteenth century, was based on observations made in military hospitals. In this period Ambroise Paré, as a military surgeon in the campaigns of Francis I in Piedmont, was the first to maintain that gunshot wounds were simply traumatic and not essentially poisoned. In his introduction of the ligature to control hemorrhage, supplanting the cautery iron, he made the first substantial contribution to modern military surgery and made possible the successful performance of major amputations. The tourniquet introduced by Fabriz von Hilden (1560–1634) found its first general application, in an improved form, at the siege of Besançon in 1674. In England in the seventeenth century Richard Wiesman, in the wars of the Commonwealth, first advocated immediate amputation in cases of severe gunshot wound. At that time amputations, treated conservatively, were almost invariably fatal. This practice of amputation continued through the Peninsular, Crimean, and the American Civil War. In 1714 at Berlin and in 1785 at Vienna schools for the teaching of military surgery were founded and have continued to the present day. In the last decade of the eighteenth century, with the approval and encouragement of Napoleon, Baron Larry introduced mobile field hospitals (*ambulances volantes*) for the treatment of wounds on the battlefield; his colleague, Baron Percy, organized companies of stretcher bearers. The development of the field-ambulance system to its modern form we owe to Surgeon Jonathan Letterman, U.S.A., in the American Civil War.

Coincident with the close of the American Civil War Lord Lister's deductions from Pasteur's discoveries in fermentation, establishing the microbic cause of wound infection, rendered so relatively insignificant all earlier contributions to surgical art and so advanced the methods of wound treatment that the practice of present-day military surgery may be said to date from that time. These principles of antisepsis led to the application of an antiseptic first dressing. Later it was assumed that military wounds in general were sterile, and an aseptic first-aid packet was substituted for the one devised by Von Esmarch containing an antiseptic powder. Now there has been a complete *volte face*. All military wounds are infected. In the milder grades the resistant body fluids may overcome invading microbes and the wound heal without pus formation. Nothing should be left to chance, however, and the first-aid packet, a part of every soldier's personal equipment, should contain antiseptics. The latest form of first-aid packet of the United States soldier contains an ampule of sublimated iodine with which a germicidal solution is to be prepared, in addition to the sterilized pads and bandages for wound dressings.

Military surgery, then, is concerned with three cardinal conditions: (*a*) frequency and forms of battlefield casualties; (*b*) arms and missiles as related to wounds; (*c*) care of wounds and the wounded.

Battle losses in killed and wounded are the most important concern of military surgery, as upon the experience of the past must be based the estimates of the future in making provision for the care of the wounded. While losses vary greatly with the character of engagements and range from inconsiderable numbers to comparative annihilation in occasional disasters, the morale of men in all ages seems to have been so much the same that not only the percentage of losses, but also the ratio of killed to wounded, has remained strangely constant throughout the history of warfare. The losses in the Roman legions which reached 10 per cent were understood to approach so near to disaster that decimation even then attained something of the connotation of annihilation. Analysis of losses in modern battles leads to the conclusion that present-day troops will bear with no greater fortitude a larger percentage of losses than soldiers of the past; that after a loss of more than 10 per cent they must be expected to waver, lose their formation, and retreat. Although maximum casualties may attain a greater rate in smaller units in particularly hazardous situations, military estimates are still based on the assumption of 10 per cent battlefield loss.

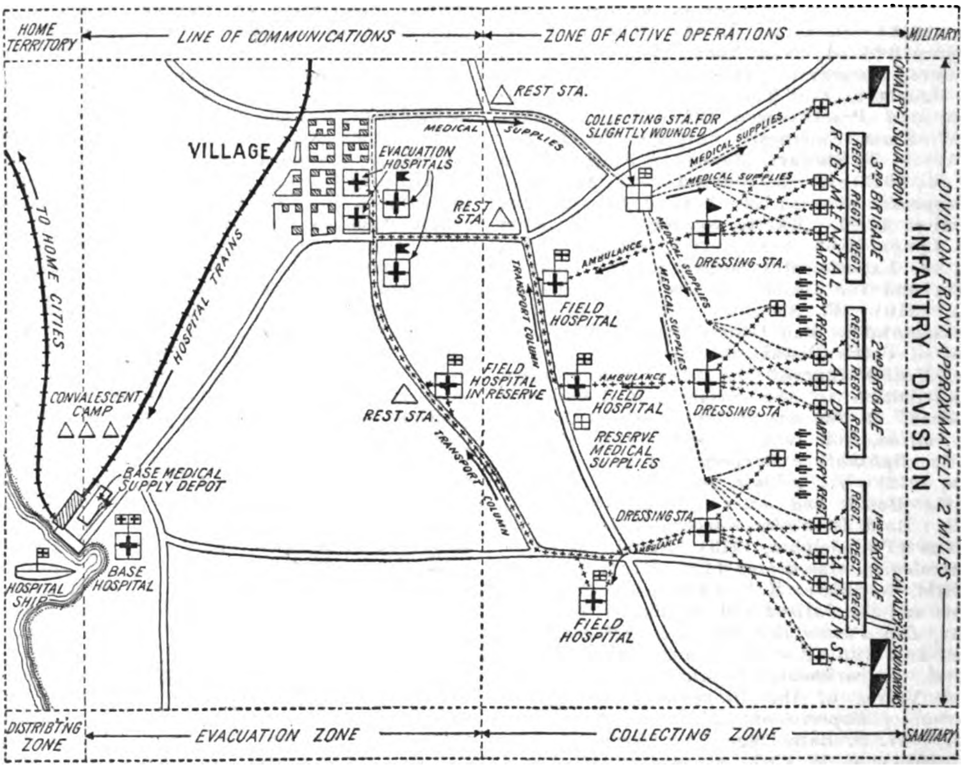

DIAGRAM SHOWING SANITARY ORGANIZATION OF AN INFANTRY DIVISION, UNITED STATES ARMY. (THE DIVISION FRONT IS ON THE EXTREME RIGHT.)

	Officers	Soldiers
3 Brigades. Infantry	453	16,524
1 Regiment, Cavalry	50	1,236
1 Brigade, Light Artillery	83	2,256
1 Battalion, Engineers	15	494
1 Battalion, Signal Corps	8	163
Headquarters and Train	33	430
Total	642	21,103
Sanitary Department	94	826
Total	736	21,929
Aggregate	22,665	

In the combatant branches casualties have generally been greatest in infantry, less in artillery, least in cavalry. The reports of the Russo-Japanese War, however, show that the losses sustained by Japanese sanitary troops, as officers and men of medical corps are now called, were next in order to those of infantry. In the early stages of the Great War the losses sustained by sanitary troops were relatively greater than those in all other branches, excepting only the field artillery. In the battles of the last 50 years, even with the use of firearms of vastly varying degrees of efficiency, and in both the victorious and vanquished forces, an almost constant ratio of one killed to four wounded has obtained. Such official reports of the Great War as have been made public show a rather remarkable persistence of the ratio of one to four in killed and wounded. While in some of the fiercer engagements of the Western and Gallipoli theatres the killed have even exceeded the wounded, the more mobile actions on the Eastern front have served to maintain the old general average.

The introduction of the military rifle, firing a long small-calibre jacketed bullet at greatly increased velocity, changed the nature of small-arm wounds almost as much as Listerism modified the principles of treatment. The elongation of the old lead ball, for reduction of weight and diminution of air resistance to attain steadiness of flight and to increase range, encountered mechanical limitation in the fouling of the spiral grooving in the rifle with particles of lead stripped from the bullet. The remedy for this was offered by an army surgeon when, in 1875, Surgeon-General Reger of the German army recommended covering a lead core with a jacket of harder metal which would satisfactorily engage the rifling and impart the rotary motion necessary to accuracy of fire. This newly fashioned arm is now known as the small-calibre rifle, and its cylindrical roundheaded bullet is technically termed ogival.

Since 1906 the United States, England, France, Germany, Turkey, and Switzerland have enhanced the efficiency of their small arms by making the point of the bullet sharp, and further increased velocity by reducing air resistance. Prior to the Great War, France and Switzerland again accelerated the velocity of the bullet by tapering its base to about two-thirds the diameter of the waist where it engages the rifling. This change accomplished another reduction of air resistance by applying the principle employed by the naval architect in sharply modeling the stern of a yacht, to allow the displaced medium to press in behind and reduce the back drag. The French bullet now exhibits still another innovation, as it is made solid of brass alloy. These changes may appear, at first blush, to be of minor moment, but the effects produced on the human target are of vital importance to military surgery, because the mere sharpening of the bullet's point has reduced its time of flight in 2700 yards from 2 seconds to 1.6 seconds, and it arrives with a velocity of 1140 instead of 940 feet per second.

Trajectory, or curved line of flight, of the small-calibre bullet is so much flatter than that of the older form that, at all ranges, it passes closer to the line of sight and greatly increases the danger zone. Velocity is the chief factor in the wounding power of the small-calibre bullet; the greater the velocity, the more severe the wound. Energy, or striking force, as the resultant of weight and velocity, represents the *real* damaging quality of a projectile, varying as the energy is distributed by its form. Energy is expressed in the formula: $E = \frac{wv^2}{2}$. Range is important only when the velocity, weight, form, etc., of a projectile are known; then these ballistic data are of great interest because they reveal the energy or damaging force remaining in a projectile. The remaining energy of the American or German bullet, e.g., will drive it through the bodies of two men at 2000 yards and cause disabling injuries at twice that range.

The wound effects of small-calibre bullets at various ranges are usually classified as follows: (1) explosive range from 0 to 500 yards; (2) perforating range from 500 to 2500 yards; (3) penetrating range from 2500 yards. The greater number of severe wounds is inflicted at a range of much less than 500 yards, as the terrific initial striking force of from 2 to 2.5 foot tons loses two-thirds of its energy within this range, although the bullet continues its flight for six times that distance. Ricochet shots, occurring as often as one in three, provide irregular elements which disturb any classification based on wounds made by undeflected bullets. Jacketed bullets are rarely deformed by striking the body; infrequent exceptions prove the rule. Every deformed bullet is caused by a ricochet shot.

Early experiments with the ogival blunt-nosed and the ogival sharp-pointed bullets on cadavers demonstrated their great destructive action. This was manifested by extensive laceration and blowing out of tissue at the wound of exit when, at close ranges, the bullets struck resistant tissue, as bone, and fluid-containing organs, i.e., stomach, bladder, and intestines. "Explosive effect," the misnomer applied to this phenomenon, suggests the action of the explosive bullet. The real cause is the imparting of the energy of the bullet to the wound fragments which become secondary missiles. The false interpretation of these manifestations had led, at the beginning of every recent war, to charges and countercharges of the use of explosive and dumdum bullets. Explosive bullets containing a charge and fulminate which causes them to explode in the wound with *real* explosive effects are no longer used in any army. Dumdum bullets, taking their name from a British arsenal near Calcutta where they originated, were first made with an uncovered soft-lead cylindrical-cupped extremity. Later the lead core of the bullet was exposed either by sawing right-angle cuts through the covering of the rounded extremity or by removing the jacket entirely from the nose. These bullets tear wounds frightfully, because they mushroom, flatten, and break up on impact, producing wounds like those of the explosive bullet.

As one shot in every three fired ricochets, it is impugning the intelligence of the enemy to accuse him of using either the explosive or the dumdum bullet when one-third of his missiles would become ineffective through disintegration. All nations signatory to the second Hague convention, excepting the United States and Great Britain, renounced the use of dumdum and explosive bullets. These missiles are used only against a fanatical foe, charging in masses small bodies of troops, because the stopping power of the normal military bullet is not great enough to check promptly such an advance.

Artillery wounds are inflicted by two classes of projectiles—shrapnel and shell. A modern shrapnel consists of a thin-walled steel cylindrical envelope with a thick bottom containing, like a shotgun cartridge, a charge of powder behind a number of naked lead balls. The top of the envelope is closed by an ogival head carrying both time and percussion fuses. The former provides for the ignition of the powder charge at the time estimated for the projectile to reach the desired point, when the contents of the envelope are projected like the charge of a shotgun *without bursting the envelope.* The percussion fuse is designed to explode the shrapnel on impact only when the time fuse fails. The shrapnel used in the field guns of most armies is approximately 3 inches in calibre and contains about 300 balls of about 0.5 inch diameter. A shell, on the other hand, is a thick-walled steel capsule filled with high explosive and armed with a percussion fuse to cause explosion only on impact. Shell wounds are produced by the flying fragments of the shell itself.

Shrapnel wounds are like those of the old round leaden musket balls. Because of their low velocity they are more frequently lodged in wounds than are rifle bullets. Shell wounds as a class are much less frequent but far more severe than shrapnel wounds. Shell fragments cause complete destruction near the bursting point, but effect less damage in more distant zones. Both shrapnel and shell wounds are usually infected, because the missiles carry into the wounds pieces of clothing and other foreign matter. The danger of infection is much increased because of the greater extent of laceration. Wounds by bayonet, sabre, and lance occur so infrequently as to be of minor interest. During the Franco-Prussian War there were only 600 wounds by cold steel among 98,000 wounded. Grenades, thrown by hand, rifle and trench mortar, a revival in late wars of an earlier practice, recently have been used to a conspicuous extent in Flanders and France. Their wounds differ in no material particular from those of shell fragments and subterranean mines.

Among the most conspicuous innovations of the Great War is the use of asphyxiating gases. Two kinds have been employed. One, the trench gas, is emitted from cylinders containing the vapor under pressure; this consists chiefly of chlorine. The nature of the other gas or gases thrown out by asphyxiating shells has not been determined, but organic compounds of bromine have been identified. The gases, being heavier than air, settle in trenches and depressions of the terrain. Effects produced are ocular, respiratory, and gastric irritation and general toxic action. Radiography, which has always contributed so much more to military than to other branches of surgery, has been further adapted to the treatment of gunshot wounds by a recent method of finding missiles by direct view on the radiographic screen. As pus infections have been more successfully controlled by modern methods, the two most resistant conditions, tetanus and gas bacillus infections, have become more conspicuous in late wars. Although there is an antitoxin for tetanus, it is efficient only when administered as a prophylactic.

Gaseous gangrene is the result of an infection with a bacillus which grows in the recesses of a wound, developing a virulent toxin and a gas which inflates the tissues. Absorption of the toxin is so rapid that death may intervene in a few hours or days. Incision, drainage, antisepsis, and even amputation often fail to save life. No specific remedy has been found for the disease, now the most feared and fatal of all wound complications. Treatment is based on antiseptic measures.

For the prevention of wound infection Sir Almroth Wright has presented new principles and recommended new practice. The most concrete and practicable method, perhaps, is that advised by Carrel of the Rockefeller Institute, as the result of recent experience in France, who urges the use of Dakin's special sodium hypochlorite solution in the early treatment of all gunshot wounds.

Theatres of operation have much to do with the incidence of various surgical conditions. In the French retreat from Moscow and in the Crimea, frostbite and resultant gangrene played an important part in the surgical history of those campaigns. Densely populated districts, where intensive cultivation and fertilization provide a congenial habitat for bacterial flora, offer favorable conditions for wound infections, especially when military operations conduce to contamination of wounds from the soil. On the other hand wound infections are more rare in campaigns in sparsely settled countries. Makins says that in the Anglo-Boer War he knew of only one case of traumatic tetanus.

In general it may be said that wound treatment should be directed primarily to the prevention and control of infection with a secondary regard for the correction of deformities. The latter should follow after resolution is established. Conservatism to a degree that seems beyond the experience and conception of civil surgeons should always be practiced, as urged by Delorme, who says: "In order to avoid the excess of operative measures practiced in recent wars, I am impelled to enjoin all military surgeons to practice almost uniform conservation." Consult Edmond Delorme, *War Surgery* (New York, 1915). See AMBULANCE; HOSPITAL, *Military Hospitals;* HYGIENE, *Military Hygiene.*

SURGICAL ASSOCIATION, AMERICAN. A society founded in 1880 for the primary purpose of cultivating and improving the science and art of surgery. The active membership is limited to 125 fellows; the honorary membership to 25 fellows. An applicant to be eligible for fellowship must be 30 years old, a graduate of five years' standing from a recognized medical college, and have an established reputation as a practitioner, author, or investigator. The meetings of the association are held annually. Every third year the association joins with the constituent associations of the Congress of American Physicians and Surgeons in a meeting held in Washington, D. C. An annual volume of *Transactions* is published.

SUR'HAY. See SONGHAY.

SU'RICATE. The meerkat (q.v.).

SURIGAO, so͞o'rē-gä'ō. A province of northeast Mindanao, Philippine Islands (Map: Philippine Islands, E 6). Area, 6988 square miles. The greater part is covered with forests, and the river forms almost the only means of communication, most of the towns being situated on its banks. Cotton, hemp, rice, sugar, and tobacco are raised, and betel nuts and coconuts are exported. Pop., 1903, 115,112, mostly Visayans. The capital, Surigao, had (1903) 7749 inhabitants.

SURIGAO, STRAIT OF. The strait connecting the Sulu Sea with the Pacific Ocean, extending between the island of Mindanao on the south and the islands of Negros, Cebú, Bohol, Leyte, and Samar on the north (Map: Philippine Islands, E 5).

SURINAM, so͞o'rĭ-năm'. A river of Dutch Guiana. It rises in the south-central part of the country, flows northward a distance of 400 miles, and empties into the Atlantic Ocean through an estuary 3 miles wide, on whose shore lies the town of Paramaribo. It is navigable 40 miles for the largest vessels and 100 miles for ships drawing 10 feet. Near its mouth it is joined by the Cottica River, a navigable channel running 100 miles parallel with the coast and connecting with the mouth of the Maroni.

SURINAM. A Dutch colony in South America. See GUIANA.

SURINAM BARK. See ANDIRA.

SURINAM TOAD. See PIPA.

SURKI. See CEMENT.

SURMUL'LET (OF., Fr. *surmulet*, from *sur*, *sor*, *saur*, reddish + *mulet*, dim. of *mulle*, from Lat. *mullus*, red mullet). One of certain species of mullets found for the most part in the tropical seas. The striped red surmullet (*Mullus surmuletus*), attaining a weight of six to eight pounds, is sometimes abundant on the coasts of Europe. A very similar species (*Mullus auratus*), about 8 inches long, occurs along the Atlantic coast of North America, particularly towards the south. See Plate of MULLETS AND ALLIES.

SURNAME (OF., Fr. *surnom*, from ML. *supernomen*, from Lat. *super*, over + *nomen*, name). In modern usage, the family name, as distinguished from the given or individual name. Many are based on personal peculiarities, as William Rufus or *red*, John Lackland, and were originally mere epithets. Another class is patronymic, indicating descent, as Johnson, Williamson. This form of surname prevailed especially in Scandinavian countries, surviving in Denmark until about 1850, when it was replaced by the system of family names. For other kinds of surnames, see COGNOMEN; NAME.

SURPLICE (OF., Fr. *surplis*, from ML. *superpelliceum*, surplice). A linen vestment worn in the Roman Catholic church by all ecclesiastics in choir except the officiants of the mass, and by the clergy of the Anglican communion; also, in both churches, by laymen and boys who sing in the choir or assist at the altar. The shape of the vestment in mediæval days was long and flowing; the modern tendency has been to reduce its size so that it usually comes little below the waist. The Italian name *cotta* is frequently applied to the modern vestment. See Plate of COSTUME, ECCLESIASTICAL.

SURRATT, sŭr-răt′, MARY E. (c.1817–65). An American woman who became involved in the conspiracy against the life of Abraham Lincoln. She was born near Waterloo, Prince George Co., Md., and about 1835 married John H. Surratt. In 1862 Mrs. Surratt went to Washington and opened the boarding house which became the meeting place of the men who plotted to kill President Lincoln and other members of the government. After Lincoln's death Mrs. Surratt was arrested and, with three of Booth's accomplices (see BOOTH, JOHN WILKES), was tried and convicted by a military commission appointed by President Johnson. The sentence of death by hanging was carried out at Washington on July 9, 1865. During the trial doubts as to Mrs. Surratt's guilt were expressed, and a long controversy in the press followed, the weight of opinion inclining in her favor. It was said that a majority of the members of the military commission had signed a petition for clemency to President Johnson and that this petition was withheld from his knowledge, but this was vigorously denied.

SURRENDER. In law, the giving up or abandonment of an estate for life or years in real property to the person next entitled to the remainder or reversion, with intent to merge the lesser estate in the greater. This differs from renunciation (q.v.), which is practically the refusal to receive an estate to which one is legally entitled. A valid surrender can be made only by an adult person of sound mind. Under the Statute of Frauds in most States a surrender in fact, i.e., by agreement, can be made only in writing, where the unexpired term of the lease is greater than could be created by parol. Thus, the mere cancellation or destruction of the instrument creating the estate will not operate ipso facto as a surrender. However, a surrender may take place by operation of law. Thus, where the landlord accepts another person as tenant; where the landlord takes possession of the premises to his own use; or where the tenant accepts a new lease for the same premises, these acts will be construed as a surrender by operation of law. The legal effect of a surrender is to terminate the relation of landlord and tenant and to discharge the latter from liability for future rent, though not for rent already accrued. See LANDLORD AND TENANT, and authorities there referred to.

SUR'REY. An inland county of southeast England (Map: England, F 5). Area, 758 square miles. Pop., 1901, 519,766; 1911, 676,027. The surface is hilly and diversified, with a north slope towards the Thames. The principal streams are the Mole and Wey, tributaries of the Thames. The north half of the county along the valley of the Thames is fertile, though little over half of the land in the county is cultivated, hops, wheat, and the ordinary crops being raised; market gardening constitutes a lucrative industry. In the west and southwest the land is to a great extent covered with heath. The numerous manufactures include silk, cloth, leather, paper, pottery, and beer. The varied and picturesque scenery of the county is responsible for the fact that it has become a great residential district for London business men. Consult *Victoria History of the County of Surrey*, vols. i–iv (London, 1902–12), and J. S. Ogilvy, *Pilgrimage in Surrey* (2 vols., New York, 1914).

SURREY, EARL OF ARUNDEL AND. See FITZALAN, THOMAS.

SURREY, HENRY HOWARD, EARL OF (c.1517–47). An English soldier and poet, son of Lord Thomas Howard, affirmed third Duke of Norfolk. His youth was spent in France and at the court of Henry VIII, and he received a careful classical education. He was made Knight of the Garter in 1541 and in 1543 joined the English army in France, where by his prowess he gained the title of field marshal. He captured Boulogne, was made its Governor, and gained other victories, but was recalled to England after slight reverses at Saint-Etienne. His influence at court was no longer so powerful as in the life of his youthful friend and companion the Duke of Richmond, Henry's natural son, and charges of treasonable ambition were constantly urged against Surrey and his father by the Hertford faction. In 1546 the two were arrested; Norfolk was sent to the Tower, and Surrey, on trivial charges, was beheaded in 1547. Though not primarily a man of letters, his work in that field left a more abiding impression than his soldiery. He wrote amatory verses and elegies, but his service to English literature lay in the insight with which he enriched its poetry by the introduction of new verse forms. His translation of two books of the *Æneid* gave the language its most powerful and characteristic poetic form, blank verse; and the sonnet which Shakespeare used, consisting of three quatrains and a couplet, was also introduced by Surrey. The best-known edition of his verse and that of Wyatt, including a memoir, is by G. F. Nott (London, 1815–16; new ed., 1871); there is also the Arber reprint of *Tottel's Miscellany*, in which the work of both of them first appeared. Consult also an essay in J. W. Hales, *Folia Literaria* (London, 1893).

SUR'ROGATE (Lat. *surrogatus*, *subrogatus*, p.p. of *subrogare*, *surrogare*, to substitute, from *sub*, under + *rogare*, to ask). A judicial officer having jurisdiction over the probate of wills, the administration and settlement of decedents' estates, and in some States the power to appoint and supervise guardians of infants and other legally incompetent persons. As the derivation of the name indicates, a surrogate was formerly the substitute or representative of another official. Originally in England the ecclesiastical courts had jurisdiction of all the matters above mentioned, and as their business increased it became necessary for the bishops to delegate some one to act in their places. These substitutes were at first ecclesiastical, and at a later period lawyers, and were known as surrogates. In 1857 the probate jurisdiction of the surrogates was transferred to the Court of Probate and Divorce.

Prior to the Revolution the governors of the various American Colonies were accustomed to appoint surrogates to represent them in matters of probate and administration of estates. In New York and several other States to-day the surrogate of a county is an independent judicial officer. The incidental jurisdiction of the surrogate generally extends to contests of wills and controversies over the descent and distribution of property of decedents. Surrogates exercise a close supervision over the conduct of guardians' affairs, and the latter may apply to them for advice in case of doubt on any matter pertaining to their trusts. Proceedings before a surrogate are conducted with practically the same formality as in other courts. An appeal from the decisions of surrogates will lie to appellate courts. Surrogates correspond to probate judges and judges of widows' and orphans' courts in some States. See COURT; PROBATE COURT; and consult the authorities there referred to.

SURTEES, sûr'tēz, ROBERT (1779–1834). An English antiquary, born at Durham. He graduated B.A. from Christ Church, Oxford, in 1803, then studied law at the Middle Temple. In 1802 he settled on the family estate at Mainsforth in the County of Durham. Surtees devoted his life to his *History of Durham* (vol. i, 1816; vol. ii, 1820; vol. iii, 1823; vol. iv, ed. by James Raine, 1840). This is a careful and exhaustive work, readably written. Surtees was also an adept at composing ballads which were playfully palmed off as ancient. Scott himself was deceived by *The Death of Featherstonehaugh*, which was inserted in the *Minstrelsy of the Scottish Border*. As a memorial the Surtees Society was established in 1834 at Durham for publishing unedited manuscripts bearing on the history of the northern counties of England from the earliest period to the Restoration. Consult G. Taylor, *Life of Surtees* (Surtees Society, Durham, 1852).

SURTEES, ROBERT SMITH (1803–64). An English sporting novelist, born in Durham and educated for the law. In 1832 he helped to found, and for five years he edited, the *New Sporting Magazine*, to which he contributed (1832–34) humorous papers chronicling the sporting experiences of a cockney grocer. Collected as *Jorrocks' Jaunts and Jollities* (1838) and illustrated by "Phiz," these sketches had an immense vogue. This volume suggested the original plan of *Pickwick Papers*. In *Handley Cross* (1843) Jorrocks reappears, this time as a master of hounds. Surtees wrote various other books on the same order, most of them illustrated by "Phiz" or John Leech. Consult the memoir prefixed to the London, 1869, edition of *Jorrocks' Jaunts*, and W. P. Frith, *John Leech* (2 vols., ib., 1891) passim.

SURVEY. See COAST AND GEODETIC SURVEY, UNITED STATES; GEODESY; GEOLOGICAL SURVEY, UNITED STATES; SURVEYING.

SURVEYING (from *survey*, from AF. *surveer*, *survoir*, from Lat. *supervidere*, to overlook, oversee, from *super*, above + *videre*, to see). The art of ascertaining by measurement the shape and size of any portion of the earth's surface and representing the same on a reduced scale on maps in a conventional manner, or the reproduction on the ground of a predetermined line or lines, as for the construction of a canal, railway, bridge, or other structure for which plans have been drawn. The art of surveying or the measurement of land is probably as old as civilization. According to Herodotus the science of surveying, which is nothing more or less than practical geometry, originated in Egypt, where it was necessary accurately to reëstablish each year the land boundaries obliterated by the inundations of the Nile.

The early history of surveying is the history of geometry, and all early textbooks invariably treated the two together. The first treatise on surveying extant is that of Hero of Alexandria (c.130 B.C.). In all times and in all civilized countries surveyors have been important public functionaries and were essential officers in all military campaigns or conquests. Surveys must be made preliminary to undertaking any kind of civil engineering or architectural construction; consequently surveying is a recognized branch of civil engineering.

Surveys are broadly separated into two classes, determined by the extent of the area surveyed or the purpose for which the survey is made. Plane surveying includes all surveying based on the assumption that the earth's surface is a plane. When the survey is of small areas or of a line or narrow belt of country, as for a railway, this assumption causes no serious difficulty. However, it is obvious that there is an error even in the smallest survey executed according to the rules of plane surveying. If two fields side by side be independently surveyed, the two planes supposed to represent them will not be extensions of each other, but will be slightly inclined to each other, the angle of their inclination being equal to the amount of the earth's curvature between their middle points. In the supposed case of two fields side by side the angle would be so slight as to be imperceptible, but if the two fields were separated from each other by 100 miles, their inclination would be so great that the plane of one of them extended in the direction of the other, instead of coinciding with it, as it would if the earth's surface were a plane, would pass over it at a height of 1¼ miles. A more accurate method, taking into account the shape and size of the earth, is geodetic surveying or geodesy (q.v.).

Plane surveying ordinarily includes besides land surveying, topographic surveying, hydrographic surveying, mine surveying, city surveying, and the measurement of earthwork or volumes of any material. Geological surveying is a development of topographic surveying in which the outcrops of the earth's rock formation are located and denoted on topographic maps. Geodetic surveying is a class by itself, as is also photographic surveying (q.v.).

PLANE SURVEYING

Land Surveying. Land surveys are made: (1) to establish certain monuments, corners, lines, and boundaries, so as to lay out and divide land; or (2) to identify and locate such monuments, lines, and boundaries after they have been established, as in all resurveys for location and area. In all cases of land surveying the boundaries and dividing lines are the traces of vertical planes on the surface of the ground, and the area is the area of the horizontal plane included between the bounding vertical planes. In other words, the area sought is not the real surface, but the horizontal projection of that surface. On the ground lines are marked only at regular intervals called stations or at the angles, points, or corners. The corner marks are called monuments and are usually of a permanent character, although anything from a mound of earth or a handful of buried charcoal to a cut stone with a copper bolt centre has been used.

For ordinary land surveying but two instruments are required, a chain or tape and an instrument for measuring angles or for determining the difference in direction between two or more intersecting lines. The simplest instrument for this purpose is a square or cross-staff, which gives two horizontal lines of sight at right angles to each other. By placing one line of sight coincident with one of the intersecting survey lines, at some convenient distance from the point of intersection, a right angle offset perpendicular to it from the other survey line may be readily established and measured. Thus, any acute angle may be measured by knowing the lengths of the two legs of the right triangle including it. The cross-staff, or some form of it, is one of the most ancient of surveying instruments. No radical departure was made from this method until the introduction of the magnetic compass, which was probably made use of by surveyors soon after its adoption by mariners.

The measurement of angles directly in degrees and minutes of circular arc did not come into vogue until about the sixteenth century. The combination of a magnetic compass with instruments for accurate angular measurement is a comparatively modern invention (c.1830). In using a magnetic compass the index of the dial is placed in the vertical plane of the line to be surveyed. The reading of the needle will then be the angle that the line makes with the magnetic meridian and is called the magnetic bearing of the line. There are many inaccuracies arising from the use of a magnetic compass, not only from the irregularities of the needle according to the laws of terrestrial magnetism (q.v.), but from local attraction. It is no longer used except for reconnoissance or very rough work, but it is still universal practice to describe land by distances and bearings of courses. For this purpose the bearing of any starting course may be assumed, for it is evident that it is the difference in the courses which establishes the angles between lines, irrespective of whether the bearings are true or not. The true bearing of any line may be easily determined by observations on the sun, the pole star, Polaris, or any heavenly body whose position at the time of observation can be readily computed. This is called the determination of the azimuth of the line. The now universal surveying instrument is the transit. (See SURVEYING INSTRUMENTS.) Measuring the lengths and directions or bearings of survey lines is called traversing.

The simplest method of computing area is to divide the survey polygon into triangles. This, however, is cumbersome and requires many additional measurements. The method most used depends upon establishing the corners by a system of rectangular coördinates, known as latitudes and departures, which are readily computed by trigonometry from the lengths and bearings of the courses. Mathematical tables for simplifying these computations are called traverse tables. To illustrate the use of latitudes and departures reference will be made to the diagram, in which the lines *A B C D E* represent the boundary of a field of land whose area is required. Beginning at *A*, the surveyor proceeds around the field, obtaining the bearings and lengths of the lines *AB*, *BC*, *CD*, *DE*, and *EA* one after the other in the order named. This being done he states these bearings and distances on paper, giving the figure *A B C D E* shown by the sketch. He next draws a meridian line *NS* through the westernmost corner of his boundary and computes the various perpendiculars shown by the broken lines. These per-

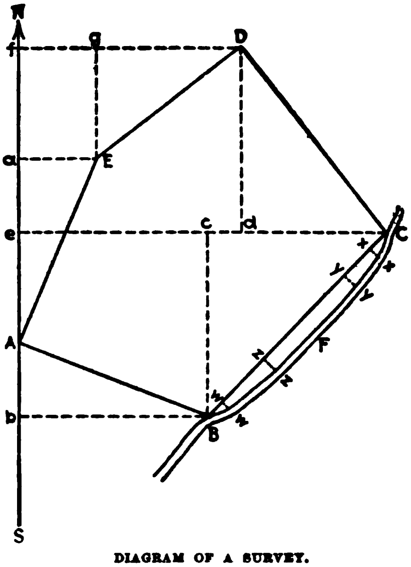

DIAGRAM OF A SURVEY.

pendiculars are the latitudes of the several lines; thus, for line DC, dD is the latitude, dC is the departure, and $(fD + eC)$ is the double meridian distance. The following rule is used for calculating the area: twice the area of the figure is equal to the algebraic sum of the products of the double meridian distances of the several courses into the corresponding latitudes, north latitude being reckoned positively and south latitude negatively. Expressed symbolically, for the figure shown, this rule is as follows: $2A = (bB + eC)\,Bc + (eC + fD)\,Dd - (fD + aE)\,Eg - (aE)\,Aa - (bB)\,Ab$. It may often happen that one boundary of a field is not a right line, but is an irregular curved line such as the course of a stream $C\ F\ B$ instead of by the right line $B\ C$. The area of this field is then the area of $A\ B\ C\ D\ E$ plus the area of $C\ F\ B$; the surveyor when measuring the line $B\ C$ measures two or more perpendiculars such as xx, yy, zz, and ww, known as offsets and extending from the line $B\ C$ to the stream. These perpendiculars divide the area $C\ F\ B$ into a number of small areas each of which approximates closely a simple trapezoid or triangle whose area is easily determined and the sum of whose areas is the area of the total tract. There is of course a slight error in this method, but it can be made so small by an experienced surveyor as to be practically negligible.

The system of laying out the United States public lands furnishes a good example of the methods of laying out land on a large scale. This system probably was devised by Gen. Rufus Putnam, of Revolutionary War fame, and was first used in laying out the eastern portion of the State of Ohio in 1786–87. The reference lines employed in these public land surveys are in each case a principal meridian and a base line, the meridian running, of course, north and south, and the base line running east and west. From the principal meridian and its accompanying base line guide meridians are run north and south from the base line 24 miles apart, and standard parallels are run east and west from the principal meridian 24 miles apart. These lines are run with great care, making allowance for the curvature of the earth. Every mile is marked by a monument and is called a section corner, and every sixth mile has a different mark and is called a township corner. From each township corner on any standard parallel, auxiliary meridians are run north to the next standard parallel. Since these meridians converge somewhat towards the principal meridian, they will not be quite 6 miles apart when they reach the next standard parallel, and therefore, to run the next series of auxiliary meridians north, the start is made not at the points where the first series terminate, but at the 6-mile points previously marked off. Where the auxiliary meridians have been lined out, the land is divided into a series of strips running north and south and 6 miles wide. These are called ranges. The next step is to cut these ranges transversely by running east and west lines at 6-mile intervals. The land is thus divided into squares measuring 6 miles on each side. These squares are called townships, and each contains 36 square miles, or 23,040 acres. The next step is to run meridians and parallels 1 mile apart to divide the townships into 36 sections. Monuments are set at intervals of ½ mile on the lines to divide each section into quarter sections. The quarter section is the smallest primary division of the public land surveys.

Topographic Surveying. The topography of a country is the collection of physical features which characterize it, and hence a survey intended to locate and map those features is a topographic survey. Ordinary land surveying takes into account only features which are relevant to the purpose of the survey and only those features which can be shown by horizontal measurements. Topographic surveying requires measurements in vertical planes as well. Otherwise it does not differ from ordinary land surveying except in instruments and methods. The basis of all topographic surveys is a line or network of lines established by accurate measurements, to which all the other details are tied either by rectangular or polar coördinates or a combination of both. The simplest topographic survey is that for a railway location. A single survey line or centre line is established on the ground by stakes driven at 100-foot intervals. The direction of this line is determined by angular measurements with a transit, starting from a line of known direction. When it has been marked upon the ground by stakes as described, the line is leveled (see LEVELING) and the elevations of the ground at each stake determined. With the notes of the transit and level surveys the topographer follows over the line and locates the contours, or such contours as it is desirable to show, of a belt of country 250 to 500 feet on either side of the centre line. Contours are the traces of parallel horizontal planes on the surface of the ground, or what would be the shore line at successive stages if the ground were first submerged and the water allowed to recede in stages of 2, 3, 5, 10, 20, or 50 feet, whichever is chosen as the contour interval. The instruments ordinarily used by the railway topographer are a hand level and a cloth tape.

When topographic surveys are made of extensive areas, the foundation network is usually a system of triangulations established by precise or geodetic methods. The important features of the landscape are then tied into this network of known points by means of coördinates in both vertical and horizontal planes. Measurements in both planes are made by stadia "shots," taking into account the vertical angle from the plane of the horizon to the point sighted at. The stadia (q.v.) is the most simple instrument for measuring distances ever devised. It is the invention of James Watt, the English engineer, and was used by him in canal surveys in the last quarter of the eighteenth century.

A topographic survey may be made by stadia, using a transit and afterward plotting the notes of the survey in the office, or it may be made with a plane table (q.v.), in which case the computations are made and the map is plotted in the field while making the survey. The United States Geological Survey is engaged in making topographic surveys of the entire country. These surveys are based on the primary triangulation system established by the United States Coast and Geodetic Survey, which system is further subdivided into secondary and tertiary triangulation systems by the Geological Survey.

Hydrographic Surveying. Hydrographic surveying is a general term which includes two very different kinds of work. Charts of the seacoast and the shores of any body of water are intended to show much the same information in regard to the sea bottom that topographic maps show of the surface of the land. Depths of water are determined by sounding lines. The location of each sounding with respect to some known lines or points is determined in a variety of ways, based either on rectangular or polar coordinates. In recent years the United States Coast and Geodetic Survey has developed a method of verifying the depths of extensive areas or of determining shoals or obstructions in those areas by sweeping over them with long wire drags or sweeps, which consist essentially of a horizontal wire suspended at any desired depth and drawn through the water by small power boats. See HYDROGRAPHY.

The other kind of surveying included under the term "hydrographic" is the measurement of stream flow. There are several methods; the simplest, of course, is to measure the size of the stream bed and the velocity of the flow. Hydrographic surveying also includes studies of rainfall and run off and other allied subjects.

Mine Surveying. Mine surveys are of two classes: (1) surveys to determine the surface location and boundaries of mining claims; and (2) underground surveys to determine connections, lay out work, establish the relations of the underground workings to the surface lines, points, and so on, and measure the ore removed or still in the mine. The surface methods employed are substantially land surveying methods as modified by the local and general mining laws. The underground surveys comprise carrying surface locations underground, lining on the galleries and shafts, running levels, etc., and laying out tramways and railroads. This work is ordinarily carried on much the same as it is on the surface. See MINES AND MINING.

City Surveying. City surveying is ordinary land surveying in theory, but geodetic or precise surveying in practice. Linear measurements are accurately made with standardized steel or invar tapes, making allowance for the stretch and sag of the tape and its change in length from differences in temperature. Angular measurements are made to seconds of arc by repeating the measurement and averaging the sum of these repetitions. Land in great cities is often worth several thousand dollars a front foot, and errors of a fraction of an inch would be costly.

Measurement of Earthwork. The determination of earthwork quantities is one of the most important functions of the surveyor and civil engineer. It requires careful measurements in both horizontal and vertical planes. The horizontal measurements with tape and transits furnish the plan, as in any survey, and the vertical measurements with level and level rod furnish the cross sections. From these the volumes of the inclosed prisms of earthwork are computed. See COAST AND GEODETIC SURVEY; ENGINEERING, MILITARY; GEODESY; GEOLOGICAL SURVEY; SURVEYING INSTRUMENTS; LEVELING; PHOTOGRAPHIC SURVEYING; PLANE TABLE; STADIA.

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SURVEYING, MARINE. See HYDROGRAPHY.

SURVEYING INSTRUMENTS. The various instruments used by the engineer and surveyor in determining elevations, directions, and distances in their work of mapping land and locating and laying out engineering works. They may be broadly divided into instruments for (1) measuring distances, (2) determining directions, (3) determining horizontal lines, (4) measuring angles, and (5) miscellaneous work.

For measuring distances chains, tapes, and wooden or metallic rods may be used. The chain is of two kinds, the Gunter and the engineer's. The former was invented by Edmund Gunter, an English engineer, in 1620 and is 66 feet long, divided into 100 links, each of which is 7.92 inches long. These links are composed of heavy steel wire and each includes one, two, or three rings of the same material. At every tenth link is a numbered brass tag, while at each end of the chain is a handle. This chain is used now only in connection with the United States Public Lands or farm surveys, where the unit of area is the acre, of which the Gunter chain is an integral part, and where extreme accuracy is not a required essential.

The engineer's chain is similar to the Gunter chain except for the fact that it is 100 feet long instead of 66 and has, as the other, 100 links each 1 foot long instead of 7.92 inches. It too is seldom used except in a rough reconnoissance or in the preliminary location of the centre line of a railroad, where the stations or marks are 100 feet apart, therefore a chain length, and where, in rough country, a tape is likely to be broken.

The tape is now universally used, as it is more convenient, less bulky, more accurate, reads to finer divisions, and is in every way superior to the chain. Tapes vary from the small 3-foot pocket tape to the 1000-foot tape used in mine surveys, and usually are thin ribbons of steel or a nickel-steel alloy with small temperature coefficient known as invar (q.v.) with the feet and subdivisions etched upon them, though there are cloth and metallic tapes which are made of oiled cloth, the latter with threads of metal woven into them to prevent stretching. The usual length is 50 or 100 feet.

In very precise surveying, i.e., in geodetic work, metallic rods or bars called base bars are used to measure the base lines, upon which a system of triangulation is built up for the purpose of accurately locating points and determining distances. The United States Coast and Geodetic Survey makes use of invar tapes carefully standardized and with care paid to support, tension, and conditions of temperature. See GEODESY.

For measuring direction the most simple instrument employed is the surveyor's compass, but it is now rarely seen. This consists essentially of two uprights having vertical slits to give a line of sight, which are attached to a horizontal graduated circle at the centre of which is mounted a magnetic needle free to move, the whole being supported with devices for leveling. The use of the needle compass is confined almost entirely to land surveying when extreme accuracy is not of great importance. It is used by setting up the instrument over one point of the line whose direction is to be determined, and sighting through the upright slits at a mark or rod set at another point of the line, and then by means of a graduated plate reading off the deviation of this line of sight from the north and south line indicated by the needle. The solar compass was a modification of the above, but from an observation on the sun the true meridian and the bearing of a line are determined instead of the magnetic bearing. The prismatic compass is a hand instrument with a glass prism so arranged that the needle is read while taking the sight.

For determining horizontal lines the engineer's level is the instrument most commonly employed. This instrument consists of a telescope with cross hoist to determine the line of sight, clamped in Y-shaped uprights rising from a bar and carrying a spirit level and resting on a vertical pivot revolving in a socket in the plate which fastens the instrument to its tripod or other support. Leveling screws permit the adjustment of the spirit-level bar to a horizontal position, and, when the axis to the telescope is parallel to this bar, the line of sight is horizontal. In connection with the level there is used a level rod graduated to feet and fractions of feet and having a target which can be slid up and down the rod to coincide with the line of sight through the telescope. The form of level just described is often called a Y level. A dumpy level has a short telescope with a wide aperture. An architect's level has a compass attachment. The level is used to find the relative elevation of points a considerable distance apart, to obtain the profile of a line, and to establish a grade. See LEVELING.

For measuring angles the instrument most commonly used by engineers is the transit. This is the most useful and universal of surveying instruments. Besides measuring horizontal and vertical angles it will read distances by means of stadia wires, determine bearings by means of the magnetic needle, do leveling by means of a bubble glass attached to the telescope, and do the work of a solar compass by means of a special device attached for the purpose. The transit consists essentially of two concentric circular plates of copper, brass, or other material (the upper plate or upper horizontal either being smaller and let into the lower or lower horizontal, or the rim of the lower raised round the outside of the upper) moving round a common axis, which, being double, admits of one plate moving independently of the other. Upon the upper horizontal rise two supports, bearing a horizontal crossbar, which is the axis of a vertical circle. This circle either has a telescope fixed concentric with itself, or a semicircle is substituted for the circle, and the telescope is laid above and parallel to its diameter. The circles, as their names denote, are employed in the measurement of horizontal and vertical angles. For these purposes the outer of the horizontal circles is graduated, and the inner carries the index point and the verniers (q.v.); the vertical circle is also graduated, and the graduations are generally read off by an index point and vernier firmly attached to the supports. The upper horizontal is furnished with two levels placed at right angles to each other for purposes of adjustment and has a compass box let into it at its centre. The stand consists of a circular plate supported on three legs and connected with the lower horizontal by means of a ball-and-socket joint, the horizontal adjustment of the instrument being effected by means of three or four (the latter number is the better) upright screws placed at equal distances between the plates. The telescope is so fixed as to be reversible, and the adjustments are in great part similar to those of other telescopic instruments, but are too numerous and minute to be detailed here. Both horizontal plates being made, by means of the screws and levels, truly level, the telescope is pointed at one object, and the readings off from the graduated circle again performed; and by the difference of the readings the angular horizontal deviation is given. When vertical angles are required, the readings are taken from a vertical circle in a similar manner.

An instrument of the same construction, but the telescope of which cannot make a complete revolution on the horizontal axis, and thus does not transit, is usually called a theodolite. Theodolites are commonly made larger and more powerful than transits and are mostly used in important triangulation work for coast and geodetic surveys, etc. (See illustration under GEODESY.) The sextant (q.v.) is a convenient hand instrument for measuring angles universally and for making observations on shipboard, and also frequently used by engineers in surveying when angles have to be measured from a boat, as in locating soundings, buoys, etc. The plane table (q.v.) is an instrument for making topographic surveys and consists of an ordinary drafting board mounted on a tripod together with an instrument called an alidade. This latter consists of a line of sight, usually telescopic, mounted on a vertical support to which is attached a ruler, the edge of which is parallel to the line of sight.

Among miscellaneous engineers' instruments may be mentioned the aneroid barometer (q.v.) for determining altitudes; the pedometer for recording the number of steps taken by a walking man, which number multiplied by the length of step gives the distance traveled; the odometer, cyclometer (qq.v.), or speedometer, which record the number of revolutions of a wheel, which number, multiplied by the circumference of the wheel, gives the distance traveled; the clinometer, a device for measuring the dip of a vein, etc.; the planimeter (q.v.), a device for measuring irregular areas which have been mapped to scale; the pantograph (q.v.), for reproducing to the same or different scales from maps drawn on paper; and various drawing instruments, used in making maps and scale drawings of structures and machines. The heliotrope is an instrument used in geodetic surveying for the purpose of locating for the observer the station he wishes to observe, and at the same time it acts as the object to be sighted. It consists of one or more mirrors so arranged as to reflect a ray of light to the observer. See GEODESY; PHOTOGRAPHIC SURVEYING; SURVEYING. Consult: I. O. Baker, *Engineers' Surveying Instruments* (2d ed., New York, 1892); A. T. Walmisley, *Fieldworks and Instruments* (ib., 1904); J. B. Johnson, *Theory and Practice of Surveying* (17th ed., ib., 1910); W. F. Stanley, *Surveying and Leveling Instruments* (4th ed., ib., 1914).

SURVEYS, Military. See Engineering, Military.

SURVEYS, National. See Coast and Geodetic Survey, United States; Geological Survey, United States.

SURVI′VORSHIP. A term commonly employed to describe a doctrine prevailing in some jurisdictions to the effect that where two or more persons perish in the same accident or calamity there is a presumption of law that the stronger of them survived the others. This doctrine originated in the Roman and civil law, but generally no presumption exists in England or most of the United States, and a person seeking to establish the survivorship of one who lost his life with others in the same peril must do so by logical and relevant evidence as in any other case, or he will fail to sustain the burden of proof resting upon him. This proof need not be direct; the facts and circumstances may be shown if they furnish any reasonable basis for a conclusion. See Evidence; Presumption.

SURVIVORSHIP, Right of. The right of a person holding a title jointly with another to succeed to the latter's rights upon his death, by operation of law. This right exists in case of joint tenancies, in the absence of statutes to the contrary; in a husband and wife where they hold real property as tenants by the entirety; and in surviving partners after the death of another for the purpose of winding up the business, and in some forms (tontine) of life insurance. See Insurance; Joint Tenancy; Partnership; Property.

SURYA, sōōr′yȧ (Skt., sun). In Hindu mythology, the god of the sun, who is honored in the hymns of the Rig-Veda. (See Veda.) All creatures depend on him, for he drives away disease and upholds the sky. His father is variously said to be Dyaus, the sky, or Indra (q.v.), or Soma (q.v.). On the other hand he is the son of Aditi or of Ushas (q.v.), who is also regarded in other hymns as his wife, who bears the Asvins (q.v.). In later mythology Surya is the son of the sage Kasyapa and Aditi. He married Sanjna, who, overpowered by his radiance, left him, substituting for herself Chaya (Shadow). When he discovered this, he prevailed on his wife to return, and at his request his father-in-law, Tvashtar, the divine craftsman, ground off one-eighth of his brightness, from which were made the disk of Vishnu (q.v.), the trident of Siva (q.v.), and other divine implements. He is still worshiped on the first Sunday of the month of Magha (January–February), although he has degenerated into a petty godling in modern times. Consult: A. A. Macdonell, *Vedic Mythology* (Strassburg, 1897); W. J. Wilkins, *Hindu Mythology: Vedic and Puranic* (2d ed., London, 1900); Maurice Bloomfield, *Religion of the Veda* (New York, 1908); L. D. Barnett, *Antiquities of India* (ib., 1913).

SURYASIDDHANTA, sōōr′yȧ-sēd-hăn′tȧ (Skt., textbook of the sun). The earliest Hindu astronomy that has been preserved, composed after c.300 A.D. It was one of four treatises and is written in verse containing 14 chapters. For the adherents of the Hindu science of astronomy it yet remains the chief authority in India, along with the work of Brahmagupta (q.v.). It is probable that Greek astronomy exercised some influence over this as over later Hindu works on this science. The *Suryasiddhanta* has been published repeatedly in India, the best editions being those by Hall and Deva Sastri (Calcutta, 1859) and Dvivedi (ib., 1911). It has been translated into English by Deva Sastri (ib., 1860) and by Burgess and Whitney in the *Journal of the American Oriental Society*, vol. vi (New Haven, 1860). Consult Thibaut, *Astronomie, Astrologie und Mathematik* (Strassburg, 1899), and L. D. Barnett, *Antiquities of India* (London, 1913).

SU′SA (Lat., from Gk. *Σοῦσα*, *Sousa*, Heb. *Shûshan*, Pers. *Shûs*). The capital of the Province of Susiana or Elam (q.v.) in Persia and a very important city of the ancient East. The site is in a plain in the modern Province of Khuzistan between the Ab i Kerkhah (the ancient Choaspes) and the Shaur (the ancient Eulæus) (Map: Persia, C 5). It is marked by the so-called tomb of Daniel, a pilgrimage shrine of repute, and by the Kaleh i Shus (acropolis of Susa), with extensive ruins that consist of three spacious artificial platforms more than 100 feet high. The name of Susa occurs on Assyrian monuments of the time of Asurbanipal (668–625 B.C.), who captured it in 645 B.C. (See Assyria; Sardanapalus.) At first under Babylonian dominion, it came, at the time of Cyrus (q.v.), under Persian rule, and the Achæmenian kings raised it to the dignity of a metropolis of the Persian Empire. (See Achæmenes.) When Babylon had risen again to importance under Alexander and his successors, Susa gradually declined. In the Arab conquest of Persia it held out bravely for a long time, defended by Hormuzan. During the Middle Ages it was still inhabited and known for its manufactures of sugar. Excavations by Williams, Loftus, Dieulafoy, and others have revealed a citadel of semicircular form and the remains of the extensive colonnade, with a frontage of 343 feet and a depth of 244 feet, of the great palace built by Darius Hystaspis (q.v.) and restored by Artaxerxes Mnemon (q.v.), after having been ruined by fire in the reign of Artaxerxes Longimanus (q.v.). Cuneiform inscriptions, friezes of lions and archers, finely colored, now in the Louvre at Paris, and other remains have been recovered. Consult: Dieulafoy, *L'Acropole de Suse* (3 parts, Paris, 1888–92); Billerbeck, *Susa* (Leipzig, 1893); J. de Morgan, *Fouilles à Suse* (Paris, 1900); L. de Milloué, "Les fouilles de Suse," in the *Annales du Musée Guimet*, vol. xxvi (ib., 1907).

SUSA, sōō′zȧ (Lat. *Segusio*). An episcopal city in the Province of Turin, Italy, 32 miles by rail west of the city of Turin, on the Dora Riparia (Map: Italy, A 2). It has a triumphal arch 44 feet high, dedicated, the inscription reads, in 8 A.D. to Augustus. Its cathedral dates from 1029. It was formerly of strategic importance, being regarded as the key to the Alpine roads over Mont Cenis and Mont Genèvre. Pop. (commune), 1901, 4957; 1911, 3874.

SUSA, or Sousse. A port of Tunis, on the Gulf of Hammamet, in the Mediterranean Sea, 32 miles east-northeast of Kairwan, with which it is connected by rail, as also with Tunis (Map: Africa, F 1). It is surrounded by old walls, and its lofty, ancient, and restored citadel is used as the French military headquarters. A large modern town has grown up north of the old port, whose harbor, constructed in 1901, allows vessels of 25 feet draft to approach the quays. Phosphates, oil, cereals, and esparto grass are the chief exports. Susa is on the site of the Roman city of Hadrumetum. Pop., about 27,000, including some 6000 Europeans.

SUSAN′NA (Gk. *Σούσαννα*, *Sousanna*, from

Heb. *shûshan*, lily), History of, also known as The Judgment of Daniel and as Susanna and the Elders. One of three deuterocanonical additions to the Book of Daniel in the Greek Bible, the others being *The Song of the Three Holy Children* and *The History of Bel and the Dragon* (q.v.). The story of Susanna is as follows: in the early days of the Babylonian captivity there lived a woman, Susanna by name, who was celebrated for her beauty and her virtue. She was the wife of Joiachim, a wealthy and respected man, and daughter of a priest, Hilkiah. Two elders, who were also judges and held in high repute, were seized by desire for Susanna and, meeting each other unexpectedly in Joiachim's garden, agreed to coerce her. Susanna refused to listen to them, and in revenge the elders accused her of adulterous relations with a young man who had fled when surprised by their sudden appearance. She was condemned to death on this evidence, but Daniel, then a very young man, appeared and undertook to prove Susanna's innocence. By questioning the witnesses apart and showing discrepancies in their testimony he succeeded. The people applauded Daniel and put Susanna's accusers to death. It was probably written originally in Aramaic or Hebrew. Kay assumes a date of c.136 B.C., but it may be earlier. In most manuscripts it precedes the first chapter of the Book of Daniel, and so we find it in the old Latin and Arabic versions; but the Septuagint, the Vulgate, the Complutensian Polyglot, and the Hexaplar Syriac place it at the end of the book and reckon it as the thirteenth chapter. Consult: Fritzsche, *Apokryphen* (Leipzig, 1871); Otto Zöckler, *Apokryphen des Alten Testaments* (Munich, 1891); Emil Kautzsch, *Apokryphen und Pseudepigraphen des Alten Testaments* (Tübingen, 1899); D. M. Kay, in Charles, *The Apocrypha and Pseudepigrapha of the Old Testament* (Oxford, 1913).

SUSANNES GEHEIMNISS, zōō-zăn'nĕs ge-hīm'nĭs. See Segreto di Susanna.

SUSEMIHL, zōō'ze-mēl, Franz (1826–1901). A German classical scholar, born at Laage in Mecklenburg-Schwerin. He was appointed professor of classical philology at the University of Greifswald in 1856. Among his works the most valuable are: *Die genetische Entwickelung der Platonischen Philosophie* (1855–60); text editions of Aristotle's *Politics* (with Ger. trans., 1879) and *Ethica Nicomachea* (1880); the very important treatise, *Geschichte der griechischen Litteratur in der Alexandrinerzeit* (1891–92). Consult J. E. Sandys, *A History of Classical Scholarship*, vol. iii (Cambridge, 1908).

SUSIAN, sōō'sĭ-*a*n. See Cuneiform Inscriptions.

SUSITNA. See Iditarod.

SUSIT'NA VALLEY. The main watershed of the Susitna River, the principal affluent of Cook Inlet, Alaska (Map: Alaska, J 5). It has an area of about 8000 square miles, is fairly timbered, and has sections suited for agriculture and stock raising. The Susitna route of the government railway between Cook Inlet and Fairbanks, Tanana valley (q.v.), runs from the head of Knik Arm westerly and northwesterly, crossing the Little Susitna, to Willow Creek; thence northerly, following the drainage of the Susitna and Chulitna rivers to Broad Pass into the Tanana valley.

SUSO, zōō'zō, or **SEUSE**, zoi'ze, Heinrich (c.1295–1366). A German mystic. He was born at Ueberlingen, Baden. At the age of 13 he entered the Dominican Order and spent most of his life in monasteries at Constance and Ulm. He was impulsive and an enthusiastic disciple of Eckhart (q.v.), but gives the master's speculative ideas a spiritual expression. He was truly called "the sweet" Suso on account of his poetry and childlike religion. He was not a member of the Brethren of the Free Spirit, as has sometimes been supposed. His *Autobiography* and his *Book of Everlasting Wisdom* have been translated into many languages and are both of unique importance for the study of the psychology of mysticism. He died at Ulm and was beatified by Gregory XVI in 1831. Consult H. Diepenbrock, *Heinrich Suso: Leben und Schriften* (Regensburg, 1829, 1837, and Vienna, 1863; new ed. by H. E. Bihlmeyer, Stuttgart, 1907; Fr. trans. by Thirot, Paris, 1899), and R. A. Vaughan, *Hours with the Mystics* (7th ed., London, 1895). A more critical edition of Suso's works is that by Denifle (Augsburg, 1878–80), and there is an English translation (London, 1865).

SUSPENDED RAILWAY. See Monorail.

SUSPEN'SION. See Harmony, *Anticipations, Suspension, Resolution.*

SUSPENSION BRIDGE. See Bridge.

SUSPEN'SOR (from Lat. *suspendere*, to hang). A special, usually filamentous organ developed by and at the base of the embryo, which is thereby related more effectively to its food supply. The suspensor chiefly appears among seed plants. See Embryo.

SUSQUEHANNA, sŭs'kwē-hăn'ȧ. A borough in Susquehanna Co., Pa., 23 miles southeast of Binghamton, N. Y., on the Susquehanna River and on the Erie Railroad (Map: Pennsylvania, K 2). Shops of the railroad are here. The institutions include the Barnes Memorial Hospital, public library, and Y. M. C. A. There are manufactories of metal goods and washing machines. Pop., 1900, 3813; 1910, 3478.

SUSQUEHANNA RIVER. A river draining the greater part of Pennsylvania (Map: Pennsylvania, J 5). It rises in Otsego Lake, central New York, and flows southward in three large zigzag bends across Pennsylvania and into Maryland, where it empties into the north end of Chesapeake Bay at Havre de Grace after a total course of about 500 miles. It is almost throughout a shallow, swift, and unnavigable stream, but its entire course is through some very populous industrial and mining regions. After flowing through the northern plateau it enters the anthracite districts of the Appalachian valley. First it follows one of the western longitudinal valleys, and then turning to the southeast it breaks through all the Appalachian ridges, after which it traverses the more open but still picturesque piedmont plain. It receives its chief tributaries from the west, the Chemung, which joins it near the New York boundary, the large West Branch, 200 miles long, and the Juniata. Its lower and middle course is followed by a lateral canal, but its only importance as a waterway is for floating lumber. The chief cities on its banks are Harrisburg and Wilkes-Barre in Pennsylvania, Port Deposit in Maryland, and Binghamton in New York. The principal city on the West Branch is Williamsport.

SÜSS, zṳs, Hans, also called Hans von Kulmbach (c.1476–1522). A German historical painter and engraver. He was born at Kulmbach in Franconia, studied at Nuremberg under

Jacopo dei Barbari, a Venetian, and later worked in Dürer's studio. In 1514 he went as court painter to Cracow, where 13 of his paintings are preserved, and in 1518 he returned to Nuremberg. The influence of both his masters can be traced in his works, that of the Venetian being most visible in the "Adoration of the Kings" (1511, Berlin Gallery), "St. George" (Germanic Museum, Nuremberg), and the "Blessing of the Chalice" (St. John's Chapel, Cracow); and that of Dürer in the "Last Supper" (ib.), eight scenes from the "Lives of St. Peter and St. Paul" (Uffizi Gallery, Florence), and his masterpiece, the "Coronation of the Virgin" (church of St. Sebaldus, Nuremberg). Süss was one of the most important of Dürer's followers. His color is pleasing, his light effects often beautiful, and his rendering of material fine, but his types are often superficial, and he lacked imagination and nobility of conception.

SUS'SEX. A maritime county of southeast England (Map: England, F 6). Area, 1458 square miles. Pop., 1901, 605,052; 1911, 666,229. The South Downs traverse the county from west to east, ending about 20 miles east of Brighton, in the lofty cliff of Beachy Head, and the northern escarpment of the Downs leads down to the fertile and richly wooded district of the Weald. The chief rivers are the Arun, Adur, and Ouse. A remarkably productive tract of land extends west from Brighton along the coast to the Hampshire border, and in the southeast of the county the rich marsh lands that line the coast make excellent pasture grounds. The Down lands are covered with a fine, short, and delicate turf, on which the well-known breed of Southdown sheep are pastured. The principal industries of the county are agriculture and cattle raising. Thick beds of gypsum are worked at Netherfield. The fisheries are important, and there are large railway works at Brighton. Capital, Chichester. See *Victoria History of the County of Sussex*, vols. i, ii (London, 1905–07).

SUSSMANN-HELLBORN, zṳs'män hĕl'bôrn, Louis (1828–1908). A German sculptor, born in Berlin, where he studied under Wredow and where he settled in 1857 after a sojourn in Rome (1852–56). Of his genre and mythological subjects, a "Drunken Faun" (1856) and "Sleeping Beauty" are in the National Gallery. His monumental work is represented by statues of "Frederick the Great in Youth" (1862), City Hall, Breslau; "Frederick the Great in Mid-Age" and "Frederick William III" (both 1869), City Hall, Berlin; "Holbein" and "Peter Vischer," both in the Art-Industrial Museum, Berlin, which he helped to establish in 1867. Sussmann-Hellborn was artistic director of the Royal Porcelain Factory in 1882–87.

SUSTERMANN, sŭs'tẽr-mȧn. See Lombard, Lambert.

SUSTRIS, sŭs'trĭs. See Lombard, Lambert.

SUTECH, sōō'tĕk. An Egyptian deity. See Set.

SUTH'ERLAND. A county of north Scotland (Map: Scotland, D 1). Area, 2028 square miles. Pop., 1901, 21,440; 1911, 20,180, the majority of whom speak Gælic. The coast line is 60 miles in extent, and the shores, rugged on the north and west, where they are broken by the force of the Atlantic, are comparatively flat on the east. The southern and central regions of Sutherland are the most elevated; the principal mountain peaks are Ben More in Assynt (3273 feet) and Ben Clibrigg (3154 feet). The chief rivers are the Oikel and the Shin. Extensive moors stretch across the county, and the rivers and lakes, the chief of which is Loch Shin, form numerous low-lying valleys or straths. In the eastern districts the soil is very fertile, yielding all kinds of agricultural produce. Coal, granites of various colors, marble, limestone, etc., are found; there are good salmon, herring, and other fisheries. The capital is Dornoch.

SUTHERLAND, Alexander (1833–1910). A Canadian Methodist clergyman. He was born in Wellington County, Ontario, early became a printer, and after attending Victoria College, Cobourg, was ordained to the Wesleyan Methodist ministry in 1859. Subsequently he was pastor of important churches in Hamilton, Toronto, and Montreal. He was elected missionary secretary of his church in 1874 and displayed remarkable zeal and eloquence as well as business ability in expanding and consolidating the missionary interests committed to his charge. An active worker in the temperance cause, he was made president of the Prohibition Third party in Ontario. He took a foremost part in the work of uniting the Wesleyan Methodist, Methodist Episcopal, Bible Christian, New Connexion, and Primitive Methodist denominations into one Methodist church in 1883.

SUTHERLAND, George (1862–). An American lawyer and legislator, born at Stony Stratford, Buckinghamshire, England. His parents brought him to the United States in 1864 and settled in Utah. He graduated from Brigham Young University in 1881 and, in law, from the University of Michigan in 1883. After 1893 he practiced law in Salt Lake City. A stanch Republican, he was a member of the Utah Senate (1896–1900), a Representative in Congress (1901–03), and Senator (1905–11; 1911–17). He was regarded as one of the ablest lawyers in the Senate and was frequently mentioned for the Supreme Court, but gained the reputation of an ultraconservative in politics. Sutherland showed deep interest in irrigation problems and in the conduct of foreign relations. He was a delegate to several Republican national conventions. In 1913 Columbia University gave him the degree of LL.D.

SUT'LEJ, or **SATLEJ**. The chief tributary of the Indus. It rises in the southern part of Tibet near the sources of the Indus and the Brahmaputra, and, after winding through the Himalaya past Simla, it flows southwest through the great arid plains of the Punjab, joining the Indus in the southwestern part of that province after a course of about 950 miles (Map: India, B 3). After passing through Lake Manasarowar (q.v.) the river, whose upper course is very rapid, flows through a series of lofty and highly picturesque mountain valleys. In the low doabs of the Punjab its waters are largely used for irrigation, but its volume is nevertheless almost equal to that of the Indus. The Sutlej is the eastern and southernmost of the Five Rivers of the Punjab, the other four being its two main tributaries, the Beas and the Chenab, together with two branches of the latter. Below the confluence of the Beas the river is sometimes called the Ghara, and its lowest course, after receiving the Chenab, is called the Panjnad, or Five Rivers.

SUTRA, sōō'trȧ (Skt. *sūtra*, thread, clew). In Sanskrit literature, the technical name of brief, aphoristic rules and works consisting of such rules. The object of the sutras is to supply a short survey of the facts of any given science in a form so brief that the whole theme may be memorized. In the later works of this class brevity and allusiveness are carried to such an excess that, but for the aid of commentaries which regularly accompany them, they would be obscure and sometimes absolutely unintelligible. Probably this peculiar style of writing originated with the mnemonic methods of teaching which have prevailed in India from early times.

The importance of the sutras will be understood from the fact that they form in very early times the standard medium of most of the ritual, legal, grammatical, metrical, and philosophical literature. The ritual sutras, known as *Srauta Sūtras* and *Gṛhya Sūtras*, are systematic compendiums of the priestly sacrifices and the ceremonies of the householder respectively. The *Dharma Sūtras*, the oldest sources of Indian law, are also rooted in the Veda (q.v.). There is another class of Vedic sutras, concerned with religious practice, the *Sulva Sūtras*, of which class the last chapter of the sutra collection of the school of Apastamba (q.v.) is an example. These are practical manuals giving the measurements of the altars, etc. They show quite an advanced knowledge of geometry and constitute the oldest Indian mathematical works. In addition the systematic study of the Vedas produced a series of ancillary Vedic sciences in sutra style, the so-called six Vedangas (q.v.). The most important class of these texts are the *Prātiśākhya Sūtras*, which deal with accentuation, pronunciation, and other matters, but are chiefly concerned with the phonetic changes undergone by Vedic words when combined in a sentence. Their observations are so minute and acute as to approach the best results of the modern science of phonetics. A still more important branch of sutra literature is grammar, in which the Hindus again surpass all nations of antiquity. The systematic analysis of words into roots, suffixes, and inflectional elements evolved by Panini (q.v.) has been adopted with unimportant changes by modern grammarians.

Later systematic philosophy, which has grown up on the basis of the theosophic hymns of the Veda and the Upanishads (q.v.), also adopts the sutra style of presentation in the six systems of philosophy. Even so remote a theme as erotics is given in the *Kāmasūtra* (Love Sutra) of Vatsyayana, who naïvely treats this subject in the form of sutra rules. In one quarter, however, the sutra has abandoned its style and has become the reverse of brief, for the Buddhist *Sūtras*, or *Suttas* (see PITAKA), the sermons ascribed to Buddha, excel in prolixity almost every other type of literature in existence.

Bibliography. A good bibliography of sutra texts that have been edited and published may be found in A. A. Macdonell, *History of Sanskrit Literature* (London, 1913). Among recent editions not mentioned in this work are *The Srauta Sūtra of Apastamba* (ed. by R. Garbe, 3 vols., Calcutta, 1901–03); *The Srauta-sūtra of Drāhyāyaṇa* (ed. by P. N. Reuter, London, 1904); *Prayogādipikā of the Aśwalāyana Srauta Sūtra* (ed. by Nyayopadhyaya and Kavyatirtha, Benares, 1907); *Der Arṣeyakalpa des Sāmaveda* (ed. by W. Caland, Leipzig, 1908); *Das Vaitānasūtra des Atharvaveda* (Ger. trans. by W. Caland, Amsterdam, 1910); *Sutras of the School of Hiranyakesin* (ed. by Okapahra, Poona, 1908–16). Consult also V. Henry, *Les littératures de l'Inde* (Paris, 1904), and E. J. Rapson, *Ancient India* (Cambridge, 1914).

SUTRI, sōō'trē (anciently **SUTRIUM**). A town in the Province of Rome, Italy, 29 miles northwest of Rome. It is interesting for its ancient walls and gates, its Etruscan tombs, and the ruins of an amphitheatre dating from the time of Augustus. Sutri is known as the scene of the synod which in 1046 deposed Popes Gregory VI and Sylvester III. Pop. (commune), 1901, 2795; 1911, 2942.

SUTRO, sōō'trō, ADOLPH HEINRICH JOSEPH (1830–97). An American mining engineer and philanthropist. He was born at Aix-la-Chapelle in Rhenish Prussia, came to the United States in 1850, and soon after went to the Pacific coast. He was best known as the designer and constructor of the famous Sutro Tunnel, built to drain and ventilate the mines of the celebrated Comstock silver lode in Nevada. It is 20,500 feet long and cost about $6,500,000. It did not prove so valuable as had been hoped, but by investing the returns which he got from it in San Francisco real estate Sutro became a millionaire. In 1894 he was elected mayor of the city by the Populists. During his life he made numerous gifts to the city, and by his will left to it a park and a library of 250,000 volumes; but after his death the estate was involved in family lawsuits, and the library was packed away in storage, unclassified. In the earthquake and fire of 1906 about 150,000 volumes were destroyed. In 1913 a settlement was made by which Sutro's heirs gave to the State Library the books saved (about 100,000), on condition that they be kept in San Francisco.

SUTTEE, sŭt-tē' (from Skt. *satī*, true wife). The practice which prevailed in India of a wife burning herself on the funeral pile, either with the body of her husband, or separately if he died at a distance. Suttee for the orthodox Hindus is based on the injunctions of their sacred books, and there can be no doubt that various passages in the Puranas (q.v.) and codes of law countenance belief in its efficacy. These, however, are all rather late texts. Classical authors mention it as early as 316 B.C. It has been referred to the Rig-Veda as authority, and it was even thought that a Vedic verse had been falsified to give support to the practice. This view, however, is untenable, for the Rig-Veda does not recognize the custom. Manu (q.v.), the lawgiver, does not sanction it either, though it was known before his time. It appears at first to have been a royal custom and privilege, afterward generalized and made legal. The custom was abolished by the British in 1829. Nevertheless it has continued to the present time in isolated parts of India, for even as late as 1905 several persons who took part in a suttee in Behar were condemned to penal servitude. Suttee is by no means confined to India. Under other names the widow's death at the grave of her husband is known in many parts of the world, notably in the South Pacific, where a king's favorite wives were wont to let themselves be buried alive in his grave. Consult: H. H. Wilson, *Collected Works*, vol. ii (ed. by Rost, London, 1862); H. T. Colebrook, *Miscellaneous Essays*, vol. i (new ed., ib., 1873); J. C. Bose, *The Hindoos as they Are* (2d ed., ib., 1884); Jolly, "Recht und Sitte," in Bühler's *Grundriss der indoarischen Philologie* (Strassburg, 1896); E. B. Tylor, *Primitive Culture* (4th ed., 2 vols., New York, 1903).

SUT′TER, John Augustus (1803–80). An American pioneer, born in Kandern, Baden. He was of Swiss parentage and was educated at the military college at Bern. He emigrated to America in 1834 and became a trader at Santa Fe, N. Mex. In 1838 he made his way to the Pacific coast, thence to the Sandwich Islands, and finally to Alaska. Obtaining a grant of Mexican land, he established in 1841 a settlement called New Helvetia (Sutter's Fort), where the city of Sacramento now stands. He was Governor of the north district of California under the Mexicans, and alcalde and Indian agent after it passed to the United States. In February, 1848, gold was discovered on his estate. The discovery, however, brought him nothing but disaster. Gold diggers preëmpted his lands, and except an annual pension of $3000 granted him by the California Legislature he received nothing. He settled in Pennsylvania in 1873. Consult F. S. Dellenbaugh, *Frémont and '49* (2d ed., New York, 1914).

SUTTNER, zụt′nẽr, Bertha Baroness von (1843–1914). An Austrian novelist, especially known for her efforts to promote peace. Born at Prague, the daughter of Count Franz Kinsky, she married, in 1876, Baron Arthur von Suttner (1850–1902), also known as a novelist. In 1891 she founded the Austrian Society of Peace Lovers and, as its president, took a prominent part in the peace congresses at Rome (1891), Bern (1892), Antwerp (1894), and Hamburg (1897). She edited *Die Waffen nieder!* (Dresden, 1892 et seq.), organ of the Peace Bureau at Bern, and in 1905 received the Nobel peace prize. Her novels include: *High Life* (1884; 3d ed., 1902); *Erzählte Lustspiele* (1889); *Die Waffen nieder!* (1889; 38th ed., 1907; translated into many languages; in Eng., *Lay Down Your Arms!*, 1905) and its sequel *Marthas Kinder* (1902); *Babis siebente Liebe* (1905). She also wrote: *Das Maschinenzeitalter* (3d ed., 1898); *Die Haager Friedenskonferenz, Tagebuchblätter* (1900); *Der Krieg und seine Bekämpfung* (1904); *Randglossen zur Zeitgeschichte* (1906); *Stimmen und Gestalten* (1907); *Menschheit, Hochgedanken* (1912). A collected edition of her works appeared in 12 volumes (Dresden, 1906–07). Her *Memoiren* (1909) were translated as *Memoirs of Bertha von Suttner* (2 vols., Boston, 1910).

SUT′TON. A town in Surrey, England, 11 miles south of London and a favorite residential district for London business men. Pop., 1901, 17,224; 1911, 21,270.

SUTTON. A town in Worcester Co., Mass., 9 miles south of Worcester, on the New York, New Haven, and Hartford Railroad (Map: Massachusetts, D 4). There are manufactories of cotton goods, shuttles, and ducking. Pop., 1900, 3328; 1910, 3078; 1915 (State census), 2829.

SUTTON COLD′FIELD. A municipal borough in Warwickshire, England, 7 miles north-northeast of Birmingham, of which it is a residential suburb (Map: England, E 4). The chief objects of interest are an ancient Early English church, the grammar school founded in 1543, and the celebrated Sutton Park, a recreation ground of 3500 acres, these two latter institutions due to the beneficence of Bishop Vesey of Henry VIII's reign, who also bequeathed real estate the annual revenue of which is applied to educational and charitable purposes. Pop., 1901, 14,264; 1911, 20,132.

SUTTON IN ASH′FIELD. A town in Nottinghamshire, England, 3 miles southwest of Mansfield, known for its hosiery manufactures. It has a church of the twelfth century. Pop., 1901, 14,862; 1911, 21,708.

SU TUNG-P'O, or **SOO TUNG-P'O,** sōō′-tûng′pō′ (1036–1101). The name by which Su Shih, a Chinese statesman and poet, is best known. He entered public service in 1060 and soon attracted the attention of the Emperor. At his own request he was appointed Governor of Hangchow (q.v.). He opposed the reforms of Wang An-shih, then in favor at the court, and was degraded in consequence and banished. On the death of the Emperor in 1086 he was recalled to the capital, where he filled several high posts, becoming president of the Board of Rites in 1091. The sarcasm of his verse, however, continued to make him enemies, and, being accused of speaking ill of the Emperor, he was again banished. A new Emperor having come to the throne, he was recalled in 1101 and restored to honor, but died soon after at Changchow in Kiangsu. In the estimation of the Chinese, Su stands in the first rank as a poet. An edition of his works in 115 books was issued in his lifetime, and there have been many since then with commentaries and new arrangements. Copious translated extracts are to be found in Giles, *Gems of Chinese Literature* (London, 1884), and his *Chinese Literature* (New York, 1901).

SU′TURE (from Lat. *sutura*, seam, from *suere*, to sew; connected with AS. *siwian*, Eng. *sew*). A term employed both in anatomy and surgery. In anatomy it is used to designate the modes of connection between the various bones of the cranium and face. A suture is said to be serrated when formed by the union of two edges of bone with projections and indentations (like the edge of a saw) fitting into one another. The coronal, sagittal, and lambdoidal sutures (see Skull) are of this kind. A suture is termed squamous when formed by the overlapping of the beveled (or scalelike) edges of two contiguous bones. There are also the harmonia and schindylesis sutures, the former being the simple apposition of rough bony surfaces, the latter the reception of one bone into a fissure of another. See Joint.

In surgery the word is employed to designate various modes of sewing up wounds. The term is also applied to a single stitch. Two main varieties of suture are recognized, the continuous and the interrupted suture, and from these two a number of modifications have been made, of which the quill suture, button suture, glover's suture, quilt suture, and the intestinal sutures of Lembert and Dupuytren are examples. A buried suture is one which unites some deeper structure, such as a muscle or a layer of fascia, and which does not appear above the skin. It is often made of some absorbable material. Many materials are at present employed for sutures, such as silk, catgut, silkworm gut, horsehair, kangaroo tendon, and silver wire. Consult J. C. DaCosta, *Modern Surgery* (7th ed., Philadelphia, 1914).

SU′VA. The capital and chief port of the British colony of the Fiji Islands (q.v.). It is situated on the south coast of Viti Levu, 1100 miles from Auckland and 1540 miles from Brisbane. There is good anchorage in a harbor accessible at all tides. There was in 1911 a European population of 1376.

SUVAROV, sụ-vä′rôf, or **SUVOROV,** Alexei

Vassilievitch, Count (1729–1800). A Russian field marshal. He was of Swedish descent and was born in Finland. He served in the campaigns of the Seven Years' War and was made a colonel in 1762 after the battle of Kunersdorf (1759). His services in the Polish War (1768–72), in the war against the Turks (1773–74), in suppressing the uprising of Pugatchev, and in subduing the Tatars of the Kuban (1783) gave him increased reputation, and he rose to the rank of general. In the Turkish War of 1787–92 he was commander in chief, first bringing the bayonet into use in the Russian army, and decided by it the battle of Kinburn (1787). At the siege of Otchakov (1788), the battle of Fokshany (1789), which he gained in conjunction with the Austrians, and the decisive victory of Rymnik (1789), his system of rapid and repeated attack by overwhelming numbers secured him success. For this last, which saved the Austrians under the Prince of Saxe-Coburg from annihilation, Suvarov was created by Emperor Joseph II a count of the Empire, and from his own sovereign received the title of Count Suvarov-Rymnikski. One of his great successes was the storming, in 1790, of the fortress of Ismail, where the whole Turkish garrison was killed. He was appointed (1791) Governor of the newly conquered provinces. In 1794 he was sent into Poland, where he completed the annihilation of the Polish monarchy by a victory won with Fersen over the army of Kosciuszko, the capture of Praga, where a massacre of the inhabitants took place, and the occupation of Warsaw. The grade of field marshal rewarded these successes. Under Paul I he fell into disgrace (1798) because of his impatience with the Emperor's fantastic military regulations and was deprived of his rank, but, being restored through English influence, he commanded the army sent to coöperate with the Austrians in Italy against the French. He reached Verona in April, 1799; compelled Moreau to retire behind the Adda after defeating him at Cassano (April 27); entered Milan (April 29); again defeated the French under Macdonald at the Trebbia (June 17–19), and a third time under Joubert at Novi (August 15), driving them out of the whole of northern Italy. He next entered Switzerland in order to join Korsakov and effected a toilsome march across the St. Gotthard, in the course of which he lost one-third of his army. But Masséna defeated the army of Korsakov at Zurich (September 25), and Suvarov was compelled to execute a retreat through the Grisons and Vorarlberg. For these remarkable services he received the title of Prince Italiski. In 1800 he was named commander in chief of the Russian armies and ordered home. He arrived in the capital, where he died May 18, 1800. A monument was erected in his honor in 1801 at St. Petersburg. He left an autobiography in French, which was edited by Glinka (Moscow, 1819). Consult also: Friedrich von Smitt, *Suworows Leben und Heerzüge* (Vilna, 1833–34); id., *Suworow und Polens Untergang* (Leipzig, 1858–59); E. N. Macready, *A Sketch of Suwarrow and his Last Campaign* (London, 1851); Reding-Biberegg, *Der Zug Suworows durch die Schweiz* (Zurich, 1869).

SUVORIN, sōō-vô'rĭn, Alexei Sergeievitch (1834–1912). A Russian journalist and publisher. He was born in the Government of Voronezh, Russia, and studied at the Voronezh-Mikhailovsky Cadet School. In 1866 he wrote a novel, *Everybody*, which was destroyed by the censors, and 10 years later founded the most important Russian daily, *Novoye Vremya*. In 1872 he began the publication of the famous *Suvorin Calendar* and in 1881 appeared his monthly *Istoritchesky Vestnik*. Besides he published several reference works and "Libraries" of Russian and foreign classics in hundreds of volumes. Suvorin actively promoted the Moscow Little Theatre and wrote plays for it, some of which (*Riepin's Tatiana*, a comedy, and *Media*, a tragedy) were very popular.

SUWALKI, sōō-väl'kė. A government of Russian Poland situated in the northeastern part (Map: Russia, B 4). Area, 4763 square miles. The surface is generally flat and interspersed with lakes. The principal river is the Niemen. The soil is mostly fertile. About one-fourth of the area is in forests, which belong chiefly to the state and are extensively exploited. The principal occupation is agriculture. Pop., 1912, 693,000, half of whom were Lithuanians.

SUWALKI. The capital of the government of that name in Russian Poland, situated on a small tributary of the Niemen, 606 miles southwest of St. Petersburg (Map: Russia, B 4). Pop., 1910, 32,962. It was captured by the Germans in 1915. See War in Europe.

SUWANEE (sụ-wạ'nė) **RIVER.** A river of Florida (Map: Florida, C, D 2). It rises in the Okefinokee Swamp in south Georgia and flows southwest, emptying into the Gulf of Mexico, 12 miles north of Cedar Keys, after a course of 240 miles. The scenery along its banks is attractive, and the river has been celebrated throughout the country by the song, *Old Folks at Home.*

SUWARRO, sōō-wär'rō. See Cereus.

SUYEMATSU, sōō'yĕ-mät'sụ, Kencho, Viscount (1855–). A Japanese statesman, son-in-law of Marquis Hirobumi Ito (q.v.). He was born in Fukuoka ken and in 1877 was civilian staff officer to the commander in chief of the army during the Satsuma Rebellion. He began his public life as a writer on the staff of the *Nichi Nichi* and later was attached to the Japanese Legation in London, of which he was appointed chancellor. He was a member of the Japanese House of Commons (1890–95), director of the Legislative Bureau (1892–95), Minister of Communications in the Ito cabinet (1898), Minister of the Interior in the Seiyukai cabinet (1900–01), and nonofficial agent in England during the Russo-Japanese War (1904–05). He was created Baron in 1895 for distinguished service in the Chinese War and Viscount in 1907. He made an English translation of *Genji Monogatari* and of Anderson's *Pictorial Japan* and published *The Risen Sun: A Fantasy of Far Japan* (1905).

SUYUTI, sōō-yōō'tė (Ar. *Abū'l Faḍl 'Abd al Raḥmān Jolel al din al Suyūṭī*) (1445–1505). An encyclopædist and the most prolific writer in Arabic literature. His family was of Persian origin, but had emigrated to Egypt, where his father was a judge and professor at Cairo. Hither the son returned after the usual travels to Mecca and the centres of learning, and here he rose from one professorship to another. But at last his arrogant and dishonest conduct drove him from his position, and he died in retirement. The production of great numbers of books seems to have been his affectation, and although they do not reveal genius, they are of value for the encyclopædic information they contain. More than 500 titles of extant books of his are enumerated, touching upon every subject. Consult: Wüstenfeld, *Die Geschichtschreiber der Araber* (Göttingen, 1882); C. Brockelmann, *Geschichte der arabischen Litteratur* (Berlin, 1899); R. A. Nicholson, *A Literary History of the Arabs* (New York, 1907).

SUZZALLO, sū̆'*za*-lō *or* sū̆'z'-lō, Henry (1875–). An American educator. He was born at San Jose, Cal., graduated in 1899 at Leland Stanford Junior University, where he was an instructor for several years, and in 1905 took his Ph.D. at Columbia, where he was adjunct professor of elementary education (1907–09) and professor of the philosophy of education (1909–15). In 1909 he was made editor of the *Riverside Educational Monographs*. In 1915 he accepted the presidency of the State University of Washington.

SVANE, svä'nĕ, or **SVANING**, svä'nĭng, Hans (1606–68). A Danish statesman and Lutheran churchman. He was born at Horsens and was educated at Copenhagen, Wittenberg, Leyden, Oxford, and Paris. In 1633 he became professor of Oriental languages, and in 1646 professor of theology, at the University of Copenhagen and in 1655 was made Bishop of Sealand. In the deliberations of the Rigsdag of 1660 Svane was chiefly responsible for the change from an elective monarchy to a hereditary and absolute monarchy. As a reward two special offices were created for him, that of Archbishop and that of president of the academic consistory of the university, neither of which offices have ever since been held by a Danish ecclesiastic. In addition he was made a royal councilor, a member of the Council of State, and an assessor of the Supreme Court.

SVARGA, swär'gȧ (Skt., heaven). In Hindu mythology, the paradise of the god Indra (q.v.). It is the residence of some of the inferior gods and deified mortals, who there rest in the shade of five wonderful trees, drink *amṛta*, the beverage of immortality, and enjoy the music of the heavenly musicians, the *Gandharvas*, and the dancing of the celestial courtesans, the *Apsarasas*. Svarga is situated on Mount Meru (q.v.) and is said to be 800 miles in circumference and 80 miles high. Its pillars are of diamonds and its palaces of gold. Consult A. A. Macdonell, *Vedic Mythology* (Strassburg, 1897).

SVARTE HUK, svär'*te* hụk. See Heiberg Land.

SVEABORG, svā'å-bôr-y'. A fortress of Finland, Russia. See Helsingfors.

SVEARIKE, svā'å-rē'k*e*. One of the three historical divisions of Sweden. It lies between Götarike and Norrland. Area, 32,589 square miles. Pop., 1900, 1,579,954; 1910, 1,735,192.

SVENDBORG, svĕnd'bôrg. A seaport of Denmark, on the southeast coast of the island of Fünen, on the Svendborg Sound, 27 miles south of Odense (Map: Denmark, D 3). The town occupies a charming site in a hill-encircled valley. The chief industries are iron founding, tanning, and shipbuilding. Pop., 1901, 11,531; 1911, 12,667.

SVEND'SEN, Johan (Severin) (1840–1911). A Norwegian violinist and composer, born in Christiania. He studied at the Leipzig Conservatory (1863–67), toured extensively, later was appointed concert master of the Leipzig Euterpe concerts, and from 1872 to 1877 was conductor of the Christiania Musical Association. In 1883 he became court conductor at Copenhagen. He is one of the most important of Scandinavian masters, although his music shows few distinctly national characteristics. His works include string quartets and quintets; two symphonies, in D and B flat; violin concerto in A; overture to Björnson's drama *Sigurd Slembe; Carnaval à Paris*, for the orchestra; *Coronation March*, for Oscar II; *Wedding Cantata*, for chorus and orchestra; *Carnaval des artistes norvégiens;* a legend for orchestra, *Zorahayde;* Norwegian rhapsodies for the orchestra; overture to *Romeo and Juliet;* Scandinavian airs for string quartet; Romance in G, for the violin and orchestra.

SVENGALI, svĕn-gä'lĭ. A sinister character in George Du Maurier's (q.v.) novel, *Trilby*. He possessed hypnotic powers and through them transferred his musical knowledge to the heroine of that story, making her a great singer. His influence over her destroyed, she could no longer sing.

SVERDRUP, svĕr'drụp, Georg (1770–1850). A Norwegian scholar and statesman, born in Namdalen. Educated at Christiania and Göttingen, he became professor of Greek at Copenhagen in 1803. He did much for the establishment of Christiania University, where for many years he was professor of Greek and Latin and later of philosophy. He was president of the Assembly at Eidsvold (May 17–19, 1814) which drafted the constitution of Norway. With C. M. Falsen, Sverdrup was the leader of the majority which offered to Prince Christian Frederik the crown of Norway. His services as member of the Storthings of 1818 and 1824 were also important.

SVERDRUP, Johan (1816–92). A Norwegian statesman, born at the château of Jarlsberg. He studied and practiced law, but from 1850, when he was elected to the Storthing, gave his entire attention to politics and became the leader of the radical peasant party. As President of the Storthing since 1871 he violently fought against the royal prerogatives. He was called to preside over the ministry in 1884, but did not satisfy the radical portion of his adherents and, yielding to the combined attacks of the Conservatives and the extreme Left, resigned in 1889. His work greatly furthered the development of popular government in Norway.

SVERDRUP, Otto (1855–). A Norwegian Arctic explorer, born at Harstad Farm, District of Helgeland. He followed the sea at the age of 17, was subsequently in command of a merchant vessel, and in 1888 joined Nansen's expedition to Greenland. In 1893 he started with Nansen for the North Pole as commander of the *Fram*, which had been built under his supervision, and when Nansen, in 1895, left the *Fram* in an attempt to reach the North Pole by dog sledge, Sverdrup, remaining with the ship, brought her safe to Norway through the ice of the following years.

He led another expedition in the *Fram* (1898–1902) in an unsuccessful attempt to circumnavigate Greenland. Unable to pass north of Cape Sabine, Smith Sound, he transferred his field of operations the second summer to Jones Sound, where his explorations and discoveries were notable in extent and in success. They include Heiberg and Ringnes lands, the most westerly coasts of Grinnell Land, and regions adjacent to Greely Fiord. When commanding an expedition for the relief of missing Arctic explorers, he wintered (1914–15) on the shores of Kara Sea. He wrote *New Land: Four Years in the Arctic Regions* (1904).

SVET'LA', Karolina. See Mužáková, Johanna.

SWABIA, or **SUABIA** (Ger. *Schwaben*, Lat. *Suevia*). A mediæval duchy in the southwest of Germany. It took its name from the Suevi, by which the Germanic people of the Alemanni (q.v.), who occupied southwestern Germany in the third century, were also known. The name Suevia alternates with that of Alemannia as the designation of the country in the early part of the Middle Ages, but the former finally prevailed. The region occupied by the Alemanni embraced western Bavaria, Württemberg, Baden, Alsace, and a great part of Switzerland. The bulk of the nation was subjected by the Franks at the close of the fifth century. As part of the Frankish realm Alemannia was governed by native dukes, but the duchy was abolished before the dissolution of the Frankish Empire. The country from which Alsace and part of the Alpine territories had been detached, and which now came to be known as Swabia, was then placed under the rule of counts and *nuntii cameræ*, and for a time it was nearly independent.

In 919 Swabia was constituted one of the great duchies of the German Kingdom. It comprised the region between the Rhine and the Lech and part of Switzerland. The office of duke was frequently kept in the royal family. In 1079 the duchy passed to the house of Hohenstaufen, being bestowed by the Emperor Henry IV upon Frederick of Staufen. In 1096 Frederick of Staufen was compelled to give up to Berthold of Zähringen the Breisgau and the Imperial bailiffship in Zurich. Under the rule of the Hohenstaufens, who occupied the Imperial throne of Germany from 1138 to 1254, Swabia was the most wealthy and powerful of the German duchies. On the extinction of the Hohenstaufen dynasty in 1268 disintegration took place, and the ducal vassals (cities, prelates, counts, etc.) claimed independence except for their allegiance to the emperors. The Count of Württemberg occupied the leading place among the petty rulers. The numerous lesser lords were for the most part obliged to accept the overlordship of the house of Zähringen or of Austria. The cities, of which many had become wealthy and powerful, were striving for local independence. In 1331 some of them formed the first Swabian League. In 1405 Württemberg, Baden, and 17 cities joined together in the League of Marbach. The two leagues were of little importance as political powers, but they paved the way for the Great Swabian League, formed in 1488, which under the leadership of the Count of Württemberg exercised administrative and judicial authority over the whole country. During this long period of strife a considerable portion of old Swabia had passed into the power of Bavaria. In 1512 Swabia became one of the 10 circles into which Germany was divided for administrative purposes by Maximilian I. The dissolution of the Great Swabian League took place in 1534. Among the many city commonwealths which arose in Swabia were Augsburg, Ulm, and Constance (qq.v.). The southwestern Government District of Bavaria bears the name of Swabia (or Swabia and Newburg). Its capital is Augsburg. The best general history is P. F. Stälin, *Geschichte Württembergs* (Gotha, 1882–87). Consult also Eugene Schneider, *Württembergische Geschichte* (Stuttgart, 1896).

SWABIA, Konradin of. See Conradin of Swabia.

SWABIA, Philip of. See Philip of Swabia.

SWADLINCOTE, swŏd'lin-kōt. A town in Derbyshire, England, 4 miles southeast of Burton-upon-Trent. Its industries comprise coal mining and the various branches of earthenware manufacture. Pop., 1901, 18,014; 1911, 18,674.

SWAHILI, swȧ-hē'lē. A Bantu people of the Kau District, Tana-Ozi Delta, British East Africa, mingled more or less in blood with Semites. They are Mohammedans and differ little from the Arabs in general culture. They number about 1,000,000. They are noted traders, and their language, the Kiswahili, is the great medium of intercourse throughout east Central Africa. Consult: Krapf, *Dictionary of the Suahili Language* (London, 1882); Büttner, *Wörterbuch der Suahelisprache* (Berlin, 1890); Seidel, *Grammatik der Suahelisprache* (Vienna, 1891); Steere, *Handbook of the Swahili Language* (4th ed., London, 1894); Madan, *English-Swahili Dictionary* (Oxford, 1894); Delaunay, *Grammaire Kiswahili* (Paris, 1898).

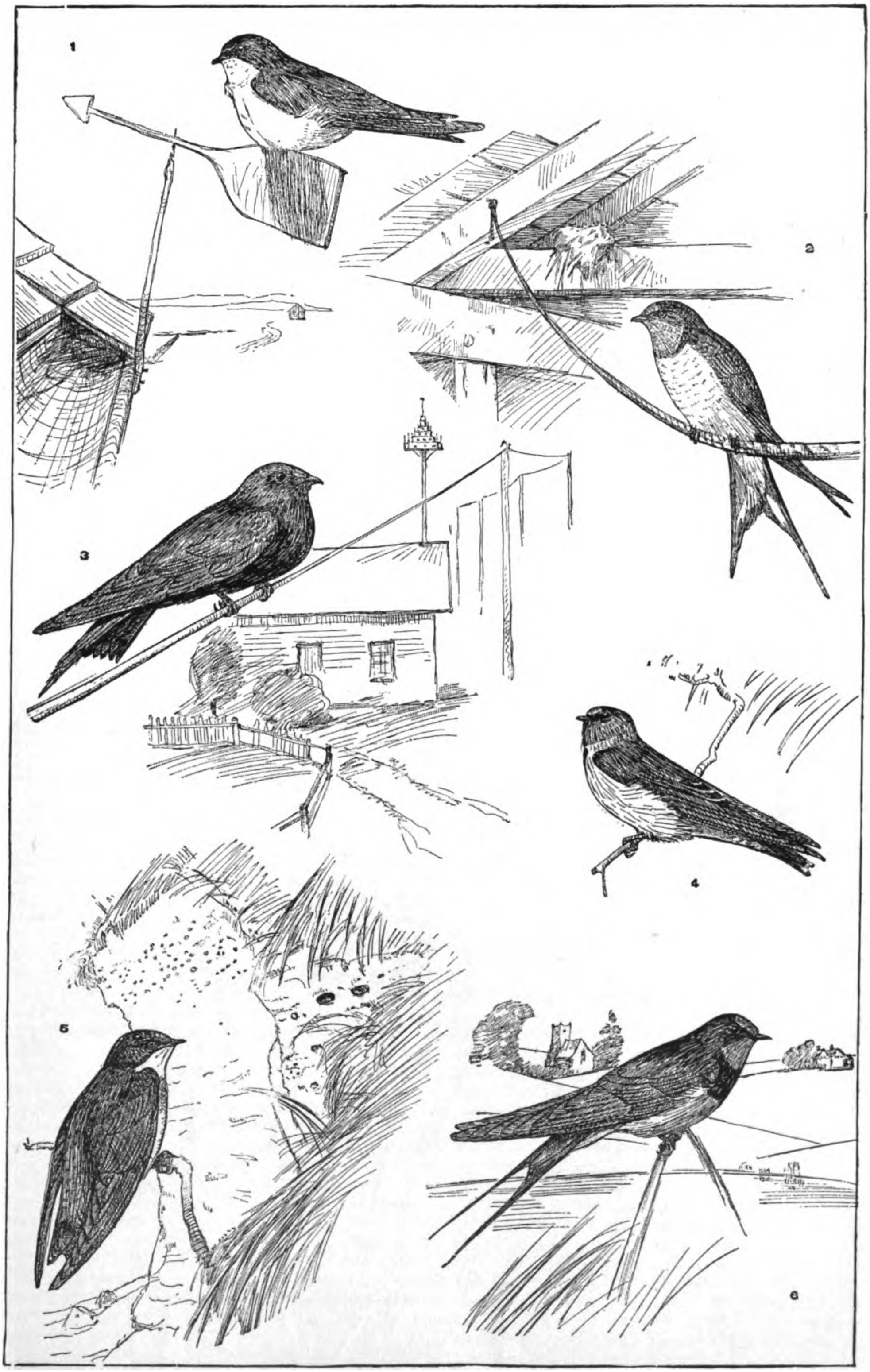
SWAIN, George Fillmore (1857–). An American civil engineer. He was born at San Francisco and was educated at the Massachusetts Institute of Technology, where he graduated in 1877. He then studied three years in the government engineering school at Berlin, Germany. Upon his return he settled in Boston, where he served as professor of civil engineering at the Institute of Technology from 1887 to 1909 and after 1887 as consulting engineer to the Massachusetts Railroad Commission. He was also made a member in 1894 and chairman in 1913 of the Boston Transit Commission. After 1909 he was professor of civil engineering at the Harvard Graduate School of Applied Science. Swain was president of the American Society of Civil Engineers in 1913. His most important publication is a "Report on the Water Power of the Atlantic Watershed" (vol. xvii of *Tenth United States Census*). He wrote also *Conservation of Water by Storage* (1915).

SWAIN, Joseph (1857–). An American educator, born at Pendleton, Ind. He graduated at Indiana University in 1883, studied in the University of Edinburgh and with the Astronomer Royal of Scotland in 1885–86, was professor of mathematics in his alma mater from 1886 till 1891, and in the latter year was called as professor of mathematics to Leland Stanford Junior University. Two years afterward he returned to Indiana University as president and remained in that position until 1902, when he accepted the presidency of Swarthmore College in Pennsylvania. Dr. Swain served as president of the National Education Association in 1913–14.

SWAIN'SON, William (1789–1855). An English naturalist, born in Liverpool. He traveled in South America and on his return to England began the publication of works on natural history. In 1841 he emigrated to New Zealand, where he became Attorney-General. Important among his works are: *Zoölogical Illustrations* (1820); *Exotic Conchology* (1821–22; 2d ed., 1841); *Ornithological Drawings* (1834–41); *Birds of Western Africa* (1837); *The Naturalist's Guide, etc.* (1840).

SWALLOW (AS. *swalewe*, Ger. *Schwalbe*, swallow). A passerine bird of the family Hirundinidæ, a family represented by many similar species in almost all parts of the world. The

FAMILIAR SWALLOWS



1. **WHITE-BELLIED or TREE SWALLOW** (Iridoprocne bicolor).
2. **BARN SWALLOW** (Chelidon erythrogaster).
3. **PURPLE MARTIN** (Progne subis).
4. **CLIFF or EAVES SWALLOW** (Petrochelidon lunifrons).
5. **BANK SWALLOW or SAND MARTIN** (Riparia riparia).
6. **ENGLISH HOUSE SWALLOW** (Chelidon rustica).

birds prey on insects, catching them in the air. They have remarkable powers of flight, now soaring very high, now skimming near the earth, and wheeling rapidly. The bill is short and weak, broad at the base, and deeply cleft, so that the gape is wide; the wings are long, pointed, and more or less sickle-shaped when expanded, and have only nine primaries; the legs are short and weak. The tail is generally forked, and the plumage is close and glossy. The family is perhaps the most sharply defined and easily recognized of all in the order. The species are about 80, widely diffused, found in all countries except near the poles. In the colder parts of the world they are summer birds of passage, migrating to warmer regions when winter approaches. Only eight species of swallow occur in North America, and all but one of these winter south of the United States, though in summer they range to the Arctic. The largest species is the purple martin; the smallest the bank swallow (q.v.). Perhaps the commonest of North American swallows is the barn swallow (q.v.). Another swallow numerous about farmyards and barns is the cliff or eaves swallow (*Petrochelidon lunifrons*), whose nest is the remarkable flask-shaped structure of pellets of mud often seen attached in rows to the outside walls of barns, near the eaves. Formerly, as in the case of other swallows (see BARN SWALLOW), this species bred in rocky places and placed its nests in large companies against the faces of cliffs.

A large and handsome swallow common throughout North America is the white-bellied or tree swallow (*Tachycineta*, or more correctly *Iridoprocne, bicolor*), steel blue or green above and pure white beneath. Of the same genus is the exquisite little violet-green swallow (*Tachycineta thallasina*) of the western United States, less than 5 inches long; its upper parts are velvety green and violet purple, while the under parts are pure white. The rough-winged swallow (q.v.) completes the list. South America has a large series of swallows similar to those of the United States, and especially of that group of which the tree and violet-green swallows are a type. Some naturally breed in holes of rocks, others in hollow trees, or form nests of mud, straw, and feathers in some similar situation; but nearly all abandon wild ways as the country is settled and place their abodes near buildings. In Great Britain *Hirundo rustica*, the common or chimney swallow (to be distinguished from the American chimney swift, q.v.), is much like the barn swallow and makes a similar nest, usually placed under a shed roof, in a half-ruined building, or often in a chimney. The geographical range of this species extends over a great part of Europe, Asia, and Africa. The window swallow, or house martin (*Hirundo urbica*), is another very common European species, glossy black above, white below and on the rump, the feet covered with short downy white feathers, which is not the case in the chimney swallow. The swallows, because of their insectivorous diet, are of considerable economic value. Flies, mosquitoes, and gnats, as well as many insects injurious to crops, form the bulk of their food. The barn swallow is of particular service about fields of grass, where it destroys the moths of some of the smaller cutworms as they fly low over the grass.

Consult Sharpe and Wyatt, *Monograph of the Hirundinidæ, or Family of Swallows* (London, 1885–94), containing a description, with colored plates, of all the species of the world and a full bibliography, and general ornithologies; also Forbush, *Useful Birds and their Protection*, published by the Massachusetts Board of Agriculture (Boston, 1913).

SWALLOWTAIL. Any member of a family of large butterflies, Papilionidæ, with tail-like prolongations of the hind wings. Black, yellow, blue, and green are the prevailing colors. About 35 species occur in the United States. South America is most rich in these butterflies. About 850 species have been described in all. The larvæ of the swallowtails possess a curious process on the thorax called an osmaterium, which is usually retracted, but may be thrust forth at will. It is a Y-shaped process and contains a scent gland which emits a strong odor when the organ is thrust out. The pupa is placed with the head upward, fastened by the tail to the supporting object, and is kept in place by a silk band around the middle of the body. (See BUTTERFLIES AND MOTHS, and Colored Plate therewith, Fig. 5.) In certain species the males and females differ so much both in form and coloration that they might easily be mistaken for distinct species. In New Guinea there occurs a swallow-tailed butterfly (*Ornithoptera paradisea*) the female of which is black, white, and gray, and the male is gold and green, with very long tails on the hind wings. The males of another species of the same genus are numerous and the female is rare; the proportion is said to be about 1000 to 15. Not only does the female show sexual dimorphism, but even considerable seasonal dimorphism. The tiger swallowtail (*Jasoniades glaucus*) is a North American species which shows a striking sexual dimorphism in a portion of its range. The form now known as *Turnus* is straw-colored above, banded and marked with black. In the South and West black forms of the female sex occur and belong to the so-called *glaucus* form. The caterpillar of these two forms is dark green with two purple eyespots, one on each side of the third thoracic segment, which are bordered with black, yellow, and black again in turn. When not feeding, this caterpillar rests on a bed of silk spun on a leaf. The zebra swallowtail (*Iphiclides ajax*) presents one of the most striking cases of seasonal dimorphism known among butterflies, so that until the life history of this form was known three different species had been described from it. There are several broods a season, and the last brood winters in the chrysalis stage. The butterflies that appear in the early spring are known as the *marcellus* form and those that appear later in the spring as the *telamonides* form. The latter are larger butterflies with longer tails and more white than the *marcellus* form. (See Colored Plate of AMERICAN BUTTERFLIES.) All the late spring broods produce a third form which is still larger and with longer tails. This summer brood is known as the *ajax* form. See illustration at SKIPPER.

SWALLOW THORN, or SEA BUCKTHORN (*Hippophaë*). A genus of shrubs of the family Elæagnaceæ, natives of Europe. The commonest species (*Hippophaë rhamnoides*) is a spiny shrub often planted for ornament in sandy soil, especially near the sea. It is valued for its silvery leaves and yellow, acid, one-seeded berries, which, besides being attractive, are useful for sauces and jellies.

SWALLOWWORT. See ASCLEPIAS.

SWAMMERDAM, swäm′mĕr-däm, JAN

(1637–80). A Dutch naturalist, born in Amsterdam. He studied medicine at Leyden, but devoted most of his life to the study of insects and other animals. He was a skilled dissector of small animals and was the father of the scientific study of the morphology and metamorphosis of insects. He first made a natural classification of insects by distinguishing between those which have a complete metamorphosis and those which have not. He wrote: *Tractatus de Respiratione usuque Pulmonum* (1667); *Allgemeene verhandeling van bloedeloose diertjes* (1669); *Biblia Naturæ, sive Historia Insectorum in Certas Classes Redacta* (ed. Boerhaave, 1737–38).

SWAMP (AS. *swam*, swamp, MHG. *swam*, *swamp*, Ger. *Schwamm*, sponge). An area of wet ground usually covered with certain coarse grasses, trees, and other plants peculiar to such land. Drainage seems to be the principal controlling factor in producing typically different swamps. In undrained swamps acids and other products of plant decay, together with various root excretions, accumulate, while the soil is relatively cold and poorly oxygenated; hence conditions are relatively unfavorable for plant growth, and many xerophytes (q.v.) are found in such places. River swamps, being comparatively well drained, afford some favorable habitats and are dominated by hydrophytes (q.v.). Swamps abounding in xerophytic plants are peat bogs or moors and salt marshes. In the latter many of the plants are succulents, while the coarse grasses resemble those of the prairies. (See Halophytes.) In mangrove swamps xerophytic leaf structures, kneelike processes from the roots, supposed to be of advantage in aëration and vivipary (q.v.), are among the most interesting features. Cypress swamps of the southern United States show many similar phenomena. (See Cypress.) All swamp plant associations may be considered as ephemeral, the areas becoming grassland or forest with the development of the drainage. Consult Eugenius Warming, *Œcology of Plants* (new ed., Oxford, 1909).

SWAMP DEER, or Barasingha. A deer of northern India, of rather large size, with smooth and somewhat flattened antlers, with a prominent brow tine and sometimes 16 to 20 points. It is a grazer, keeps in the outskirts of the woods, and on grassy lands and in winter gathers into small bands. Its scientific name is *Cervus duvauceli*. Consult R. Lydekker, *Deer of All Lands* (London, 1898), and id., *The Game Animals of India, Burma, Malaya, and Tibet* (ib., 1907).

SWAMP HARE, or Swamp Rabbit. A hare of the swamps of the lower Mississippi valley (*Lepus aquaticus*), 24 inches long, finely mottled above with buff, rufous, and black, and more buffy than the cottontail; belly and underside of tail pure white. Its habits are little known. Cf. Marsh Hare.

SWAMP HONEYSUCKLE. See Honeysuckle.

SWAMP OAK. See Casuarina.

SWAMP'SCOTT. A town in Essex Co., Mass., adjoining Lynn and 13 miles from Boston, on Massachusetts Bay, and on the Boston and Maine Railroad (Map: Massachusetts, F 3). It is attractively situated and is known as a summer resort. There are two parks and a public library. The Phillips School is the most prominent building along the shore. Fishing is of some importance, but the community is engaged largely in the industries of Lynn (q.v.). The town includes several villages. Pop., 1900, 4548; 1910, 6204; 1915 (State census), 7345.

SWAMP WARBLER. A large genus (*Helminthophila*, or more correctly *Vermivora*) of American warblers (q.v.), so called because of their fondness for low, swampy places. They are small, trim, insect-catching migratory birds prevailingly gray or green and yellow in color, and most of them breed north of the United States and winter in the tropics. A good example is the goldenwing (*Vermivora chrysoptera*), which is gray on the upper parts and white below, with the throat and auricular region black, and a conspicuous yellow patch on the wing.

GOLDENWING.

SWAN (AS., OHG. *swan*, Ger. *Schwan*, swan; probably connected with Lat. *sonus*, sound, Skt. *svan*, to resound). A water bird of the duck family, the seven species of which constitute the subfamily Cygninæ. To six of these, English ornithologists give the generic name *Cygnus*, while the Americans call them *Olor*. Swans are larger in body than geese and are recognizable by their long arched necks, enabling them to reach food on the bottom of streams and shallow ponds without diving. They nest mostly in high latitudes, constructing on the ground a rude receptacle of rushes and the like for the half a dozen greenish eggs. They feed chiefly on vegetable substances, as the seeds and roots of aquatic plants, but also on fish spawn, of which they are great destroyers. They hiss like geese and strike with their wings in attack or defense.

The typical and most familiar example of the tribe is the tame or mute swan (*Cygnus*, or *Olor*, *olor*), which is about 5 feet in entire length and weighs about 30 pounds. It is known to live for at least 50 years. The male is larger than the female. The adults of both sexes are pure white, with a reddish bill; the young (cygnets) have a dark bluish-gray plumage and lead-colored bill, surmounted by a black knob at the base of the upper mandible, and with a black nail. (See Colored Plate of Water Birds.) In its wild state this species is found in eastern Europe and in Asia; in a half-domesticated state it has long been a common ornament of ponds, lakes, and rivers. It has a soft low voice, plaintive, and with little variety, heard chiefly when it is moving about with its young.

Swans, according to the law of England, are birds royal; those actually kept by the crown had a mark, and the King's swanherd once was an important person. The royal swans of the Thames are so marked to this day by notches and lines cut upon the beak, and the process of collecting and marking them annually is called upping. Other Old World swans are the whooping swan, Bewick's swan, and the aberrant black swan (*Chenopis atrata*) of southern and western Australia and Tasmania, which is comparatively small and deep black except the white wing quills and the red bill.

The North American swans are three in number. The most common species (*Olor*, or *Cygnus*, *columbianus*) breeds in the Far North and is seen in the United States only on its migrations, which extend to the Gulf of Mexico, and it is very rare east of the Alleghanies. The trumpeter swan (*Olor*, or *Cygnus*, *buccinator*), noted for its sonorous cry, breeds from Iowa and Dakota northward and winters southward to the Gulf. It is one of the largest species, measuring 5½ feet in length. It is extremely rare and apparently on the point of extinction. The black-necked swan is a South American species. Consult C. W. Beebe, "The Swans," in *Tenth Annual Report of the New York Zoological Society* (New York, 1906). See DUCK.

SWAN, JOHN MACALLAN (1847–1910). An eminent English painter and sculptor. He was born at Old Brentford, studied at the Lambeth and Royal Academy schools, London, and in Paris with Gérôme and Frémiet, and was influenced by Barye. In 1889 an oil painting, "The Prodigal Son" (Tate Gallery), established his reputation. His sculptured works—in nearly every material—are usually studies of the feline family, and his modeling is broad, flexible, and realistic. "The Jaguar," "Puma and Macaw" (1900), "Wounded Leopard," and "Leopard Running" (1899), are especially important. His subjects in oil include animals, figures, and landscapes and are distinguished by massive, simple treatment and a strongly imaginative element, the color low in tone and well modulated. Notable paintings are: "Ocelot and Fish"; "Tigers"; "Tigers Drinking" (Henry Frick, New York); "Ceylon Leopards" (National Gallery, New South Wales); "Puma and Macaw" (George J. Gould, New York); "Panthers Resting" (Tate Gallery). Swan was elected to the Royal Academy in 1905 and received numerous honors, including gold medals at Munich and Paris (1900). Consult Baldry, *J. M. Swan, R.A.* (New York, 1905).

SWAN, SIR JOSEPH WILSON (1828–1914). An English inventor, born at Sunderland and there educated. He made several inventions of great value, among them the carbon photographic process called autotype, a miner's electric safety lamp, improvements in electro metallurgical deposition, but most notable of all an incandescent electric lamp. In 1879 he exhibited a lamp with a filament of carbon in a vacuum bulb and followed this by various improvements. These inventions brought him many honors, including a fellowship in the Royal Society and knighthood (1904).

SWAN, KNIGHT OF THE. A very old and popular myth found in French, German, and English mediæval romances, first mentioned by William of Tyre about 1180. Helias, Knight of the Swan, is one of eight children of Oriant of Lilefort. Seven are changed to swans, one drawing the hero in a boat to become champion for Clarissa of Bouillon, the ancestor of Godfrey, thus connecting the story with the Crusades. After marriage the knight departs when his wife breaks the taboo on his name, a Grail feature common to all variants, as *Lohengrin*, showing its partly Celtic origin. The scene is generally on the lower Rhine, connecting it with the dukes of Brabant and Cleves, whose symbol was a swan. Consult W. W. Newell, *Legend of the Holy Grail* (Cambridge, Mass., 1902), and R. Jaffray, *Two Knights of the Swan* (New York, 1910). See CHEVALIER AU CYGNE.

SWAN, ORDER OF THE. A religious association of princes and nobles formed in 1440 by Elector Frederick II of Brandenburg for benevolent purposes. It was extinguished during the Reformation, but was renewed in 1843 by Frederick William IV of Prussia as an association, open to men and women of all creeds, for the amelioration of physical and moral ills.

SWANMOTE, swŏn′mōt. See FOREST LAWS.

SWAN PAN. A Chinese calculating device. See CALCULATING MACHINES.

SWAN RIVER. A small river of Western Australia entering the Indian Ocean at Fremantle, 12 miles below Perth. It is navigable to vessels of light draft. On its banks the first British emigrants landed and founded in 1829 the Swan River Colony, which formed the nucleus of the State of Western Australia.

SWANS. See SUANITIANS.

SWANSEA, swŏn′sĭ. A seaport in Glamorganshire, South Wales, at the mouth of the Tawe, 60 miles west-northwest of Bristol (Map: Wales, B 5). Swansea is the chief seat of the tin-plate trade of England and one of the most important copper smelting and refining centres in the world. The vast resources of the surrounding coal field began to be exploited about 1830, and since that time the progress of Swansea has made it next to Cardiff the most important town in South Wales. The principal edifices, for the most part of modern construction, comprise a guildhall with the crown and law courts and municipal offices, the Royal Institution of South Wales, the grammar school founded in 1682, a good public hall, and a spacious and well-arranged infirmary. The harbor is formed by piers of masonry projecting from either side of the mouth of the Tawe into Swansea Bay, a wide inlet of the Bristol Channel. The total tonnage entered and cleared, excluding coastwise vessels, was 4,902,000 in 1913. In the immediate vicinity are smelting works, in which many thousands of tons of copper ores, silver ores, and zinc ores are smelted annually. The total amount of coal exported from Swansea in 1913 amounted to 4,451,597 tons, valued at $15,734,070. Swansea owes its origin to a castle erected in 1099. In 1260 the castle was burned down. It was twice rebuilt, but was finally dismantled by the Parliamentarians in 1647 and is now an interesting ruin. Pop., 1901, 94,514; 1911, 114,663.

SWANSON, swŏn′son, CLAUDE AUGUSTUS (1862–). An American lawyer and legislator, born at Swansonville, Va. He was educated at Randolph-Macon College (A.B., 1885) and, in law, at the University of Virginia. He afterward practiced law at Chatham. A Democrat, he served as a member of Congress from 1893, resigning in 1906 after being elected Governor of Virginia. His four-year term in this office was generally regarded as able. In 1910 he was appointed to fill an unexpired term as United States Senator, and the next year he was elected for a full term. He was considered a conservative in politics, but supported President Wilson. He was chairman of Committee on Public Grounds and Buildings after 1913.

SWANTON, swŏn′ton, JOHN REED (1873–). An American ethnologist, born at Gardiner, Me. He was educated at Harvard (A.B., 1896; Ph.D., 1900) and studied also at Columbia from 1898 to 1900. Thenceforth he was connected with the Bureau of American Ethnology, Washington, D. C. In 1909 he served as president of the Folk Lore Society and in 1910 became an associate editor of the *American Anthropologist*. His publications include: *Contributions to the Ethnology of the Haida* (1905); *Haida Texts and Myths* (1905); *Haida Texts—Masset Dialect* (1908); *Tlingit Myths and Texts*

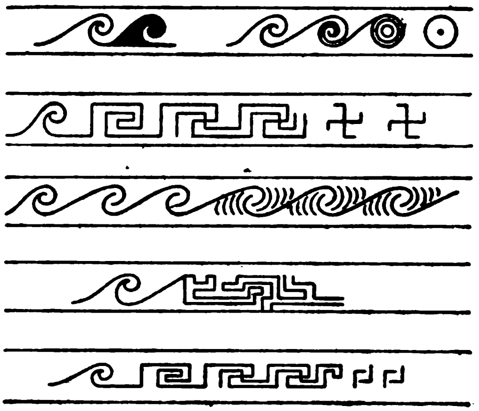
(1909); *Indian Tribes of the Lower Mississippi Valley and Adjacent Coast of the Gulf of Mexico* (1911).

SWANWICK, swŏn′ĭk, Anna (1813–99). An English author and feminist, born in Liverpool. In Berlin she studied German, Greek, and Hebrew, and after settling in London took up mathematics also. Her volumes of translations appeared as *Selections from the Dramas of Goethe and Schiller* (1843); *Faust, Tasso, Iphigenie, and Egmont* (1850); complete translation of Æschylus (1873); *Faust* (1878). Both in the case of Goethe and of Æschylus, her translations still remain of the best. She also assisted in the founding of Girton College and Somerville Hall, Cambridge; advocated the study of English literature in the universities; and signed John Stuart Mill's petition to Parliament for the political enfranchisement of women. To the feminism of her time her career was notably stimulating. Besides her translations, Miss Swanwick published several books of her own writing. Consult Mary L. Bruce, *Anna Swanwick* (London, 1903).

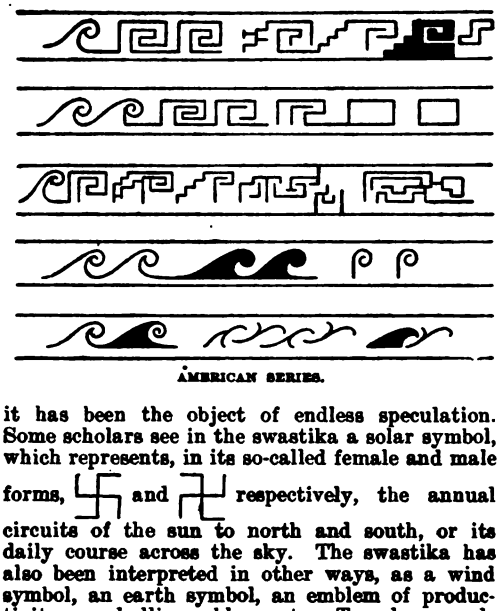
SWARTHMORE (swạrth′mōr) **COLLEGE.** A coeducational institution for higher education founded in 1864 by members of the Society of Friends of Swarthmore, Pennsylvania. Until 1903 the college conferred the degrees of Bachelor of Letters and Bachelor of Science. In that year degrees of Bachelor of Arts and Bachelor of Science in engineering were made the only ones given. In 1912 the degree of Bachelor of Science was abolished and since that time the degree of Bachelor of Arts is the degree conferred in all departments. The work is partially elective. The degree of Master of Arts and the degrees of civil, mechanical, and electrical engineers are given for advanced work. In 1915 there were 445 students in all departments with 44 acting instructors and 5 emeritus professors. The college library contained 26,000 volumes. The productive funds amount to $1,600,000, and the annual income to about $168,000. The total value of the college property is $1,800,000. During 1915 two swimming pools, one for the women and one for the men, were added to the gymnasium building. In the same year the Sproul Astronomical Observatory was finished. The equipment of this includes a telescope with an equatorial refractor of 24″ aperture and 36′ focal length. The president in 1915 was Joseph Swain, M.S., LL.D.

SWAS′TIKA (Skt. *svastika*, of good fortune). A fylfot or four-foot cross, a monogrammatic sign having four branches, of which the ends are bent, generally at right angles, thus 卐 or 卍. In one form or another it has been used as a symbol of welfare from a very early time. The sign appears in a variety of modifications, often connected in a continuous scroll, of which there are two types, the European and Asiatic, and the American, as illustrated by the diagrams.

Though the swastika has been found in Europe, Asia, and America, it seems to have been unknown to Oceania; at least up to 1916 no examples had been found there. There is, furthermore, no evidence to show that it was current as a native symbol in Egypt, Babylonia, Assyria, Phœnicia, or (till a late period) in Persia. It was adopted as a sacred symbol by both Jainism (q.v.) and Buddhism (q.v.) and its presence in China, Japan, and Tibet can easily be explained as due to the latter religion. The swastika is first mentioned in India by Panini (q.v.) in the fourth century B.C., and appears to have been a simple cross, as in crossed arms. Many of the swastikas found at Hissarlik (ancient Troy) were probably not true swastikas. They are not found before the third city. Its original significance is unknown, but it has been the object of endless speculation. Some scholars see in the swastika a solar symbol, which represents, in its so-called female and male forms, 卐 and 卍 respectively, the annual circuits of the sun to north and south, or its daily course across the sky. The swastika has also been interpreted in other ways, as a wind symbol, an earth symbol, an emblem of productivity, a phallic emblem, etc. Temple regards it as in origin merely decorative, and suggests that the running design may have been taken from a coil of string. In the opinion of d'Alviella, who calls it, from its shape, gammadion, the swastika was chiefly talismanic. It has been derived by some from the cross; by others, from the circle; it has also been regarded as an evolution from the lotus-petal in architecture; and as a mystic design it has been associated with fire and with water. The sun and fecundity are its most probable sources, if it had any meaning beyond that of an ornament becoming a mystic sign. The swastika appeared first in the Bronze age, and occurs in the Swiss



EUROPEAN AND ASIATIC SERIES.



AMERICAN SERIES.

lake dwellings, but, according to the discoveries of Chantre, it seems to have originated in the region of the Caucasus. In the historic period it is found in Japan, Korea, China, Tibet, Armenia, Asia Minor, Greece and its islands (especially Cyprus and Rhodes), Italy, France, Germany, Russia, Scandinavia, Great Britain (perhaps only under Scandinavian influence), North America (in the mounds of Ohio, Tennessee, Mississippi, Alaska), Mexico, and South America (e.g., Brazil). In assigning its original home, it must be remembered that no case of Oriental swastikas precedes the period of Greek influence in India. It seems probable that d'Alviella may be right in ascribing an eastern emigration from a western centre, if not from Troy itself. It is said that there is in Tibet a sect of rationalists called Swastikas, but this is probably an error, and the sect meant is that of the Jains.

Consult: R. C. Temple, *Journal of the Anthropological Society of Bombay*, vol. i (Bombay, 1886); Eugène Goblet d'Alviella, in *La migration des symboles* (Paris, 1891); also Thomas Wilson, "The Swastika, the Earliest Known Symbol, and its Migrations," in United States National Museum, *Annual Report, 1894* (Washington, 1895); Léon de Milloué, "Le Svastika," in *Annales du Musée Guimet*, vol. xxxi (Paris, 1909).

SWATOW, swä'tou' (a local corruption of Chinese *Shan-t'ow*, fish-trap head). A treaty port in the Province of Kwangtung, southeast China, situated on the left bank of the river Han near its mouth (Map: China, L 7). It was opened to foreign residence and trade by the treaty of Tientsin (1858), and the British and United States consuls were appointed in 1860. The foreign community is small and isolated, partly in the vicinity of the native town and partly on the hilly ground on the opposite side of the river. Sugar making is the chief industry of the region served by Swatow. Sugar is the heaviest export, and bean cake from Niuchwang, for use as manure in the sugar fields, is one of the heaviest imports of native products. There are several large sugar refineries here, and a steam flour mill. Other products are tea, grass cloth, indigo, vegetable oils, paper, tobacco, joss sticks, joss paper, etc. Pop., 1910, 66,000. In 1912, foreign and Chinese imports amounted to 41,209,329 Hk. taels, and exports to 16,181,795 taels (Hk. tael = $0.728).

SWATS, swäts. A people of the Indo-Afghan frontier, constituting a branch of the Yufufzais, who belong by race and language to the Ayran stock. Their country, called Swat, traversed by a river of the same name, an affluent of the Kabul, is included in the Northwest Frontier Province of India. After having been nearly exterminated at the end of the sixteenth century, the Swats came under the religious dominance of Abdul Ghafur (1794–1877), who was practically their ruler during his last years. Fanatical Mahommedans, the Swats gave the British government much trouble in 1895 and 1897. See AFGHANISTAN; AKHUND OF SWAT.

SWAZILAND, swä'ze-länd. A British protectorate in South Africa (Map: Cape of Good Hope, K 6). The area is stated at 6536 square miles. The country consists of three distinct regions: a mountainous region in the west reaching an altitude of over 4000 feet; the Middle Veld, about 2000 feet lower; and the Low Veld, having an average altitude of about 1000 feet and bounded on the east by Lebombo Mountains. The first two regions are well watered and healthful, and adapted for agriculture and grazing. The natives raise insufficient crops of corn, millet, sweet potatoes, groundnuts, etc. The estimated number of cattle in 1914 was 73,000, and of native sheep and goats 170,000. Upward of 150,000 merino sheep are brought in annually from the High Veld for winter grazing. Gold and tin are worked at several localities; in 1913–14 the output of tin amounted to 493 tons, valued at £51,220, and of gold, 11,325 ounces, £48,105. Since 1910 the country has been treated for customs purposes as a part of the Union of South Africa. By an Anglo-Boer convention of 1894 Swaziland was placed under the administration of the South African Republic. Administration passed to the Governor of the Transvaal in 1903 and to the High Commissioner for South Africa in 1906. The laws of the Transvaal were extended to Swaziland; except where modified by statute, the Roman-Dutch law is in force. In 1907 the paramount chief and other chiefs were confirmed in their civil jurisdiction over natives, subject to appeal to a British resident commissioner. British headquarters are at Mbabane; this and Bremersdorp, the old capital, are the only European villages. The Swazis are an intelligent tribe akin to the Zulus; in 1911 they numbered 98,733. Population as returned by censuses of 1904 and 1911 respectively: European 890 and 1083; other, 84,601 and 98,876; total, 85,491 and 99,959. Estimated total in 1914, 107,117.

SWEARING, PROFANE. See BLASPHEMY.

SWEAT (AS. *swāt*, Ger. *Schweiss*, sweat; connected with Lat. *sudor*, Gk. *ἱδρώς*, *hidrōs*, sweat). The fluid excreted through the pores of the skin; perspiration. The nature, composition, and uses of this fluid in the normal state have been noticed in the article on SKIN (q.v.). Sweat is diminished in amount in many febrile diseases, especially if the temperature is high and fever prolonged. Anhidrosis, as this condition is called, accompanies diseases in which there is a profuse discharge of fluid from the kidneys, as in diabetes, or from the bowels or stomach. In anasarca or general œdema and myxœdema sweat is diminished from stretching of the skin. Certain drugs, as belladonna and strychnine, markedly diminish the amount of sweat; others, notably pilocarpine, increase it. Profuse sweating (hyperhidrosis) occurs in acute rheumatism, Asiatic cholera, and certain adynamic fevers, the sweating stage of malaria, the advanced stages of pulmonary phthisis, and septicæmia. Certain ailments are characterized by localized sweats: the hands and feet in conditions of general debility; the head in rickets; and unilateral or one-sided sweating of the head or face or body in some nervous diseases, or from pressure on the sympathetic nerves by thoracic aneurysm. The composition and color of the sweat may rarely undergo remarkable alterations. When through disease the action of the kidneys has become impaired the sweat has sometimes a urinous odor and deposits white scales or urinary solids upon the skin. This is known as uridrosis. Bromidrosis is an affection of the sweat glands characterized by offensive-smelling perspiration. Hæmatidrosis (bloody sweat) is a rare phenomen in which blood exudes from the sweat pores. It is seen in young, hysterical women, and has been observed on the face, hands and feet, ears and umbilicus. Chromidrosis or colored sweat may arise from various causes. The secretion may be red owing to the action of *Bacillus prodigiosus;* in copper workers the perspiration is frequently green in color; in idiopathic chromidrosis the secretion is black or sepia colored.

SWEATING SICKNESS. An extremely fatal epidemic disease which prevailed in Europe, and especially England, during the fifteenth, sixteenth, and part of the seventeenth centuries. From the fact that the English people both at home and abroad were chiefly attacked, the malady was known as the English sweat or English ephemera. It first appeared in August, 1485, in the army of Henry VII, shortly after his arrival in Wales from France to fight the battle of Bosworth, and in a few weeks it had spread to London. It was a violent inflammatory fever, attacking as a rule robust, vigorous men, and characterized by a short chill, painful oppression over the epigastrium, headache, stupor, and a profuse fetid sweat. The disease took its course in about 24 hours. The patient suffered profound prostration and intense internal fever, but refrigerants seemed only to do harm. This epidemic lasted about a month, but during this short period many thousands died. The disease returned to England in 1506, 1517, 1528, and 1551. The epidemic of 1528 was particularly severe and was long referred to as "the great mortality." It raged throughout Europe. In Hanover alone 8000 persons died. After 1551 no further epidemic occurred until the beginning of the eighteenth century. The disease is nearly always prevalent in some part of the world, most frequently in France (Picardy) and Italy, under the more modern name of miliary fever. (See Miliaria.) An epidemic occurred in France in 1906, through transmission by rats or field mice and their fleas. A year before this there was a small epidemic of 126 cases in Austria. In Germany it is still known as the English sweat. As now observed, the disease is characterized by fever, profuse sweats, and an eruption of miliary vesicles. As in influenza a large number of people are attacked, but the epidemic soon passes and the mortality is not high. Consult: J. F. K. Hecker, *Epidemics of the Middle Ages* (Eng. trans. by B. G. Babington, published by the Sydenham Society, 3d ed., London, 1859); August Hirsch, *Handbook of Geographical and Historical Pathology* (Eng. trans. from 2d Ger. ed. by Charles Creighton, published by the New Sydenham Society, 3 vols., ib., 1883–86); Charles Creighton, *History of Epidemics in Britain* (ib., 1891); William Osler, *Modern Medicine* (Philadelphia, 1914).

SWEATING SYSTEM. The practice pursued by certain manufacturers, particularly of clothing, of giving out piece work to individuals on which the work is to be done at home and at starvation wages. The system is a survival of the household form of industry that still exists in certain trades in large cities. The term sweater was used first by journeymen tailors in London, who worked long hours. As more work was given out, the home worker employed his family and outsiders, and thus a system of subcontract developed in which the middleman was called the sweater. Evils of the sweatshop are long hours—10 to 18 hours a day, including Sunday; overcrowding in shops and surrounding tenements; unsanitary conditions in work rooms and tenement houses, lacking in light, air, and cleanliness; child labor, young girls and boys often running the machines; disease and deformity brought on by confinement and dust; irregularity of work; and poor pay. The chief causes of the sweating system are (1) the excessive supply of unskilled labor; (2) an economic advantage to large dealers, in having their work done in small shops, thereby saving rent and evading factory laws, in cheap labor, in the inability of isolated workers to combine, and in the irregularity of work; (3) finally, the irresponsibility of employers, and public indifference.

Among proposed remedies may be mentioned (1) stringent legislation, backed by public opinion, to force these kinds of work into large shops and factories; (2) coöperative production; (3) trade unions for unskilled workers; (4) public workshops; (5) restriction of foreign immigration; (6) an eight-hour day; (7) consumers' league. Factory laws of Ohio, Massachusetts, Illinois, and New York require licenses, or permits, describing rooms in which it is proper for work to be done. See Consumers' League; Factories and the Factory System; Factory Inspection; Labor Problems.

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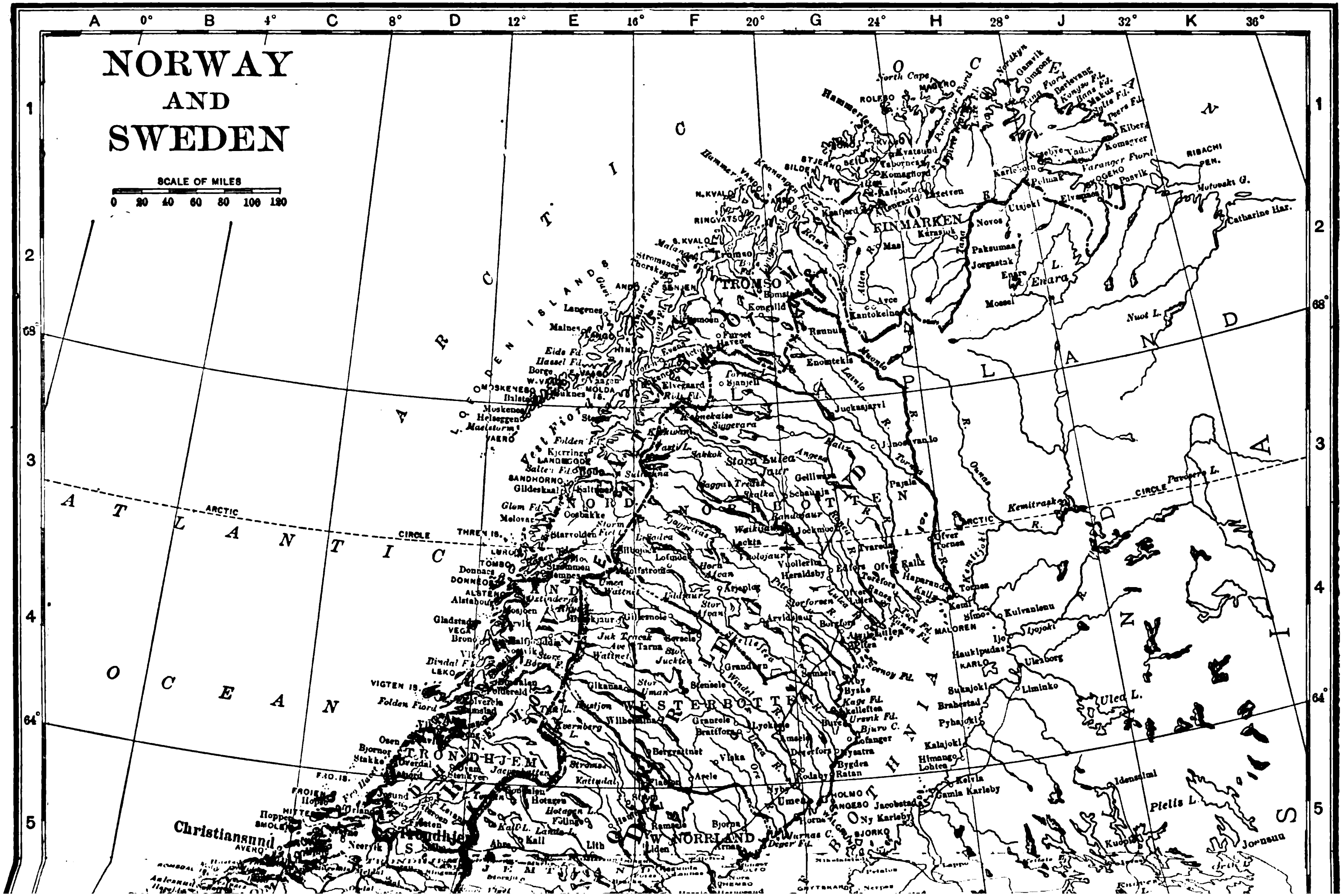
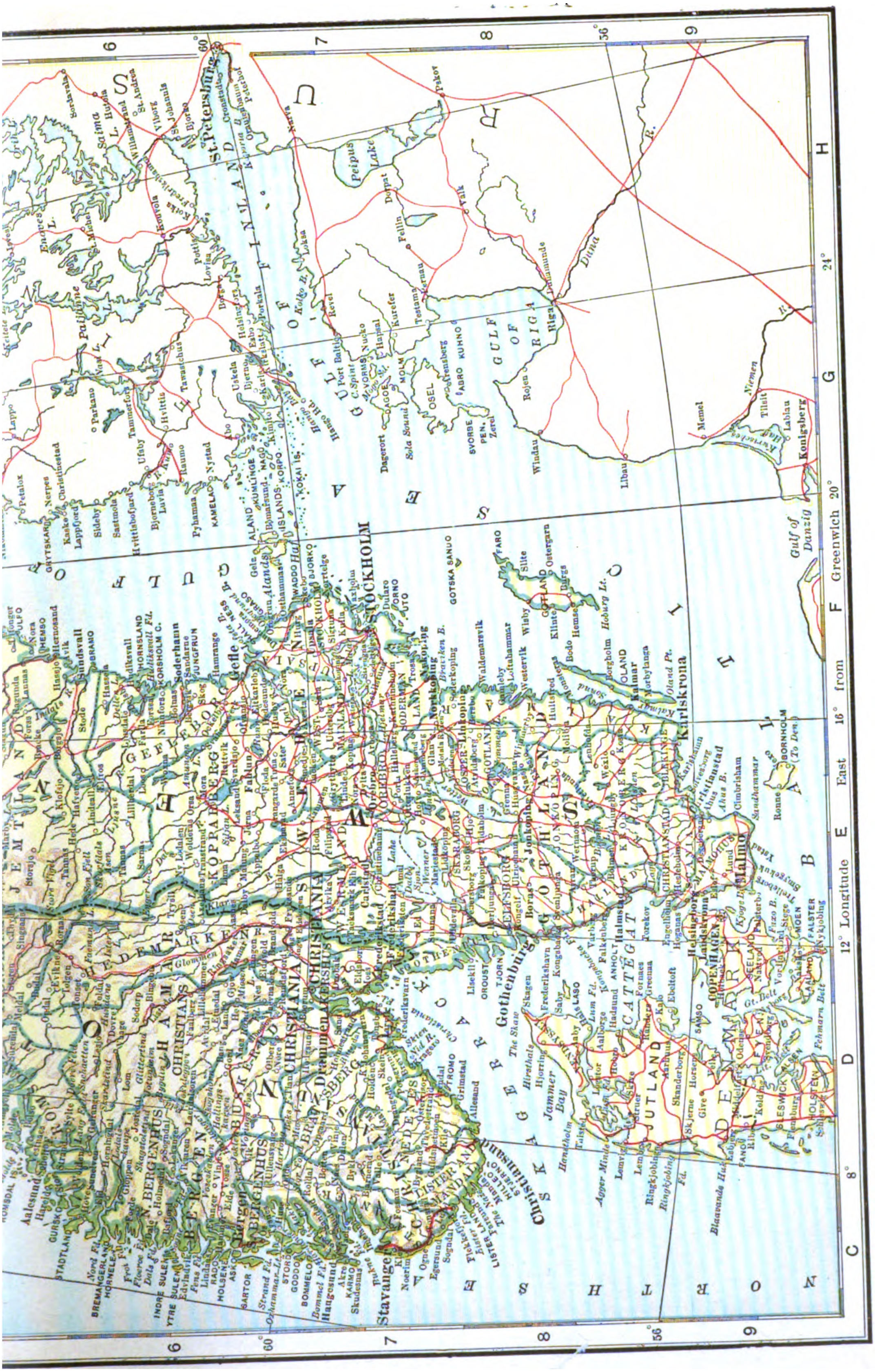
SWEATMAN, swĕt′man, Arthur (1834–1909). A Canadian Anglican archbishop. He was born in London, England, was educated at Christ's College, Cambridge, and, after his ordination as a priest of the Church of England, was successively curate at Islington and Canonbury. Going to Canada in 1865, he became in the same year headmaster of Hellmuth Boys' College, London, and in 1871 mathematical master in Upper Canada College. He was rector of Grace Church, Brantford (1872–76), archdeacon of Brant (1876–79), was elected Bishop of Toronto in 1879, and in 1907 became Archbishop and Metropolitan and Primate of All Canada.

SWE′DEN (Sw. *Sverige*). The country occupying the eastern and larger part of the Scandinavian peninsula. It extends from lat. 55° 20′ to 69° N., and from long. 11° to 24° E. Area, 172,963 square miles. In several physical aspects it differs much from Norway. It contains more level land and is more fertile and therefore adapted to support a larger population. Its coasts are not so deeply indented; its climate is continental instead of oceanic; and its harbors may be blocked with ice for five months, while those of Norway are unfrozen. Sweden comprises three main divisions. The north half, which is very scantily inhabited, is called Norrland. The south half comprises Svealand (Svearike), in the north, and Gotland (Götarike), in the south.



NORWAY AND SWEDEN


STOCKHOLM
Gothenburg
CHRISTIANIA
St. Petersburg
Riga
COPENHAGEN
Malmo
Karlskrona
Konigsberg
Stavanger
Bergen
Christiansand
Memel
Libau
Reval
Narva
Dorpat
Gefle
Upsala
Abo
Helsingfors
GULF OF RIGA
GULF OF FINLAND
GULF OF BOTHNIA
SKAGER RACK
CATTEGAT
JUTLAND
DENMARK
GOTLAND
OLAND
BORNHOLM
OSEL
Peipus Lake
Ladoga
Gulf of Danzig
Jammer Bay
The Skaw
BALTIC SEA
NORTH SEA
12° Longitude East 16° from Greenwich 20° 24°
C D E F G H
6 7 8 9
56° 60°

Topography. The area of all the islands that are a part of Sweden is about 3000 square miles. A group of islands without mountains or vegetation lie off the shore of Göteborg; and the entire Baltic and Bothnia shore is lined with many islets, chiefly low rocks in shallow water, remnants of the Swedish plain. Two large islands in the Baltic lie off the southern part of Sweden. The smaller, Öland, a narrow strip of land, 80 miles long, was once a part of the chalk shore of the mainland, from which it is separated by only 2 miles at the narrowest part of Kalmar Sound. The other, Gotland, is farther at sea, but connected with the mainland by a submarine bank. Only a comparatively small part of Sweden is mountainous—the portion lying along the Norwegian border, and forming the watershed of the peninsula and the boundary between Norway and Sweden for the greater part of its length. (See NORWAY, *Topography.*) The greatest heights are in the north, Kebnekaisse (7004 feet) and Sarjettjokko (6988 feet). In the south is a hilly district rising from a plateau several hundred feet above the surrounding plains of the coast, and separated from the mountains of the north by the great depression occupied by the southern lakes. Most of the remainder of Sweden is a plateau sloping rapidly from the mountain fringe to a plain which stretches along the east coast to the southern extremity of the country, and which includes the fertile lowlands of Gotland, strewn with bowlders, where the largest and most productive farm lands are found.

Hydrography. Sweden is rich in streams and in lakes. Many rivers flow from the mountains southeast to the Gulf of Bothnia or the Baltic, affording much water power, but little navigation, on account of their rapid fall. They pass through many lakes, particularly in their upper courses, and the lakes have the effect of equalizing the floods so that the rivers are quite regular in their discharge. Numerous falls and rapids give a picturesque charm. The Klar Elf (clear stream), the largest river, flows south into Lake Vener. The Göta Elf, which discharges the waters of Lake Vener into the Cattegat, is more important, because its falls and rapids have been circumvented by canals, making it a part of the waterway system of south Sweden. The principal river emptying into the Baltic is the Dal Elf. Many of the Swedish lakes are large and beautiful, distinguished by clear water and picturesque surroundings. The four great lakes of the country lie in the depressed area north of the plateau of southern Sweden. Lake Vener, the largest of them, is the third largest in Europe (2100 square miles). Lakes Vetter (730 square miles), Hjelmar, and Mälar (about 670 square miles) drain into the Baltic.

Climate and Soil. As the western mountains shut off the tempering influence of the Atlantic, the climate has a continental character. The country being in the latitude of Labrador, the summer is short and the winter is cold and long. At Stockholm the mean temperature in January is about 25° F. and in July about 61° F. The mountains prevent the greater part of the precipitation from reaching the eastern plateaus and plains, so that the mean rainfall in Sweden is less than 20 inches. The greatest rainfall is on the southwest coast, facing the Cattegat, where the average is 35 inches annually, while on the Baltic coast at the same latitude but 13 inches is the average. The country is almost completely covered with snow in winter, when snow traveling on ski is a favorite amusement. The splendid and extensive forests and the farms of Gotland and Scania, where the grain fields return as much to the acre as in England, show that the soils of the central and southern parts of the country are not deficient in fertility.

Flora. Forests cover about 51.9 per cent of the country, pines and firs predominating, and extend beyond the Arctic circle. Over 2000 European plants have their northern limit in the Scandinavian peninsula. In Sweden beeches are found only in the extreme south, the oak disappears a little north of Stockholm, while the pine, fir, and alder extend nearly to the limit of arboreal vegetation. The forests of the southern plains differ little in appearance from those of the more temperate parts of Europe, but farther north, in the region of prevailing conifers, the labyrinth of moss-covered bowlders, amid which the towering trees rise, where even a path is scarcely possible, gives a special character to the woodlands. The Dal Elf, north of Stockholm, is practically the northern limit of wheat, but barley is grown to the Arctic circle.

Fauna. The bounties paid for bear, lynx, wolf, and fox skins and for birds of prey have resulted in nearly exterminating the leading wild animals. The beaver and hare survive, but the wild reindeer is no longer found. Fish are much less abundant in Swedish than in Norwegian waters.

Geology and Mineral Resources. Archean rocks are predominant, and in some districts, especially around the great lakes, they are overlaid by Cambrian and Silurian formations. In large areas also the ancient rocks are covered by extensive glacial deposits of clay, sand, gravel, and erratic bowlders. Triassic, Jurassic, and Cretaceous rocks appear only in Scania, in the extreme south. Some time after the glacial epoch the Scandinavian peninsula subsided till the sea level, in relation to the land, stood 500, 700, and in some places 1000 feet higher than before, as is shown by marine terraces and marine deposits resting on rocks that had been scarred by glacial ice. Then the land began to rise again and the gradual upheaval is still in progress. The movement is best observed, of course, along the coasts. It is nowhere so rapid as on the Swedish side of the Gulf of Bothnia, and it is most rapid at the northern extremity of the gulf, where the upheaval is estimated at about 5 feet in the past century. In the extreme south no change of level has been observed. Thus the Gulf of Bothnia appears to be slowly draining into the southern basin of the Baltic.

The mining industry competes with difficulty against the powerful rivalry of the leading European countries, although it is more important than that of Norway. Sweden is poorly supplied with coal (only 333,832 tons having been mined in south Sweden in 1910). Manufacturers are compelled to import coal or use charcoal. The most important and valuable mineral product is iron. In 1910, 6,674,670 tons of iron ore were mined in the Kingdom. While about 1,000,000 tons are mined every year near Gefle, Falun, and Dannemora, the largest supply comes from Gellivare, about 130 miles north of the Arctic circle. Swedish iron is regarded as unsurpassed in the world, as it is almost entirely free from phosphorus (0.05 per cent or less), and is therefore of superior value for the manufacture of steel. For this reason it now rivals the ores of Spain in British and German markets, and large quantities are exported. Magnetite and manganese ores (6341 tons of manganese in 1910) used in steel making also abound. The copper industry of Falun was long widely renowned, but the yield was formerly much larger than at present. Three-fourths of the total yield of zinc ore (54,523 tons in 1910) is produced at the Ammeberg mines, on the north side of Lake Vetter. The yield of lead in 1910 was 355,400 kilograms. The number of persons engaged in mining declined from 35,000 in 1890 to 29,990 in 1910. In 1910 there were 529 mines and ironworks, with 112 smelting furnaces. The value of the mining industry in 1910 was $60,781,600. The earnings of the mine owners in the same year was $6,686,666.

Agriculture, Live Stock, and · Fisheries. Nearly one-half of the population support themselves by agriculture, though only about 12 per cent of the land area is under cultivation. Natural meadows cover 3.5 per cent of the surface, tilled fields 8.9 per cent, forests 51.9 per cent, and 35.9 per cent is unproductive. In 1910, 356,956 farms were under cultivation, of which about two-thirds were from 5 to 45 acres in extent. The preceding table shows the area (in acres) under the chief crops and the yield (in bushels) in 1913. The value of the cereal crops, in 1913, was estimated at 336.8 million kronor, and of all crops at 879.7 million kronor.

	Area (acres)	Yield (bushels)
Wheat	287,533	9,106,624
Rye	910,393	21,816,304
Barley	441,488	15,388,728
Oats	1,973,678	80,981,176
Mixed grain	422,741	18,289,704
Pulse	55,822	1,233,000
Potatoes	383,270	683,727,000

The largest and most productive area of farm lands is in the East and West Gotland and Scania, in the south of the country. Despite improvements in farming, especially through importation of modern farm machinery and implements, the country cannot produce wheat and rye enough for home consumption, and large quantities of breadstuffs are brought in every year, chiefly from the Baltic countries. Nearly half the total grain raised is oats—an export crop. The sugar beet thrives in the extreme south, but the acreage given to it does not supply the demand for sugar. Flax, tobacco, and hops are cultivated with success. The value of the agricultural products of 1910 was $211,206,000. At the end of 1913 Sweden had 596,072 horses, 2,719,018 head of cattle, 985,932 sheep, and 968,888 hogs. Great quantities of butter are exported to Great Britain. The government has done much to improve agriculture by founding schools of agriculture and by the appointment of peripatetic teachers. The fisheries are important, though inferior to those of Norway. They do not suffice for the needs of the country. On the other hand, the timber trade is of much greater value than that of Norway.

Manufactures. Although the manufacturing industries have been stimulated in every way by the government and have made great progress, Sweden is still largely dependent upon foreign countries for most of these commodities. The Kingdom lacks the coal, population, and capital for the most successful development in this respect. The industrial advance, however, has been most substantial, as is seen from the following comparisons: From 1905 to the close of 1910 the number of manufacturing establishments changed from 11,949 to 11,435; the number of workpeople in them increased from 280,995 to 302,157, and the total value of the product from $323,292,200 to $429,805,990. The saw mills in 1910 contributed $48,910,500 of the total value of product; flour mills, $28,523,500; textile mills, $56,182,500; machine shops, $35,573,800; and iron and steel manufactures and foundries, $34,839,800. The timber industry in all its branches, including wood pulp, is the leading manufacturing industry. The public forests (area, 22,111,000 acres) yielded 3,912,800 cubic metres of timber in 1910. In 1910, 39,605 workpeople in 1232 saw and planing mills produced lumber worth $48,915,800; furniture and other woodwork were also large products. Swedish matches, everywhere famous, are produced chiefly at Jönköping, where one factory employs 1500 hands. There are woolen and cotton factories at Norrköping, Stockholm, and Göteborg, but the manufacture of linen, a household industry, is the only branch of textile manufacture which meets the domestic demand. The most famous ironworks are near Eskilstuna and the chief machine shops at Motala. Swedish bar iron, steel goods, blades, armor plates, cables, nails, and knives are highly esteemed.

Commerce. The average annual trade (in million dollars) is as follows:

	1881–85	1891–95	1905	1910	1913
Imports	85.5	97.5	156.1	180.1	226.9
Exports	67.5	88.5	122.0	158.9	219.1

The Kingdom sells abroad the abundant product of its forests, iron and zinc mines, dairies, and oat fields. Its home supplies of textiles, wool, machinery, railroad iron, and many other things are inadequate, and it must supplement them by foreign purchases. The table (page 721) gives the value in kronor of the leading imports and exports, 1900 and 1910 (a krona equals in value $26\frac{7}{10}$ cents). Its trade is chiefly with the countries bordering on the Baltic and North seas. The value of its trade in 1900 and in 1910 with leading countries is shown in the lower table on page 721.

The exports of the United States to Sweden in the calendar year 1903 were $5,806,000, and the imports were $3,584,000; in 1906 the exports to Sweden were $9,073,000 and the imports were $3,943,000; in the fiscal year of 1910 the exports to Sweden were $5,991,896, and the imports were $6,830,477; in 1914 imports, $11,590,107; exports $14,644,226. During the Great War the United States exports to Sweden greatly increased, being in the calendar year 1915 $84,806,759. Among the things that the United States sells to this country are provisions, wheat, machinery, tools, and cotton.

Transportation and Communication. Railroads are cheaply built, because of the small cost of land, lumber, and iron. Uninterrupted rail communication extends between Gellivare in the north and Malmö in the south, over 1200 miles.

A line has been constructed from Gellivare to Ofoten Fiord, Norway, giving the iron ore of north Sweden an outlet on the Atlantic coast. The total length of railroads in 1910 was 8643 miles, of which the state owned 2761 miles. Southern Sweden has an excellent system of waterways by which a series of canals and canalized rivers unite the great lakes with both the North and Baltic seas, providing 2500 miles of interior navigation. In 1910, 140,177 ships and boats passed through the canals. Swedish trade is predominantly maritime, and Swedish vessels are engaged in both home and foreign trade. The mercantile fleet in 1910 comprised 2849 vessels, of 769,985 tons, including 1214 steamers, of 593,073 tons. Göteborg is the principal port, with Stockholm, Malmö, and Helsingborg following. The tonnage entered and cleared (1910) was 22,095,228, over one-half in Swedish bottoms.

COMMODITY	Imports		Exports	
	1900	1910	1900	1910
	Kronor	*Kronor*	*Kronor*	*Kronor*
Textile manufactures	41,958,659	59,494,389	1,544,852	2,679,647
Grain and flour	51,793,392	55,291,320	2,145,094	1,093,459
Colonial goods	45,584,093	47,578,919	336,180	461,733
Raw textile material and yarn	46,165,793	66,768,376	1,502,842	2,237,986
Minerals, of imports mostly coal	104,052,262	87,920,189	22,518,863	58,028,162
Metal goods, machinery, etc.	65,009,836	67,472,187	25,316,543	59,087,492
Live animals and animal food	29,195,718	24,088,096	43,161,578	70,023,169
Hair, hides, and other animal products	20,438,630	40,414,044	5,370,750	10,597,420
Metals, raw and partly wrought	25,556,124	36,444,449	52,395,037	58,400,833
Timber, wrought and unwrought	5,925,996	15,124,113	200,559,375	264,736,479
Paper and paper manufactures	4,407,698	3,678,037	14,392,265	32,227,726
Other articles	94,846,909	148,319,045	22,090,583	26,058,537
Total	534,935,110	671,632,596	391,333,962	592,864,140

COUNTRY	Imports from		Exports to	
	1900	1910	1900	1910
	Kronor	*Kronor*	*Kronor*	*Kronor*
Great Britain	176,504,553	164,481,221	169,248,313	190,656,424
Germany	187,897,874	231,036,380	65,244,540	124,482,840
Denmark	62,525,129	45,086,501	47,682,183	55,146,264
Norway	21,761,911	21,140,707	7,186,593	28,764,600
Russia (including Finland)	34,358,984	47,252,550	14,027,846	17,716,133
France	9,692,566	28,094,659	29,807,333	42,352,467
Spain	1,736,294	2,725,596	3,649,832	7,562,063
Netherlands	11,184,842	18,378,929	29,941,211	16,091,671
Belgium	13,166,404	9,745,190	14,839,185	16,770,416

Banking. The National Bank of Sweden (Riksbank) belongs to the state, regulates financial relations with foreign countries, receives private accounts, and lends money on security to nonspeculative enterprises. The bank is under the guarantee of the Diet, its capital and reserve are fixed, and its note circulation is limited by its metallic stock and its current accounts. Its actual circulation is kept far within the authorized limit. The assets and liabilities of the Swedish banks balanced (in kronor) on Jan. 1, 1914, as follows: National Bank, 430,296,681; private banks, 860,857,774; joint-stock banks, 1,987,255,225. The savings banks (exclusive of post office) had, at end of 1913, 1,738,438 depositors, and deposits of 961,798,726 kronor. At the end of the same year the Post Office Bank had 578,254 depositors and deposits of 48,075,655 kronor.

Government. From 1814 to 1905 Sweden was united with Norway under a common king, but each was in effect a separate kingdom with its own government. The fundamental laws of Sweden have never been embodied in any single written constitution, but consist of various enactments of the Diet from 1809 to 1866. By the fundamental laws a limited monarchy is constituted, at the head of which is a king, who is required to be a member of the Lutheran church and who is bound by oath to observe the laws of the land. By the law of succession women are excluded from the throne. In case of failure of succession the King is to be chosen by the Swedish Diet. The King has the exclusive right of legislation as regards trade, commerce, manufacturing, mines, and forests. He is also empowered to issue police regulations and to make rules concerning vagrancy, sanitation, protection against fire, etc. In legislating on other matters he must act with the consent of the Diet. He possesses the right to declare war and make peace upon the advice of a Council of State. He nominates higher officials, military and civil, negotiates treaties with foreign countries, and presides in the Supreme Court. He is advised and in some manner assisted by a Council of State consisting at present of 11 ministers, at the head of which is the Minister of State. They have seats in the Diet with the privilege of debate and the right to initiate legislation. They sometimes resign in case of serious disagreement with the Diet, but the principle of ministerial responsibility is not yet freely recognized. Every new law must have the assent of the crown.

The National Parliament or Diet (Riksdag) consists of two Chambers, both of which are representative in principle. The Upper Chamber consists at present of 150 members chosen for a term of six years by the provincial legislatures (Landstings), 25 in number, and by the municipal governments of those towns which are not represented in the provincial assemblies. These towns are Stockholm, Göteborg, Malmö, Norrköping, and Gefle. The members are distributed on the basis of one to every 30,000 of the population, and are required to be 35 years of age and in the possession for at least three years prior to their election of property of the taxable value of about $22,000, or an annual income of about $1100. They receive no compensation for their services. The Lower Chamber consists at present of 230 members chosen for a term of three years. Of these, 80 are chosen by the towns and 150 by the rural districts. The rural members are distributed on the basis of one member to every 40,000 inhabitants, while the towns are allowed one member for every 10,000 of the population. All native Swedes 21 years of age possessing property of taxable value of about $280, or who cultivate for a period of five years a certain amount of land, or who pay an annual income tax on an income of about $225, are qualified voters. Any elector 25 years of age is qualified for membership in the Lower Chamber. At the election to the Lower Chamber, in 1914, 760,000 votes were cast and approved out of 1,092,000 having the right to vote. The two Chambers never meet in joint session. The members of the Second Chamber receive compensation.

The union of Norway and Sweden under the same executive made necessary some provision for the administration of those affairs which were common to both monarchies, such as the conduct of their foreign relations. In this domain the King was given power to act for both countries, but his action was subject to the approval of the joint Council of State. Thus, he might declare war and make peace, send and recall ambassadors, use ships of war, etc., with the consent of the joint Council. This did not, however, destroy the individuality of either nation as regarded foreign affairs, since the King might conclude treaties which affected but one of his kingdoms. Matters of common interest not within the power of the King were regulated by concurrent action of the two Diets. For the purposes of local administration Sweden is divided into 24 läns or provinces, each under the supervision of a prefect nominated by the King. In each province there is a general council or Landsting, which regulates internal affairs. The city of Stockholm, the capital, constitutes a separate administrative division. In the communes there is almost complete local self-government, all taxpayers being voters. Some of the communes have primary assemblies very much like the town meetings of New England, while those which are larger and more populous have municipal councils. In the parishes there are local assemblies for regulating ecclesiastical affairs. See paragraph on *History*.

Finance. The sources and amount of revenue and the expenditures for 1907 and 1912 were as follows:

REVENUE	1907	1912
	Kronor	*Kronor*
Domains, railways, land taxes, etc.	17,200,000	75,730,000
Customs	58,000,000	63,575,000
Post	17,800,000	10,186,000
Stamps	9,200,000	17,431,000
Impost on spirits, beet sugar, etc.	23,500,000	43,891,000
Tax on incomes, etc.	22,600,000	45,649,000
Net profit of the National Bank	5,350,000	6,399,000
Surplus from the previous years	3,663,000	5,034,000
Sugar tax	13,500,000	19,630,000
Malt tax	3,000,000	4,913,000
Total revenue	193,383,000	292,444,000

EXPENDITURE	1907	1912
	Kronor	*Kronor*
(*a*) Ordinary:		
Royal household	1,421,000	1,593,000
Justice	4,147,000	5,797,000
Foreign affairs	1,328,000	1,756,000
Army	42,799,000	56,717,000
Navy	15,120,000	26,854,000
Interior	33,218,000	20,809,000
Education and ecclesiastical affairs	19,946,000	27,743,000
Finance	10,231,000	16,506,000
Agriculture	5,958,000	8,533,000
Pensions	4,464,000	8,084,000
	138,631,000	174,392,000
(*b*) Extraordinary	34,750,000	40,785,000
(*c*) Expenditure through the Riksgäldskontor:		
Payment of loans and miscellaneous (Diet, etc.)	14,822,000	29,365,000
Carried to floating capital	3,279,000	12,655,000
Fund for insurance against invalidity of workmen	1,400,000	2,526,000
Fund for insurance against accidents of workmen, etc.	500,000	
Total expenditure	193,383,000	259,723,000

On Jan. 1, 1914, the public liabilities, contracted entirely for productive purposes (railroads, etc.), were 622,560,572 kronor, bearing interest at from 3 to 4½ per cent. All loans are paid off gradually by means of sinking funds. On Jan. 1, 1914, the total assets of the state were 1,927,457,433 kronor. Thus, the financial condition of the state showed a surplus of assets of 1,304,890,861 kronor.

Weights, Measures, and Money. Gold is the standard of value. The krona, the unit of coinage, is worth 26$\frac{8}{10}$ cents. The metric system of weights and measures became obligatory in 1889.

Army. In 1915 the total peace establishment consisted of 3027 officers, 2010 noncommissioned officers, and 70,218 enlisted men. Total, 75,255. On initial mobilization it is expected that the field army would amount to about 100,000 combatants, composed of 6 divisions, each of 2 brigades of 2 regiments (12 battalions in all), with a regiment of cavalry (4 squadrons), a regiment of field artillery (11 batteries of 4 guns each), a company of engineers, a pontoon train, a telegraph detachment, a supply company, a bearer company, an ammunition column and train. Added to this would be one independent cavalry division of 4 regiments, and another cavalry division of 16 squadrons and 3 horse batteries. Total about 100,000 combatants. The first uppbåd (category) of the active army would be able to furnish an equal number of reserve troops. Total for the first uppbåd of the Beväring or active army, including the peace establishment, about 275,000 officers and men. In addition to this force the third reserve (or Landstorm) would supply about 170,000, giving in all about 445,000 officers and men. The total carried on the rolls, including administration personnel, is about 485,000. Of this number, however, only about 100,000 are supposed to be available for immediate use in the field army. Service is both voluntary and compulsory, the former class (about 20,000 officers and men) comprising the permanent personnel of the skeleton organization maintained in time of peace as a training school for the yearly conscript contingent. Liability is for 23 years, from the age of 20 to 42 inclusive. The men pass through the following categories: first uppbåd of the Beväring (active army), 11 years; second uppbåd, 4 years; Landstorm, 8 years. Initial training: infantry, 250 days; cavalry and field artillery, 281 days; garrison artillery and engineers, 295 days. Subsequently infantry has 4 trainings, 3 in the first period for 30 days each, 1 later for 15 days. Cavalry and artillery have 3 trainings, 2 of 42 days and 1 of 25 days. Arms: infantry, 6.5 mm. Mauser; field artillery, 7.5 cm. Q. F. Krupp gun.

Population. The population, according to the census of 1910, was 5,522,403. The density of population is 31 to the square mile. The growth of population has been as follows: 1800, 2,347,303; 1840, 3,138,887; 1890, 4,784,981; 1910, 5,522,403. Emigration is chiefly to the United States and averages about 20,000 annually. In 1913 the emigration to the United States was 16,329.

Religion. The Lutheran church is recognized as the state religion, and most of the people are professors of that faith. There were a few followers of the Roman Catholic and other faiths. In the state church are 13 bishoprics and 2513 parishes.

Education. Education is maintained at a high level. It is under the control of the government, is compulsory, and practically all the inhabitants of school age and over can read and write. The secondary schools and the universities are modeled on the German system. In 1913 there were 2461 students in the University at Upsala and 1378 in the University of Lund. The schools included in 1913: 82 public high schools, 24,129 pupils; 44 people's high schools, 2619 pupils; 15 normal schools for elementary teachers, 1913 pupils; 2 high and 8 elementary technical schools; 10 navigation schools, 333 pupils; and besides schools for deaf-mutes and the blind, medical, military, agricultural, veterinary, forestry, weaving, mining, and other special schools. In 1913 there were 15,586 elementary schools, with 21,234 teachers and 899,850 pupils. Among the recruits of 1910 only 0.23 per cent were unlettered, only 0.43 per cent unable to write. In 1913 the expenditure on elementary education was 47,220,500 kronor, of which about one-fourth came from the national treasury.

Ethnology. The Swedes belong to the Scandinavian branch of the Teutonic stock. Their average stature is 1.705 metres, classing them among the tall races; the average cephalic index is 78.2. The Swedes are blonds, sturdy and robust. Prehistoric culture came from the south. In the settlement of Sweden the Goths or Gotar were the first conquerors of whom history tells. They occupied the southern parts, and following them came the Svear, who overran the rest of the country and gave their name to the Svenskar or Swedes of to-day. The Dalecarlians are thought to preserve best the type of the Svear; they are described as tall, slender, and agile, with blue eyes and broad, open brow, courteous, cheerful, and firm, and with a wide reputation for honesty.

History. Tacitus in the *Germania* tells of the two great Germanic tribes in the Scandinavian peninsula, the Suiones or Swedes in the north, and the Gothones or Goths in the south. These two, like other rival Germanic tribes, seem to have been generally at war with each other, and it was not until about the fourteenth century that the country was really organized and unified through the cessation of jealousy between the two sections. The ancient Swedish people had a bond of union in their religion and a common sanctuary at Upsala, which was the early centre of Swedish nationality. The history of Sweden previous to the tenth century is wrapped in obscurity. In the first half of the ninth century Ansgar (q.v.), a Frankish missionary, came to Sweden from Denmark and began the teaching of Christianity, which slowly became established in the country. Under Eric the Saint (1150–60) the Swedish power was strengthened and extended and Christianity with it. Churches were built and monasteries founded. Eric carried Christianity into Finland with the sword and established Swedish settlements in that country, whose subjugation, however, was not completed until more than a century after his death. He was defeated and killed in 1160 by the Danish Prince Magnus Henriksön, who made an unprovoked attack upon Sweden, the beginning of a long series of wars between Sweden and Denmark, productive of national hatred and bitterness. The reigns of the early Swedish kings were short and stormy. In 1389 the Swedish nobles, disgusted with the conduct of their King, Albert of Mecklenburg, offered the crown to Margaret, Queen of Denmark and Norway, daughter of Valdemar IV, who defeated and dethroned Albert, and in 1397 brought about the union of Kalmar, by which the three Scandinavian kingdoms were henceforth to remain united under a single sovereign. This union continued with interruptions for more than a century, but with constant dissensions and wars between Denmark and the Swedish people. The Swedes themselves were divided between the upholders of national sovereignty and the supporters of the pretensions of the Danish kings. In the latter part of the fifteenth century the family of Sture (q.v.) rose to eminence in the struggle for national independence, Sten Sture the Elder being proclaimed administrator of the Kingdom in 1470. In 1520 Christian II of Denmark invaded Sweden to enforce his claim to sovereignty. The administrator, Sten Sture the Younger, was defeated and mortally wounded, and Christian entered Stockholm, where he enacted a carnival of blood, executing a large number of the nobles. Sweden soon rose against the tyrant (1521) under the lead of Gustavus (I) Vasa, who was made administrator. He shook off the hated yoke of Denmark and in 1523 became King of Sweden. About 1529 Lutheranism became established as the state religion of the Kingdom. Gustavus Vasa organized the Kingdom as a hereditary monarchy, in which the power of the nobles was circumscribed and that of the clergy subordinated to that of the state. He fostered trade, manufactures, art, learning, and science, and left a full exchequer, a standing army, and a well-appointed navy.

The great work of the first Vasa sovereign was almost undone by his son and successor, Eric

XIV (1560–68), who became insane and was deposed, being succeeded by his brother, John III. At the beginning of Eric's reign Esthonia, a fragment of the dominions of the Knights Swordbearers, submitted to Sweden. The reign of John III (1568–92) was notable for a reaction towards Catholicism. He had married Catharine Jagellon, of the Polish royal house, and in 1587 secured the election of his son Sigismund to the throne of Poland. For this Sigismund had to profess Catholicism. The great majority of the Swedes were strong Protestants, and when Sigismund succeeded his father as King of Sweden and attempted to restore Catholicism he was compelled by the Diet to resign the throne in 1599. His uncle Charles, the only one of Gustavus Vasa's sons who inherited his talents as a ruler, was made administrator of the Kingdom and in 1604 was crowned King as Charles IX. The policy of Charles IX was to encourage the burgher classes at the expense of the nobility; and by his successful efforts to foster trade—in furtherance of which he laid the foundations of Göteborg and other trading ports—to develop the mineral resources of the country, and to reorganize the system of Swedish jurisprudence, he did much to retrieve the calamitous errors of his predecessors. (See **Charles** IX.) The deposition of Sigismund gave rise to a long war with Poland. Charles was succeeded by his son, Gustavus (II) Adolphus (1611–32). This greatest of Swedish kings was confronted at the beginning of his reign by wars with Russia, Poland, and Denmark, which last-named power still owned Scania and other districts at the southern extremity of the Scandinavian peninsula. These wars were concluded advantageously for Sweden, which acquired Ingria, Karelia, and Livonia (the last named not formally renounced by Poland until 1660), and the King addressed himself to the task of making Sweden the dominant power on the Baltic. In 1630 Gustavus Adolphus came to the rescue of German Protestantism, which had succumbed to the arms of Tilly and Wallenstein. (For his victorious career in Germany, and the successes of the generals who were trained in his school, see the articles **Gustavus (II) Adolphus** and **Thirty Years' War**.) The foreign policy of Gustavus Adolphus was continued after his death at Lützen in 1632 by his able Chancellor, Oxenstierna (q.v.), who directed the government during the minority of Gustavus' gifted but eccentric daughter Christina (1632–54). As a result Sweden was for nearly a century the great power of the North. By the Peace of Westphalia (1648) Sweden received Hither Pomerania (west of the Oder), the island of Rügen, and other territories in Germany, and was admitted to representation in the German Diet.

Charles X Gustavus (1654–60) waged a fierce war against the Polish King, John Casimir, in which the Swedish forces overran Poland. He conquered from Denmark the provinces of Scania, Halland, and Blekinge, which rounded out the Swedish boundaries. The war with Poland was closed at his death by the Peace of Oliva (1660). Misgovernment by a regency followed during the minority of Charles X's son and successor, Charles XI (q.v.) (1660–97). This King was involved as the ally of Louis XIV in European wars, which the regency had not left him the resources to carry on. In 1675 the Swedes suffered a great defeat at the hands of Frederick William, the "Great Elector" of Brandenburg, at Fehrbellin. Charles XI reorganized the government and was declared an absolute sovereign by the Estates in 1693. His son, Charles XII (1697–1718), by his military genius raised Sweden to an extraordinary height of power. Not long after his accession he successfully met a joint attack by Russia, Poland, and Denmark, whom he dealt blows that astonished the world. His inordinate ambition, however, finally brought ruin upon Sweden. Peter the Great wrested Karelia, Ingria, Esthonia, and Livonia from Charles, who met his death in an invasion of Norway, leaving the Kingdom overwhelmed with debts and again disorganized. With him the male line of the house of Vasa expired. Upon the death of Charles XII the power of the crown was greatly limited by a new constitution ratified in 1720. Theoretically all power was vested in the Riksdag, or Diet, consisting of four distinct orders or estates—nobles, clergy, burgesses, and peasants sitting separately. The real power, however, was exercised by a "Secret Committee" consisting of 50 nobles, 25 clergy, and 25 burgesses, which prepared all bills for the Riksdag, created and deposed ministers, and controlled the foreign policy of the nation. The King presided over the sessions of the Senate, in which body he had a casting vote in case of a tie. The constitution made the King largely a figurehead in the government. Charles XII's sister, Ulrica Eleonora, who succeeded him, and her husband, Frederick of Hesse-Cassel, who shared the throne, were mere puppets of the nobles, whose dissensions as the factions of the Hats, or French party, and the Caps, or Russian party, brought on the country calamitous wars and almost equally disastrous treaties of peace. The weak Adolphus Frederick of Holstein-Gottorp, who was called to the throne on the death of Frederick in 1751 and died in 1771, did little to retrieve the evil fortunes of the state. (See **Struensee**.) His son, Gustavus III (q.v.) (1771–92), skillfully availed himself of the general dissatisfaction of the people with the nobles to destroy the factions of the Hats and Caps, and under a new constitution to restore the power of the crown and of the popular estates at the expense of the nobles. His extravagance and dissoluteness detracted, however, from his merits as a ruler. He was assassinated in 1792. His son and successor, Gustavus IV Adolphus (q.v.), was but three years of age at his accession, and was forcibly deposed in 1809, and obliged to renounce the crown for himself and his direct heirs in favor of his uncle, Charles XIII (1809–18), who was compelled at once to conclude a humiliating peace with Russia, by the terms of which Finland was severed from Sweden. The early part of the reign of Charles, who was childless, was troubled by domestic and foreign intrigues concerning the choice of an heir to the throne. Finally, hoping to conciliate Napoleon, the dominant party in Sweden elected General Bernadotte to the rank of Crown Prince. Bernadotte led the Swedish forces in support of the allies against the French Emperor in 1813–14. With the aid of England, Sweden compelled Denmark, in January, 1814, to cede Norway to her, the Swedish possessions in Pomerania being handed over to Denmark. The Congress of Vienna (1814–15) recognized the union of Norway with Sweden; Swedish Pomerania passed to Prussia. In 1818 Bernadotte mounted the throne as Charles XIV John (q.v.). Under his able administration the united kingdoms of Sweden and Norway made great advances in material prosperity and political and intellectual progress; and although the nation at large entertained very little personal regard for their alien sovereign, his son and successor, Oscar I (1844–59), and his grandsons, Charles XV and Oscar II, who came to the throne in 1872, won a large share of the affections of the Swedes. The union with Norway, maintained in peace for many years, began to show signs of strain in the second half of the nineteenth century in proportion with the growth of Norwegian commerce and industry and of a national feeling. The union was dissolved, June, 1905, by the act of Norway. See NORWAY for an account.

During the reign of King Oscar II many important measures of social reform were adopted, including accident insurance for workingmen, limitation of the working hours for women and children, and factory legislation.

In 1907 King Oscar II died and was succeeded by his son, Gustavus V. The question of the extension of the franchise which had been under consideration since 1900 was settled in 1909 by the passage of a bill establishing manhood suffrage for the elections to the Lower House, a reduction of the qualifications for eligibility to the Upper House, and a system of proportional representation for both Houses.

A cabinet crisis arose in Sweden early in 1914 due to a difference in the policies of the King and the Liberal ministry on the subject of defense. The King advocated the immediate strengthening of the military forces of the Kingdom, while the Liberals favored an appeal to the country on the question. Popular demonstration in support of the King led to the resignation of the Liberal ministry, and in the succeeding election the Liberals suffered greatly, gains being made by both the Conservatives and Socialists.

At the outbreak of the European War in 1914 Sweden declared her neutrality. Subsequently she entered into an agreement with Norway and Denmark to defend their neutrality and protect their economic interests. See WAR IN EUROPE.

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SWE'DENBORG, *Swed. pron.* svā'den-bōry', EMANUEL (1688–1772). A Swedish scientist and theologian. He was born in Stockholm and died in London. He was educated at Upsala and traveled for four years in England, Holland, France, and Germany. On his return to Sweden he was appointed by Charles XII to an assessorship of mines. Swedenborg was ennobled in 1719, and the family name changed from Svedberg to Swedenborg. Swedenborg published short treatises on various topics in the fields of mathematics, astronomy, physics, and chemistry. He devoted himself for eleven years to the duties of his assessorship and to a systematic description of mining and smelting, and the construction of a theory of the origin of creation. The result appeared at Leipzig in 1734, in three massive folios, entitled *Opera Philosophica et Mineralia*, of which the first volume was called *Principia*. This was followed in the same year by a treatise on *The Infinite, and the Final Cause of Creation; and the Mechanism of the Operation of the Soul and the Body*, carrying the doctrine of the *Principia* into higher regions. Dissatisfied with his conclusions, he determined to track the soul to its inmost recesses in the body. His studies in human anatomy and physiology, with this end in view, appeared as *Œconomia Regni Animalis*, in two volumes (1741), and as *Regnum Animale*, in three volumes, unfinished (1744–45).

At this point his course as scientist was arrested and he entered on his career as seer, by which he is known in history. After 1745 he professed to have had his spiritual senses opened. His recorded experience was unique in that he did not claim to have communication with spirits, as does modern spiritualism, nor to have visions merely, but he claimed to be himself consciously an inhabitant of the spiritual world as if he had died, and thence to be associating with the people of that world as one of them. In 1749 he made his first public appearance in his new character in the issue in London of the *Arcana Cœlestia*, completed in 1756 in eight quartos. It is an exposition of the internal, or spiritual, sense of Genesis and Exodus. Adam signifies the most ancient church, and the flood its dissolution; Noah, the ancient church, which, falling into idolatry, was superseded by the Jewish. The spiritual sense pervades the Scriptures, with the exception of Ruth, Chronicles, Ezra, Nehemiah, Esther, Job, Proverbs, Ecclesiastes, the Song of Solomon, the Acts of the Apostles, and the Epistles. By reason of its symbolism of the inward sense, the letter of Scripture is holy in every jot and tittle. The Jewish dispensation having reached its period, God appeared in Jesus Christ. He assumed human nature in its lowest condition in the Virgin, wrought it into conformity with himself, "glorified and made it divine." There is a Trinity, not of persons, but of divine essentials, consisting of the Father, or God as He is in Himself, and thus incomprehensible to man; the Son, or God as revealed to man in Jesus Christ; and the Holy Spirit, or divine operation thence. It is imaged in man by his soul, his body, and their operation. The Church which Christ established at his advent in the flesh came to an end in 1757. Then commenced a new dispensation and a new church, signified by the New Jerusalem in the Revelation, of which church the writings of Swedenborg contained the doctrines.

The distinctive principle of Swedenborgian theology, next to the doctrine of the divine humanity, is the doctrine of life. God alone lives. Creation is dead—man is dead; and their apparent life is the divine presence. God is everywhere the same. It fallaciously appears as if He were different in one man and in another. The difference is in the recipients; by one He is not received in the same degree as another. There is an inmost or highest degree or plane of man's reception of the divine life, called the celestial or love plane; there is a second or lower degree of receptivity, called the spiritual or wisdom plane, and there is a third, called the natural or. plane of obedience. The life of evil is the perversion of divine life into disorderly forms. These degrees of man's reception of God's life are entirely separate from each other and can never be commingled. They are related by correspondence, by which each lower degree derives its existence and its life from the plane above. The relation of correspondence is complete, there being nothing in a higher plane which is not represented by something corresponding to it in the plane below; and there is nothing in the lower plane which does not exist from some corresponding thing in the plane above; and all this to the most minute detail, even to the things on this earth. Earthly things beautiful and useful manifest spiritual good; and earthly things ugly and hurtful, spiritual evil. The Scriptures are written according to correspondences, and by the aid of that science their mysteries are unlocked. By it, too, the constitution of heaven and of hell is revealed. There are three heavens in which there live three orders of angels, the natural, the spiritual, and the celestial; they are three planes or degrees of man's receptivity of divine life described above. All angels were once men, and have lived on this or some other planet. They marry and live in societies, in cities and countries as in the world, in outer appearance differing only in the vast superiority and glory of these things there. But the similarity between the life of angels in heaven and that of men on earth is of the outer appearance only, while the differences between them are internal and radical; for it is not in degrees of outer perfection and glory that the life in heaven and the life on earth may be compared truly, but in their capacity to supply a field for the realization of the inner life of the soul. To the angels the images presented to their senses are the expressions of ideas and emotions which are by this means revealed to them; and so concerned are they in these meanings, that they are unconscious of the objects of their senses, or of their own bodily life, as such. To them their sense life therefore is made only a concrete spiritual life. There is no denominational favoritism with God; all in whom the love for God and man prevails in any degree whatever, irrespective of their church or religious connection, go to heaven after the death of their bodies. Between heaven and hell there is an intermediate state called the world of spirits, where all those who pass into the spiritual world are prepared for their final states. Hell is not merely a place of punishment for the sins done in the body, but is a provision of divine love, and the necessary state and condition of the unregenerated natural man. No one is sent there, but the unregenerated seek a place there of their own accord. Hell as a whole is called the devil, or Satan; there is no supreme individual bearing that name. There are three hells opposite the three heavens.

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SWEDENBORGIANS, swē'd*e*n-bôr'jĭ-*a*nz. The name popularly applied to those who accept the doctrines of Christianity and of philosophy as set forth in the writings of Emanuel Swedenborg (q.v.). They do not call themselves Swedenborgians, but members of the New Church. Swedenborg formed no ecclesiastical organization, but declared that in time there will exist a universal new church, which is prefigured by the New Jerusalem of the Apocalypse (Rev. xxi). Many followers of Swedenborg do not sever themselves from their previous church connections; but a number have organized a church to which they give the name New Church or New Jerusalem. It is only these whose numbers and work can be definitely reported. The first movement towards organization began in Great Britain in 1782, when Robert Hindmarsh, a printer of London, and certain associates formed a class for reading and studying the writings of Swedenborg. This grew into a society for worship and preaching. Public services were first held in 1788. The General Conference of the New Jerusalem Church in that country began its sessions in 1789, and since 1815 has met annually. In 1915 the conference consisted of 72 societies, with an aggregate membership of 6694 with 46 ministers. There are also a number of societies not connected with the conference and many isolated members not reported in these statistics. There are probably 10,000 followers of Swedenborg in Great Britain and Ireland. On the continent of Europe there are societies of New Churchmen in Paris, Zurich, Berlin, Budapest, Vienna, Stuttgart, Copenhagen, and in Stockholm, and many individual followers of Swedenborg in every country of Europe. In the United States the first society of the New Church was organized in Baltimore in 1792. The General Convention of the New Jerusalem in the United States and Canada held its first meeting in Philadelphia in 1817. With four exceptions this body has held annual sessions ever since. In the United States societies are grouped into State organizations called associations. The General Convention is composed of 12 of these associations and of seven separate societies. The individual membership of the bodies composing the convention, as reported in 1915, is 6363, with 103 ministers and 96 societies. In addition to these there are many scattered receivers of Swedenborg's doctrines who are not members of the organization. There is a smaller organization of the Swedenborgians called the General Church of the New Jerusalem. Its headquarters are in the United States, though it has members in other countries. It is an offshoot from the convention, having withdrawn from that body in 1891. In 1915 it reported a membership of 1213 persons with 34 ministers. In Australia, New Zealand, Cape Province, Natal, Transvaal, Mauritius, India, British Guiana, Mexico, and Brazil, there are societies and scattered receivers of Swedenborg's doctrines, and individual members in all parts of the globe. Taken all together there are about 20,000 members of the faith in the world.

The ministry of the New Church is patterned after the Episcopal order; but there is in reality a practical congregationalism. Originating in isolated places, the societies managed their own affairs, selected their own ministers, and joined with other societies largely for coöperative missionary work. The ministers and churches of the countries outside Great Britain and the United States, although practically independent, are closely connected with the three general bodies already mentioned, both by close association and coöperation, and by assistance rendered to the relatively weak brethren scattered throughout the world.

There are three institutions at which the ministers are educated. The English Conference has a theological school in London, the New Church College. The General Convention's theological school is in Cambridge, Mass., and the Academy of the New Church located at Bryn Athyn, Pa., has a theological school at which the ministers of the General Church of the New Jerusalem are educated. The three general bodies also carry on the work of general education in a number of schools in America and Great Britain.

The organizations of the New Church have been active in printing and publishing. The works of Swedenborg have been issued in whole or in part in many different languages and in many editions. Many periodicals have been published, some of them continuing through more than a century. For bibliography, see SWEDENBORG, EMANUEL.

SWEDISH LANGUAGE AND LITERATURE. Swedish belongs to the northern branch of the Germanic family, within which it is an eastern development of the old *Dönsk tunga*, or Danish tongue, a name anciently applied to the language spoken not in Denmark only, but in the rest of Scandinavia. It was much the same in the entire Northland down to about 900 A.D., when it began to differentiate into an eastern type, ramifying into Danish and Swedish, and a western type, producing Norwegian and Icelandic. From 900 to 1500 the Swedish branch is called Old Swedish. Until after 1200 the only records are runic inscriptions, cut chiefly on gravestones. Use of the Latin alphabet began in the thirteenth century. In the fourteenth century, when a literary language began to develop out of the Södermanland dialect, differentiation from Danish proceeded slowly; then came a period of approximation to Danish, followed in time by an archaizing period, restoring original forms. Aside from divergences of vocabulary, Swedish now differs from Danish especially in its retention, after a vowel, of the old voiceless consonants, *k*, *t*, *p*, which in Danish changed to *g*, *d*, *b*, and in its retention of the vowels *a* and *o* in unstressed syllables, where Danish has *e* or no vowel; thus, Swedish *bok*, book, *mat*, meat, *apa*, ape, are in Danish *bog*, *mad*, *abe*. Swedish *talar Ni svenska* (do you speak Swedish?) is in Danish *taler De svensk;* and Swedish *flickan liknar sin mor* (the girl resembles her mother) is in Danish *Pigen ligner sin Moder*. Under this head it may be added that Swedish has not the "glottal catch" of Danish, and Danish has not the modulated musical accent of Swedish.

The main body of the Swedish vocabulary is old Germanic stock, the principal foreign ingredients being (1) Latin and Greek words that came with Christianity or with the growth of scholarship; (2) Low German words dating from the time of the Hanseatic League, as *arbeta*, to work, *stövel*, boot, *smaka*, taste; (3) German words from about 1620, as *tapper*, brave, *prakt*, splendor; (4) French words borrowed in the seventeenth and eighteenth centuries, as *affär*, business, *talang*, talent, *charmant*, charming. Like other North Germanic tongues, Swedish has the postpositive definite article (originally a pronominal affix); thus, *flicka*, girl, *flickan*, the girl. As in English, nouns have but one case (the genitive or possessive), now distinguished by inflection. The genitive ending is *-s*, which is appended after the article; thus, *flickans mor*, the girl's mother. The plural of nouns is formed by means of the endings *-or*, *-ar*, *-er*, *-en*, to which the definite article is appended in the forms *-na*, *-ne*, according to a feeling for vowel balance which began about the fourteenth century; thus, *flickorna*, the girls, but *dalarne*, the dales. A new pronoun of address, *ni*, taking the place of *I*, came in the seventeenth century and is now commonly used in books; but in conversation Swedish politeness avoids it and substitutes the title of the person addressed, putting the verb in the third person; thus, *är frun sjuk*, is the lady sick? = are you sick, madam? The verb still retains the old Scandinavian passive in *-s*, originally an affixed reflexive pronoun; thus, *kalla*, call, *kallas*, to be called. A peculiar feature of conjugation is the differentiation of the perfect passive participle into two forms, one of which, called the supine, is used to inflect the perfect tenses, while the other is declinable and serves as a true participle; thus, *jag har älskat*, I have loved, but *jag är älskad*, I am loved, and *vi äro älskade*, we are loved.

In the printing of Swedish Roman letters have long prevailed. The written language of to-day represents nearly the pronunciation of about 200 years ago; and as phonetic change has been at work during the interval, it is the case, as in English, that the written form is often a poor index to colloquial utterance. Swedish print teems with silent letters; thus, *jag skal vara i staden* (I shall be in the city) is pronounced *ja ska vara i stän;* and *hvad är det* (what is it?) becomes *va ä de*. For the learner of Swedish a great difficulty comes from its peculiar accent, which involves both stress and variations of musical pitch. Every word has either the simple or the compound tone. The simple tone is a rising modulation, while the compound "consists of a falling tone on the stress syllable, with an upward leap of the voice and a slight secondary stress on a succeeding syllable." (Sweet.) Not only pronunciation, but meaning, often depends on the exact modulation of a word's musical accent.

Literature. About 160 of the runic inscriptions of Sweden, the oldest dating from the tenth century, contain alliterating verses evidently quoted from preëxisting sagas. This and other lines of evidence show that the poetic art was widely cultivated in the Viking age. But this literature, perhaps comparable to that preserved in Old Icelandic, is lost. By the middle of the twelfth century Christianity was firmly established, and old pagan songs and sagas were banned by the Church. For five hundred years afterward national literature was dominated, more than elsewhere in western Europe, by the religious spirit. The earliest writings handed down in the Latin alphabet are codes of provincial laws (*landskapslagar*), the most important the "Elder West Göta Law" (thirteenth century). Magnus Eriksson's *Landslag* (about 1350) is that King's attempt to provide a common law for all the provinces under his rule. It was probably a scholar from his entourage who wrote the celebrated *Um styrilsi konunga ok höfthinga* (On the Conduct of Kings and Magnates). To the fourteenth century belong writings (nine books of Revelations) ascribed to St. Birgitta, a nun and mystic revealer of heavenly things. She is the most eminent personage in the annals of Catholic Sweden. Her convent at Vadstena became a literary centre, where Latin writings, mystical and hagiographic, but including also a part of the Bible, were translated into Swedish for the nuns. In poetry the mediæval period is not very rich, though its metrical production is considerable. Romances of chivalry are the so-called *Eufemiavisor*, certain tales of knighthood done into Swedish verse by a gleeman at the court of Queen Euphemia of Norway (1303–12). They are *Herra Iwan*, *Hertig Fredrik af Normandie*, and *Flores och Blanzeflor*, all in rhyming couplets with four accents to the line. Besides these there are several rhymed chronicles, the oldest being the *Erikskrönika* (about 1320), the *Chronica Gothorum* (1470) by Ericus Olai, and the ballads. The ballad-making period in Sweden was chiefly in the thirteenth and fourteenth centuries, but the extant collections are of the sixteenth and seventeenth. No well-known ballads are of indisputable antiquity, but the best compare well in form and matter with the better *Kæmpeviser* of Denmark. From the fifteenth century we have a few good poems by Bishop Thomas of Strengnäs (died 1443).

The Reformation transferred the literary centre from Vadstena to Upsala. The literature of the sixteenth century is nearly all religious, the chief writers being the brothers Petri, Carmelite monks who had been converted to Lutheranism at Wittenberg. They stand out as leading Swedish apostles of the new faith. The elder, Olavus (Mäster Olof), wrote psalms, devotional poems, a prose chronicle of Swedish history, and (probably) the mystery play *Tobiæ Comœdia*. With his brother Laurentius he directed the publication of the first Swedish Bible (Upsala, 1541). The first secular author of any note in the new era is the historian Messenius, who also wrote six "school comedies" on subjects from Swedish history. The best known is *Disa*, which was played by Upsala students in 1611.

The period of Swedish expansion (1630–1730) is marked by the widening of the literary horizon through the introduction of new ideas and forms from Germany, France, Italy, and Holland. The prominent figure is Stiernhielm (1598–1672), the father of Swedish poetry. His work was like that of Opitz in Germany, who influenced him. His poem *Hercules*, a didactic allegory on the conflict of Pleasure and Duty, may fairly be said to have nationalized the dactylic hexameter. Stiernhielm also produced sonnets and ballads. His most noteworthy disciple was the poet-scholar Columbus (1642–79). An opponent of Stiernhielm, Rosenhane (1619–84), won fame as a sonneteer. A facile, original rhymester was Johansson, called Lucidor (died 1684). The eccentric polyhistor Rudbeck (1630–1702), with his amazing *Atlantika*, belongs to the history of literary curiosities rather than of literature.

In the ensuing epoch (1730–72) the great Swedish names are Swedenborg (1688–1772) and Linnæus (1707–78), belonging respectively to religion and science. In belles-lettres the ideals of Sweden were substantially those of contemporary France and England. The presiding genius is Dalin (1708–63), whose *Swedish Argus*, started in 1733 in imitation of the *Spectator*, became the rallying point of the dominant ideas. Dalin wrote much poetry, but is best remembered as an elegant stylist in prose, the first in Swedish annals. Opposed to Dalin in some of his tendencies was the coterie of Fru Nordenflycht (1718–63), the Northern Aspasia. To her circle belonged Creutz (1731–85), best known for his pleasant pastoral *Atis och Camilla*, and Gyllenborg (1731–1808), author of ratiocinative poems. All these midcentury writers were strongly influenced by contemporaries in England.

The Gustavian epoch (1772–1809) is marked by royal patronage of letters. Gustavus III, himself a playwright and a prize orator, assembled an academic court of talent, similar to the French Old Régime. Leading Gustavians were Kellgren (1751–95), Leopold (1756–1829), and Oxenstierna (1750–1818), all poets of talent and devoted to the ideals and sentiments of their day. Here belongs also the name of the gifted poetess Fru Lenngren (1754–1817), famed for her idyls and satires and her literary salon. Quite untouched by academic influence was the much-admired Beilman (1740–95), a genial humorist of Anacreontic tendencies, who turned his observations of Stockholm low life into tuneful verse. To the Gustavian period belongs (though somewhat of a new era) the best work of the eminent lyric poet Franzén (1772–1847).

The great Romantic movement of the nineteenth century, with its renaissance of national feeling, affected Swedish literature profoundly. New ideas, coming from Germany by way of Denmark, precipitated at first a conflict of schools and tendencies, after which came a season of brilliant production. In the soulful verse of Wallin (1779–1839); in the best work of the arch-Romanticist Atterbom (1790–1855); in the fine spirituality and exquisite workmanship of Stagnelius (1793–1823); in the stirring Northern poems of Geijer (1783–1847), destined to become, next to Fryxell, perhaps, his country's greatest historian; in the productions of the brilliantly endowed but erratic Almqvist (1793–1866); and of minor poets like Sjöberg (1794–1828) and Niçander (1799–1839); but above all in the splendid talent of Tegnér (1782–1846), famed for his romanticized *Frithiof's Saga*—the national genius found a richer expression than at any time before or since.

In the midcentury period the prominent names are Fredrika Bremer (1801–65), once widely read at home and abroad, and Runeberg (1804–77), a rival of Tegnér for the first place of honor in the whole Swedish Parnassus. Somewhat later come Topelius (1818–98), best known for his novels of Finnish history, and Rydberg (1828–95), eminent as poet, novelist, and translator of Goethe's *Faust*, and the poet Count Snoilsky (1841–1903). The new realism is most conspicuously represented by Strindberg (1849–1912), the greatest author of his day and country, remarkable alike for the quality, variety, and mass of his work; by Anne C. Leffler (1849–92); and by Geijerstam (1859–1909). Opposition to realism is represented by Heidenstam (1859–), Levertin (1862–1906), and the spirited romanticist Selma Lagerlöf (1858–), a winner of the Nobel prize. Late writers who belong to no special school are the poet Fröding (1860–1911), a skilled metrician, the poet Karlfeldt (1864–), and the story writer Hallström (1866–).

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SWEDISH MOVEMENT. See Mechanotherapy.

SWEDISH MUSIC. See Scandinavian Music.

SWEDISH NIGHTINGALE. A popular name given to the Swedish singer Jenny Lind.

SWEDISH POLITICAL PARTIES. See Political Parties.

SWEELINCK, swā′liŋk, Jan Pieters (1562–1621). A Dutch organist and composer, born at Deventer or Amsterdam. He studied with Zarlino at Venice, and in 1580 succeeded his father as organist of the Old Church at Amsterdam, which position he held till his death. Through his pupils and organ works he exerted a far-reaching influence, being, in fact, the real founder of the great school of German organists which flourished during the seventeenth century. (See Music, History of, *X*.) It was he that originated the organ fugue (see Fugue) built upon a single subject to which countersubjects were gradually added. Of subsequent masters none equaled him until the mighty Bach appeared, Bach bringing this form of the fugue to perfection. Besides the organ works, upon which his importance chiefly rests, he set to music all the Psalms of David in four books (4–8 voices) and wrote *Rimes françoises et italiennes* and *Cantiones Sacræ cum basso continuo ad organum.* A complete edition of his works, in 12 volumes, edited by Max Seiffert under the auspices of the *Vereenigung voor Noord-Nederlands Muziekgeschiedenis,* was published by Breitkopf and Härtel in Leipzig (1895–1903). Consult F. H. J. Tiedeman, *Jan Pieters Sweelinck, een bio-bibliografische Scheets* (Amsterdam, 1892).

SWEE'NY, Thomas William (1820–92). An American soldier, born at Cork, Ireland. He went to the United States in 1832; in 1846 enlisted as second lieutenant in Burnett's New York Volunteers, and fought under General Scott in Mexico. At the outbreak of the Civil War he was in command of the arsenal at St. Louis, Mo. In reply to efforts of Confederate sympathizers to induce him to surrender that important post, he declared that before he would do so he would blow it up. As second in command he participated in the capture of Camp Jackson in May, 1861; assisted in organizing the Home Guards, and was chosen brigadier general of that organization, and commanded the Fifty-second Illinois at Fort Donelson. At Shiloh he successfully defended a gap in the Union line. He commanded the second division of the Sixteenth Army Corps in the Atlanta campaign. In 1866 he took a prominent part in the Fenian invasion of Canada. He retired from the army in 1870 with the rank of brigadier general.

SWEET, Benjamin Jeffrey (1832–74). An American soldier, born at Kirkland, Oneida Co., N. Y. At the age of 16 he moved with his father to Wisconsin. At the outbreak of the Civil War he helped to raise two regiments, and became colonel of one of them, the Twenty-first Wisconsin. At the battle of Perryville he received a wound that incapacitated him from further service in the field. In the spring of 1864 he was put in command of Camp Douglas at Chicago. In the following July and again in November he defeated plots of the Knights of the Golden Circle (q.v.) to capture Chicago and release the 10,000 Confederate prisoners confined in Camp Douglas. For these services he was promoted brigadier general of volunteers. From 1869 till 1870 he was United States pension agent at Chicago, and from 1870 till his death was First Deputy Commissioner of Internal Revenue at Washington.

SWEET, Henry (1845–1912). An English philologist, born in London. He was educated at King's College, London, at Heidelberg, and at Balliol College, Oxford. He devoted himself principally to Anglo-Saxon and phonetics. He was the founder and leading spirit of the English school of phonetics, and his influence was such that the teaching of English pronunciation in Germany is based almost entirely on his work. He also made researches into Arabic and Chinese, and on the science of language in all its aspects he was a profound and original thinker. From 1901 until his death he was University Reader in Phonetics at Oxford. Of his editions of Anglo-Saxon texts the most important are King Alfred's version of Gregory's *Cura Pastoralis* (1871); *Anglo-Saxon Reader* (7th ed., 1894); *Anglo-Saxon Primer* (3d ed., 1884); *Alfred's Translation of Orosius* (1883); *Epinal Glossary* (1883); *Oldest English Texts* (1885); *Student's Dictionary of Anglo-Saxon* (1897). Among his contributions to Anglo-Saxon philology are his *Dialects and Prehistoric Forms of Old English* (1876), and *A Sketch of Anglo-Saxon Poetry,* in Wharton's *History of English Poetry,* vol. iv (London, 1871). His work in phonetics includes his *Handbook of Phonetics* (1877); *History of English Sounds* (2d ed., 1888); *Primer of Phonetics* (1890; 3d ed., 1906); *Sounds of English* (1908). He is likewise the author of *Words, Logic, and Grammar* (1876); *Elementarbuch des gesprochenen Englisch* (2d ed., 1886); *New English Grammar* (1898–1900); *Current Shorthand, Orthographic and Phonetic* (1892); a literary study on *Shelley's Nature-Poetry* (1891); primers of Middle English (1884–86) and of Icelandic (1886); *The Practical Study of Languages* (1900); *The History of Language* (1900).

SWEET, John Edson (1832–1916). An American engine builder, born at Pompey, N. Y. He was a builder and architect in the South until 1861, and was then engaged as an inventor and mechanical draftsman until 1873. In 1873–79 he served as professor of practical mechanics at Cornell. After 1880 he was president of the Straight Line Engine Company at Syracuse, N. Y. He was president of the American Society of Mechanical Engineers (1884), which awarded him the John Fritz medal in 1914; of the Engine Builders' Association of the United States (1899–1901); and of the Syracuse Metal Trades Association (1906–07). He published *Things that Are Usually Wrong* (1906).

SWEETBRIER. See Eglantine.

SWEET CALABASH. See Granadilla.

SWEET CICELY. See Chervil.

SWEET CLOVER. See Melilotus.

SWEET CORN. See Maize.

SWEET FERN. A popular name for *Myrica asplenifolia* and *Myrrhis odorata,* also known as sweet cicely, both of which have fernlike foliage. The former, being rich in tannin, has been employed as an astringent in domestic medicine; the latter is employed in cooking, for its agreeable flavor.

SWEET FLAG. See Acorus.

SWEET GALE. See Candleberry.

SWEET GUM. See Liquidambar.

SWEET OIL. See Olive Oil.

SWEET PEA (*Lathyrus odoratus*). An old-fashioned papilionaceous garden flower brought into prominence and greatly improved in form and color late in the nineteenth century. The plant is a free random grower like other peas, but has perfumed flowers of greater beauty. Sweet peas should be planted as early in spring as the ground can be worked. Rich, deeply prepared clay loam is best. Thin, dry soils are not satisfactory. The seed should be sown thinly, 2 to 3 inches deep in trenches 4 to 5 inches broad and as deep, 3 to 3½ feet apart. Brush or trellis should be provided when the plants are 2 inches high, and shallow cultivation given through the growing season and blooming period, gradually filling the trench. No pods should be allowed to ripen as long as flowers are wanted: growth ceases with this ripening. Several hundred named varieties are in cultivation, including nearly a hundred winter-flowering varieties for the forcing house. Two other closely related peas are also cultivated for their flowers—the sweet tangier pea (*Lathyrus tingitanus*) and the perennial or everlasting pea (*Lathyrus latifolius*). Both have long been in cultivation in Europe. The latter, which is very hardy, has many-flowered clusters, large standard scentless flowers, strongly veined leaflets, and broad, hairless pods. There are several diseases of sweet peas that are quite destructive at times. The disease called streak in England is now known to be due to *Bacillus lathyri*, a species of bacteria, which also attacks clovers, garden beans, etc. *Fusarium lathyri* attacks the roots and *Sclerotinia libertiana* causes a collar rot of sweet peas. *Glomerella rufomaculans*, the cause of the bitter rot of apples, also causes an anthracnose of sweet peas. Seed and soil treatment with fungicides (q.v.) and planting resistant strains where any are known are suggested as methods of prevention. Consult: T. Stevenson, *The Modern Culture of Sweet Peas* (London, 1911); G. W. Kerr, *Sweet Peas up to Date* (Philadelphia, 1914); "Sweet Pea Studies," in Cornell Agricultural Experiment Station, *Bulletins 301, 319, 320, 342* (Ithaca, N. Y.). See LATHYRUS.

SWEET PEA (*Spencer variety*).

SWEET POTATO, or BATATAS (*Ipomœa batatas*). A perennial plant of the family *Convolvulaceæ*, with long creeping stems, heart-shaped leaves on long stalks, and variously lobed large purple flowers resembling those of the best-known species of *Convolvulus*, and large oblong or elongated roots. Authorities differ as to its origin (East India or America), but it is now cultivated in all tropical and subtropical countries for its sweet, wholesome roots, which are highly esteemed as an article of food. In the United States the sweet potato thrives best in the South Atlantic and Gulf coast States, but may be grown for home use as far north as southern New York. It is grown in the central valleys of California, but does not do well in dry arid regions and where the nights are cool during the growing season.

The sweet potato is propagated by sets obtained from the tubers sprouted in a specially prepared bed and when about 4 inches tall planted 18 inches apart in rows 3½ feet apart in the field; the later vine cuttings, commonly used in the Gulf States and as far north as Virginia, require from 90 to 105 days to mature their roots. The crop grows best in a warm, sandy, well-drained soil. It requires clean cultivation. Early digging yields only one-half to two-thirds as much as may be obtained from the matured crop, which averages from 250 to 275 bushels per acre. The quantity and quality of the crop decrease as the northern limit of culture is approached. The roots should be harvested before frost and when the ground is dry. The roots must be stored in a rather warm, dry place, as otherwise heavy losses from rotting occur. The so-called "yams" grown in the United States are all sweet potatoes.

The most serious diseases of the sweet potato destroy the fleshy roots. The black rot (*Sphæronema fimbriatum*), which appears as greenish-black irregular spots which increase in size and eventually destroy the whole root, may be spread by diseased tubers in the seed bed or through fungus in the soil. At the New Jersey Experiment Station sulphur in the soil has been used with success as a preventive. Dry rot (*Diaporthe batatatis*) dries, wrinkles, and fills the roots with powder. It attacks the whole root in the field. Vine wilt, yellows or stem rot, are caused by species of *Fusarium*, and it is often difficult to get a stand of sweet potatoes on account of the destruction of the young plants by these fungi. Soil rot (*Acrocystis batatas*) is often destructive of sweet potatoes in the field. Nearly all the above diseases are spread through seed tubers, slips and seed beds, hence treating tubers with fungicides and attention to sterilizing seed beds is advocated. Rotation of crops and destruction of diseased material are recommended as preventatives. There are several storage rots of the sweet potato. A soft rot (*Rhizopus nigricans*) attacks stored roots, usually commencing at places where the skin has been broken. Other rots, more or less characterized by blackening, are due to *Trichoderma koningi*, *Sclerotium bataticola*, and *Diplodia tubericola*. Since moisture favors their spread, sweet potatoes should be stored in well-ventilated, dry rooms. A leaf spot (*Septoria bataticola*) often attacks and turns the foliage white, and a leaf mold (*Cystopus ipomœæ-panduranæ*) turns the leaves, especially the older ones, brown. Spraying with Bordeaux mixture or other fungicide (q.v.) is recommended for these last two and the first disease.

As ordinarily prepared for the table the skin constitutes on an average 20 per cent and the edible portion 80 per cent of the root. The edible portion has the following percentage composition: water, 69.0; protein, 1.8; fat, 0.7; nitrogen-free extract, 27.4; and ash, 1.1 per cent, the fuel value being 570 calories per pound. Sweet potatoes are a succulent food, the chief nutrient being carbohydrates, the principal of which is starch. Sugars are also found, 2.5 per cent cane sugar and 3.4 per cent invert sugar being the average amount found in a large number of analyses. In addition to the quantities consumed in the fresh state, sweet potatoes are also canned and evaporated. They are sometimes fed to farm animals, especially pigs. To secure the greatest profit the pigs should harvest the crop and some nitrogenous feed like cowpeas should also be fed. Consult: L. H. Bailey, *Cyclopedia of Agriculture* (New York, 1907); Beattie, "Sweet Potatoes," in United States

Department of Agriculture, *Farmers' Bulletin No. 324* (Washington, 1908); H. C. Thompson, "Storing and Marketing Sweet Potatoes," in United States Department of Agriculture, *Farmers' Bulletin No. 548* (Washington, 1913); J. G. Nordin, *The Sweet Potato: How to Grow and Keep it* (Russellville, Ark., 1912). See Plate of Yam, Sweet Potato, etc.

SWEET-POTATO INSECTS. The leaves of the sweet potato are punctured by a small bronzed flea beetle (*Chætocnema confinis*), which eats channels along the veins soon after the plants have been set out and causes the leaves to shrivel. The most serious of the insect enemies of the crop are several species of tortoise beetles. (See Tortoise Beetle.) Among the commonest species are the two-striped tortoise beetle (*Cassida bivittata*), which is pale yellow and has two black stripes on each wing cover. The larva is dirty yellowish white and covers itself with cast skins and excrement. It gnaws irregular holes in the leaves underneath which it transforms to pupa. The golden tortoise beetle (*Coptocycla aurichalcea*), which is more abundant, resembles gold tinsel and is beautifully resplendent. The larva is dark brown and feeds like the previous species. Arsenical sprays have been recommended.

SWEET-SCENTED GRASS. See Holy Grass.

SWEET-SCENTED SHRUB. See Calycanthus.

SWEEP SOP (*Annona squamosa*). A small deciduous tree of the family Annonaceæ, a native of tropical America and introduced in other warm countries. The scaly greenish fruit has a soft, somewhat mealy, sweet, and luscious pulp with a musky aromatic odor and flavor. It is much used, generally raw, but sometimes cooked. Other species of Annona yield edible fruits, as the sour sop (*Annona muricata*), the custard apple (*Annona reticulata*), the cherimoyer or cherimoya (*Annona cherimolia*), pond apple (*Annona glabra*), etc.

SWEET SULTAN. A garden plant. See Centaurea.

SWEET VERNAL GRASS. A slender European grass (*Anthoxanthum odoratum*), about 18 inches tall and bearing a loose cylindrical spike of flowers. It is noted for its pleasing odor due to coumarin, which is most noticeable when the plant is in flower. It is extensively naturalized in the United States. It has some value as forage but cattle often refuse to eat it, apparently not liking the odor. See Plate of Grasses.

SWEET WILLIAM, Wild. See Phlox.

SWELL (AS., OHG. *swellan*, Ger. *schwellen*, to swell). A term applied to a local thickening of a mineral deposit. The phenomenon is not uncommon in many metalliferous veins, and is caused by local expansions of the ore-bearing fissure, due to dynamic action or solution. In coal seams a similar phenomenon is often met with, but the swell here is caused by movements of the floor and roof of the coal bed.

SWELL. See Organ.

SWELLFISH. One of the many names applied to plectognath fishes, especially of the family Tetraodontidæ, which inflate their bodies with air until they become globelike and the spines of their skin rigid, making them unpleasant morsels for an enemy to swallow. Other names are bottlefish and boxfish. A familiar example is *Tetraodon turgidus*, of the eastern American coast waters, also called swell toad and puffer. Cf. Globefish. See Plate of Plectognath Fishes.

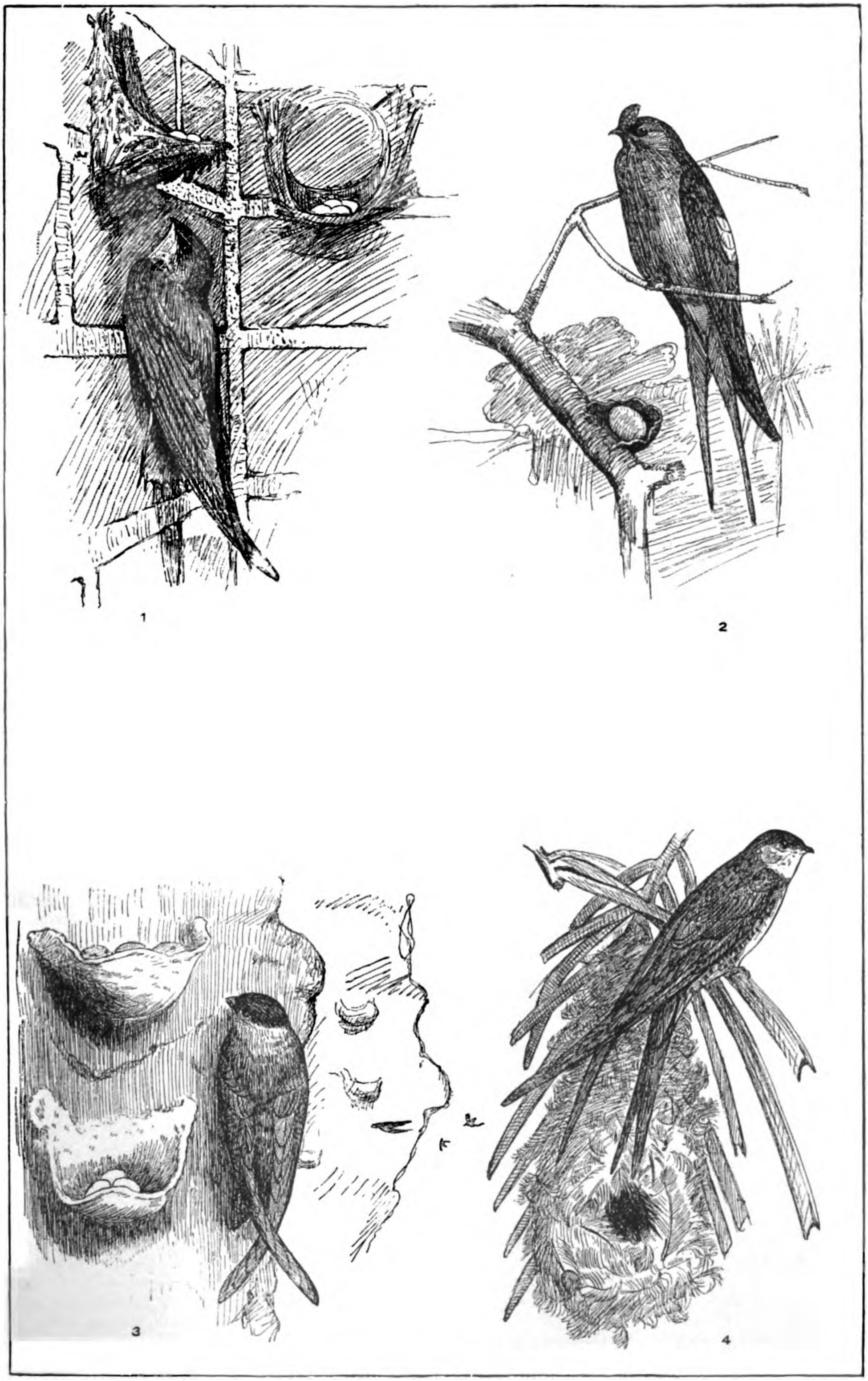
SWELL SHARK. A small, voracious gray shark (*Catullus uter*) of the family Scylliidæ, common on the Pacific coast from central California to Chile, and often taken in lobster pots. When caught it will inflate its stomach with air, until its thickness is equal to a third of its length, and will float belly upward until it supposes the danger past; hence its vernacular name. See Plate of Lampreys and Dogfish.

SWETCHINE, svĕch-ēn′, Anne Sophie Soymanov (1782–1857). A Russian-French author, born in Moscow. Her father was Soymanov, the founder of the Moscow Academy. She married in 1799 General Swetchine and established at St. Petersburg a salon of much distinction, frequented by émigrés. Thus she came into touch with Joseph de Maistre in 1815, and was by him converted to Roman Catholicism. In the next year she moved to Paris, where her equally famous salon took on a distinctly religious tone. Her writings, all of a religious or contemplative character, are edited with a *Life* by Falloux (Paris, 1860); her *Lettres* by the same editor (ib., 1862; 5th ed., 1881), who added a journal of her *Conversation* (ib., 1863), and *Lettres inédites* (ib., 1866). Her letters have been translated by H. W. Preston (Boston, 1867). Consult C. A. Sainte-Beuve, *Nouveaux lundis* (vol. i, Paris, 1863–72), and Edmond Scherer, *Etudes critiques sur la littérature contemporaine*, vol. i (ib., 1863).

SWETE, swēt, Henry Barclay (1835–). An English clergyman, especially distinguished for his work in textual criticism. Born at Redlands, Bristol, he was educated at King's College, London, and at Caius College, Cambridge. In 1877–90 he was rector of Ashdon, Essex; in 1882–90 served as professor of pastoral theology at King's College, London; and in 1890 was made regius professor of divinity in Cambridge. In 1911 he became honorary chaplain to the King. Among his published works are two essays on the *History of the Doctrine of the Holy Spirit* (1873; 1876); an edition of *Theodore of Mopsuestia's Commentary on the Epistles of St. Paul* (1880–82); *The Old Testament in Greek* (1887–94; 3d ed., 1901–07); *The Akhmîm Fragment of the Gospel of St. Peter* (1893); *The Psalms in Greek According to the Septuagint, with the Canticles* (1889; 2d ed., 1896); *The Apostles' Creed in Relation to Primitive Christianity* (1894; 3d ed., 1899); *Church Services and Service Books before the Reformation* (1896); *An Introduction to the Old Testament in Greek* (1900; 2d ed., 1902); *The Apocalypse of St. John* (1906; 2d ed., 1907); *The Appearances of Our Lord after the Passion* (1907; 2d ed., 1908); *The Holy Spirit in the New Testament* (1909; 2d ed., 1910); *The Ascended Christ* (1911); *The Holy Spirit in the Ancient Church* (1912); *The Last Discourse and Prayer of Our Lord* (1913); *The Holy Catholic Church* (1915).

SWETTENHAM, swĕt′en-am, Sir Alexander (1846–). A British colonial administrator, brother of Sir Frank Swettenham. He was born at Derby, England, and was educated at Clare College, Cambridge. Between 1868 and 1901 he held various government offices in Ceylon, Cyprus, Singapore, and the Straits Settlements (Acting Governor, 1898 and 1900). He was Governor and Commander in Chief of Brit-

SWIFTS AND THEIR NESTS



1. AMERICAN CHIMNEY SWIFT (Chætura pelagica).
2. TREE SWIFT AND NEST (Macropterix coronata).
3. SALANGANE (Collocalia fuciphaga) and edible nests.
4. PALM SWIFT (Micropus phœnicobia).

ish Guiana in 1901–04 and Captain General and Governor in Chief of Jamaica in 1904–07. In 1907 Jamaica was visited by a severe earthquake, which partly destroyed Kingston, the capital and seat of government. The United States government willingly sent assistance to Jamaica, but Swettenham appeared to resent American interference and aroused harsh criticism, both in the United States and Britain, for his failure cordially to avail himself of the offered relief. He retired from office the same year. In 1898 he was knighted (K.C.M.G.).

SWETTENHAM, Sir Frank Athelstane (1850–). A British administrator and author, brother of Sir Alexander Swettenham. He was born at Belper, Derbyshire, and after an academic education entered the civil service of the Straits Settlements in 1870. He rose to be Resident General of the Federated Malay States (1896–1901) and Governor and Commander in Chief of the Straits Settlements (1901–04). He published: *Malay-English Vocabulary* (1880); *About Perak* (1893); *Malay Sketches* (1895); *Unaddressed Letters* (1898); *The Real Malay Pen Pictures* (1899); *British Malaya* (1906); *Also and Perhaps* (1912); *Malay-English Dictionary*, with Hugh Clifford.

SWEYN, swān, **SWEGEN,** svā′gen, or **SVEND,** svĕnd. A King of Denmark, father of Canute (q.v.). See Denmark.

SWIETEN, swē′ten, Gerard van (1700–72). A Dutch physician and scholar, born at Leyden, where, after studying philosophy at Louvain, he pursued medicine under Boerhaave, whose most distinguished pupil he became. Called to Vienna in 1745 as physician in ordinary to Maria Theresa, he instilled new life into every branch of science, but especially promoted reforms in the study of medicine, which, as director of the faculty, he raised to a high standard. Reforms in the other faculties presently followed. He became custodian of the Imperial library. In science he sought his fame as an expositor of his teacher Boerhaave. In 1758 Van Swieten, having saved the life of the Empress, was created a Baron. His observations on military hygiene he deposited in *Kurze Beschreibung und Heilungsart der Krankheiten welche am öftesten in dem Feldlager beobachtet werden.* His *Commentaria in Hermanni Boerhaave Aphorismos de Cognoscendis et Curandis Morbis* (1741–42; new ed., 1787–92) hold a permanent place in medical literature.

His son Gottfried (1733–1803) succeeded him as custodian of the Imperial library and was an intimate friend of Haydn and Mozart. For the former he adapted the text of the *Creation* from the English and wrote the text of *The Seasons.*

SWIFT (AS. *swift*, fleet, rapid; connected with Eng. *swoop, sweep*). A bird of the family Cypselidæ, nearly related to the humming birds. The swifts are widely distributed, and some are only found in tropical countries; others are birds of passage, and spend the summer in colder parts of the world. Many are popularly called swallows, as the chimney swift (q.v.), the only swift common in the United States, almost always called chimney swallow. This is on account of a resemblance in the long, pointed wings, the small, widely gaping bill, the weak feet, and to the habit of capturing their insect prey by untiring hunting in the air. It is thus of some indirect value to man, as it feeds largely upon small beetles, flies, bugs, grasshoppers, and other injurious insects. About 75 species of swifts are known, half of which are American, although only four occur in the United States. Swifts are mostly dull-colored birds, black, brown, gray, and white, and are seldom over seven inches in length or more than twice that across the wings. They are remarkable for the development of the salivary glands, the secretion of which is used in building the nest. The latter may be nearly pure saliva, as in the edible nests of the salangane (q.v.), or (more commonly) may be composed of grass, twigs, or other vegetable matter, glued together and to the support by saliva. Nests are attached to cliffs, interiors of chimneys, hollow trees, the spathes of palm blossoms, or the leaves of palms, etc. The eggs are pure white, unspotted. Along the Pacific coast occurs also the great black swift (*Cypseloides niger*), ranging from the West Indies and Mexico north to British Columbia. It breeds on inaccessible cliffs, and is little known. Another large swift (*Cypselus,* or *Aëronautes, melaneucus*), which has chin, throat, and breast white, occurs in the southwestern United States, north to Wyoming and Utah, and it also breeds on practically inaccessible cliffs. To the same genus as the last-named species belong the best-known European forms. In this genus, which contains about 25 species, three-fourths belonging to the Old World, the tail is usually forked, the legs and toes are feathered, and all the toes are directed forward. The common and widespread European swift is *Cypselus apus.* Another notable species is the alpine swift of the mountainous parts of South Europe. To this same genus belong the palm swifts of the West Indies, of which a Jamaican species (*Micropus phœnicobia*) is noteworthy on account of its nest, which when placed in a palmetto is glued to the surface of one of the great fronds and formed of silk-cotton in the shape of a bag or watch pocket open at the side. Some of the most curious and interesting swifts dwell in the Orient. One genus (*Macropteryx*) contains the tree swifts, whose plumage is peculiarly soft, the tails deeply forked and the head crested. They are shy and breed in rocky jungles, forming a little cup-shaped nest of flakes of bark glued together with saliva and attached to the side of the branch of a tree. There is only one egg, which (as is the case with all the family) is pure white. Five species are found in the Indo-Chinese region and eastward to the Solomon Islands.

SWIFT. A West African gazelle. See Mohr.

SWIFT, Benjamin. See Paterson, William Romaine.

SWIFT, Gustavus Franklin (1839–1903). An American merchant, born on Cape Cod, Mass. After various business experiences he engaged in 1875 in meat-packing in Chicago, and was the first to ship meat long distances successfully. He founded and was president of the corporation of Swift & Company, one of the largest packing firms in the United States, and was a prominent member of many other similar concerns. His business enterprise did much for the trade development of Chicago.

SWIFT, Jonathan (1667–1745). The greatest of English satirists, born in Dublin, Nov. 30, 1667. He was of Yorkshire origin. His father had been attracted to Ireland by the prospect of political preferment, but died before Jonathan's birth. When he was six years old, his uncle Godwin sent him to Kilkenny School, the Eton of Ireland, where Congreve and Berkeley were his contemporaries. At 15 he was sent to Trinity College, Dublin. At Trinity the lad read much history and poetry, but was disdainful of his courses and of regulations, and received his degree only by special grace. The disturbances of the Revolution of 1688 drove him to England, and in 1689 he obtained employment as secretary to Sir William Temple (q.v.) at Moor Park in Surrey. Swift found the position trying, though he calls Temple "a man of sense and virtue." In 1694 he quarreled with his employer and returned to Ireland to seek ordination, obtaining the small living of Kilroot, near Belfast. But he wearied of rural isolation and in 1696 went back to Moor Park. Perhaps the impelling motive was the presence there of Esther Johnson, subsequently immortalized as "Stella," the daughter of a merchant who died, and whose widow became the companion of Temple's sister, Lady Gifford, who lived with Temple at Moor Park. Swift had a hand in her education; she was now, at 15, growing into a very beautiful woman. Swift remained at Moor Park until Temple's death in 1699. His sojourn, though some incidents of it may have hurt his pride, was of inestimable value to him. Besides the daily association with a statesman and a man of culture, he had time for an enormous amount of reading and for practice in writing. His only relics, however, of this period are some Pindaric odes, a species of composition for which he was little qualified, and which Dryden characterized frankly with the judgment, "Cousin Swift, you will never be a poet."

His first prose composition betrayed his resentment. This was *The Battle of the Books* (written 1697, but not published till 1704), a burlesque of the controversy then raging over the relative merits of the ancients and the moderns, in which Swift champions the ancients, and, with the most potent and mordant satire, attacks modern pedantry in particular and modern shams in general. In 1699 he returned once more to Ireland, as secretary and chaplain to Lord Berkeley, but lost the secretaryship and did not get the expected deanery of Derry. He was, however, appointed to the rectory of Agher, with the vicarages of Laracor and Rathbeggan. Swift realized that he was a poor preacher, calling his sermons pamphlets. He soon began his career as a political pamphleteer, which was to be so epoch making, with *A Discourse on the Dissensions in Athens and Rome* (1701), really a defense of Somers and the other Whig lords threatened with impeachment. In 1704 he published the *Tale of a Tub*, the most amusing of his satirical works, the most strikingly original, and the one in which the full compass of his powers was most perfectly displayed. With matchless irony he ridiculed many forms of pretentious pedantry, mainly in literature and religion. The book led to many doubts of his orthodoxy and injured his chances of ecclesiastical preferment.

Though nominally a Whig, Swift differed from his party on important questions. He hated its war policy and its alliance with dissent. These differences, along with the failure to gain anything from the connection, made it easy for him to break from his former allies. In 1710 the Tories came into power with Harley and St. John at their head and Swift was easily won over. He turned upon the Whigs with a series of brilliant squibs, assumed the editorship of the *Examiner*, the Tory organ, Nov. 2, 1710–June 14, 1711, and produced several independent pamphlets, in all of which he ably defended the policy of the Tories. Of these particular papers the most powerful was the *Conduct of the Allies* (November, 1711), in which the position was maintained that the Whigs had prolonged the Continental War out of self-interest. Swift certainly led the way to the dismissal of Marlborough and the Peace of Utrecht (1713). For three years Swift was among the most conspicuous men in politics and society. His advent marks a new era in English politics, with the accession of public opinion, fostered by him more than by any other man, to supreme power.

The *Journal to Stella* begins in 1710. Swift had invited her in 1701 to Ireland, with her friend Mrs. Dingley. They lived in his house at Laracor and Dublin when he was absent, and in lodgings when he was present. The diary letters which he sent to Stella and Mrs. Dingley, ending with April, 1713, compose one of the most interesting documents that ever threw light on the history of a man of genius. In London he lodged close to Mrs. Vanhomrigh, whose daughter Hester (called Vanessa by him) fell in love with Swift, and hugged the chains to which Stella merely submitted. In 1714 the Tory ministry fell, Queen Anne died, and Swift's power was gone. In spite of the Queen's distrust of him, he had been appointed to the deanery of St. Patrick's in Dublin, in 1713, and thither he now retired, no doubt hoping that the move would settle his private complications for him. But, as luck would have it, Vanessa's mother died and she followed him to Celbridge, in the near neighborhood. It is possible that in 1716 Swift may have married Stella. Leslie Stephen, after a careful examination of the evidence, allows it weight, but declares it inconclusive. He undoubtedly loved her and shows a tenderness never displayed in any other case. From 1717 to 1720 he and Vanessa remained apart, but in the latter year he began to pay her regular visits. In 1723 Vanessa took the desperate step of writing to Stella. Swift rode down to Marley Abbey, where she was staying, with a terrible countenance, petrified her with a frown, and departed, flinging on the table a packet containing her letter to Stella. Vanessa died within a few weeks, leaving behind her the poem he had written for her, *Cadenus and Vanessa*, and their correspondence.

Five years afterward Stella followed Vanessa, and the wretched lover sat down the same night to record her virtues in language of unsurpassed simplicity. A lock of her hair is preserved with the inscription in Swift's handwriting, most affecting in its apparent cynicism, "Only a woman's hair." Between the death of Vanessa and that of Stella, as though withheld by an evil fate until he could no longer enjoy it, came the greatest political and literary triumph of Swift's life. He had fled to Dublin a broken man, politically extinct; a few years raised him to the summit of popularity, though power was denied him. In 1724 he took Ireland by storm with the *Drapier Letters*, a series of wonderfully effective pamphlets, directed against the patent granted to one Wood, a hanger-on of the court, for coining copper halfpence in Ireland.

The noise of this success had hardly died away when Swift acquired more lasting glory by the publication of *Gulliver's Travels*. Few books have added so much to the innocent mirth of mankind as the first two parts of *Gulliver*.

With the omission of certain passages, it is one of the most delightful children's books ever written. Yet it has been equally valued, as Swift meant it to be, for an unrivaled satire on mankind. He seems to have solaced himself with its composition in the early years of what he called his exile; and if the later books show his most savage temper, it is well to remember that they were written during the years when he was attacking political corruption and when his private happiness was being destroyed. The completed manuscript was published anonymously in the winter of 1726, meeting with instantaneous success.

His last years, however, were clouded by constantly increasing torture from disease. He governed his cathedral with great strictness and conscientiousness, and for years after Stella's death held a sort of miniature court at the deanery. But death was becoming more and more real and welcome to him. His regular farewell to a friend in these latter years was, "Good night—I hope I shall never see you again." A period of absolute mental decay closed with his death on Oct. 19, 1745. He was buried in his cathedral in the same coffin with Stella, with the epitaph written by himself, "Here lies the body of Jonathan Swift, D.D., dean of this cathedral, where burning indignation can no longer tear at his heart. Go, traveler, and imitate if you can a man who was an undaunted champion of liberty."

Swift's character, as a whole, forms a fascinating psychological study. From some passages of his life he would appear a heartless egotist; and yet he was capable of the sincerest friendship, and could never dispense with human sympathy. He is the most tragic figure in the literature of the eighteenth century. "To think of him," says Thackeray, "is like thinking of the ruins of a great empire." Nothing finer or truer could be said.

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SWIFT, Joseph Gardner (1783–1865). An American soldier, born at Nantucket, Mass. He graduated at the United States Military Academy in 1802, being the first graduate of that institution; became a captain in 1806 and a major in 1808, and in July, 1812, was promoted to be colonel and chief engineer of the United States army. In the War of 1812 he served as chief engineer of the army under General Wilkinson in the St. Lawrence campaign of 1813; later had charge of the construction of the fortifications of New York harbor; was brevetted a brigadier general in February, 1814; and was superintendent of the United States Military Academy by virtue of his office as chief of engineers from 1812 to 1817. He resigned from the army in November, 1818, and afterward engaged in numerous engineering enterprises.

SWIFT, Lewis (1820–1913). An American astronomer, born at Clarkson, N. Y. He was educated at Clarkson Academy and about 1854 took up the study of astronomy. He was noted for his numerous discoveries of comets and nebulæ previously uncatalogued. He became director of the Warner Observatory, Rochester, N. Y., in 1882. His 16-inch telescope at that institution was presented to him as a gift by the citizens of Rochester and was subsequently removed by him to the Lowe Observatory on Echo Mountain, California, where he continued his researches until failing eyesight compelled his retirement in 1901. In 1881 he was awarded the Lalande prize of the Paris Academy, and the Jackson Gwilt medal and gift of the Royal Astronomical Society in 1897. He also received several comet medals from the Astronomical Society of the Pacific.

SWIFT, Lindsay (1856–). An American librarian, bibliographer, and literary historian, born in Boston. A graduate of Harvard (1877), he became editor on the staff of the Boston Public Library. He made valuable contributions to the study of American literature and history, his publications comprising chiefly: *Massachusetts Election Sermons* (1897); *The Great Debate between Hayne and Webster* (1898); *Brook Farm* (1900); *Literary Landmarks of Boston* (1903); *Benjamin Franklin* (1910); *William Lloyd Garrison* (1911).

SWIMMING (from *swim*, AS., OHG. *swimman*, Ger. *schwimmen*, to swim; connected with Eng. *swamp*). The act by which an animal progresses in the water. Man is the only animal who does not swim naturally, yet keeping the head above the water is an act which most human beings may easily learn.

The swimming of quadrupeds amounts simply to walking in the water, whereas man has adopted many kinds of stroke besides the dog-paddle method by which most land animals propel themselves. These methods involve swimming on the breast, with a broad sweep of the arms and a froglike motion of the legs; swimming on the side and swimming on the back. He has also learned to float and to tread water. In the latter case the body is held in a perpendicular position and the hands and feet beat downward. The old side stroke is the favorite style for long-distance racing. It consists of three alternate motions, an under-arm and an over-arm stroke, and a scissors leg stroke, coming between the two arm strokes. The Trudgeon stroke is a form of swimming introduced into England in 1873 by J. Trudgeon who said he had learned it in South America. This is virtually the same operation as the thrust form, described in 1825 by Clias, the writer on swimming. It is one of the fastest of all strokes for short distances. It consists of alternate overhead strokes, with a frog kick simultaneous with one of the arm strokes, the body swimming on the breast. There are several modifications of this stroke, notably that introduced by Alexander Meffert, the famous American amateur mile-champion, in which the head and forearm are kept submerged as the body is pushed forward, the body being turned from the waist and the face brought above the water as the body checks between strokes.

International swimming races between the various parts of the United Kingdom are held annually, the universities of Oxford and Cambridge include swimming on the list of inter-university sports, and intercollegiate competitions take place within the universities themselves. An amalgamation of clubs in 1869 first brought swimming under organized control, and this association developed, under several successive names, into the Amateur Swimming Association in 1886. In addition to the Amateur Swimming Association, great practical good has come to the art by the establishment of classes of already good swimmers to be further instructed in the methods of rescuing drowning persons and resuscitating those apparently exhausted.

In the United States the first championship races were held in 1877 by the New York Athletic Club, and were annual thereafter up to 1888, excepting the years 1879–82. In 1888 the management was ceded to the Amateur Athletic Union. In 1896 an indoor meet was added. Swimming records are dependent to some extent upon local conditions, though as a rule the time for standard distances shows a steady improvement. The record in 1915 (made by an Australian) was 23.16⅘. The 100-yard record in 1915 was 54⅗ seconds, made by an American. See Water Polo.

Consult: E. T. Brewster, *Swimming* (Boston, 1910); G. H. Corsan, *At Home in the Water* (New York, 1910); Frank Sachs, *The Complete Swimmer* (London, 1912); F. E. Dalton, *Swimming Scientifically Taught* (New York, 1912); H. R. Austin, *How to Swim* (London, 1914).

SWIN'BURNE, Algernon Charles (1837–1909). An English poet, son of Admiral Charles Henry Swinburne and Lady Henrietta Jane, daughter of the third Earl of Ashbürnham. He was born in London, April 5, 1837, and was educated at Eton and at Balliol College, Oxford. There he contributed prose and verse to *Undergraduate Papers*, edited by John Nichol. After three years he left Oxford (1860) without a degree and traveled on the Continent, visiting Landor at Florence (1864). Returning to England, he became closely associated with his brother romantics, Dante Gabriel Rossetti and William Morris. Having written *The Queen Mother* and *Rosamond* (1860), two dramas recalling the fire of the Elizabethan age, he published *Atalanta in Calydon* (1865), a beautiful lyric drama cast in the mold of ancient tragedy. The next year he awakened violent criticism with *Poems and Ballads*. To his assailants Swinburne replied with unmeasured scorn in *Notes on Poems and Reviews* (1866). Besides the few pieces that reasonably disturbed the moralists, the volume contained melodious lyrics, covering a wide range of motives, Hebrew, Greek, and mediæval. Swinburne now composed a series of eloquent odes, which won universal attention. and again exposed him to censure. Beginning with "A Song of Italy" (1867), they reach a point where "the heights flash" in *Songs before Sunrise* (1871), celebrating the conflict between darkness and dawn, tyranny and freedom in revolutionary Europe. In the meantime had appeared several lyrics on other themes, of which the finest was "Ave atque Vale" (written in 1867), in memory of Baudelaire. In 1865 Swinburne published *Chastelard*, a romantic tragedy on the first period in the career of Mary Queen of Scots. He continued her history in *Bothwell* (1874) and afterward completed it in *Mary Stuart* (1881). The imposing trilogy is a chronicle history cast in dramatic form with no view to the stage. The poems thus far enumerated fairly represent Swinburne, his originality, his command over hitherto unsuspected sources of melody, his passion and vehemence.

With occasional fall in power, Swinburne produced *Erechtheus* (1876), a second and more restrained classical drama; a second series of *Poems and Ballads* (1878); the grand odes to Victor Hugo; various beautiful sonnets; translations from Villon; *Songs of Two Nations* (1875); *Songs of the Springtides* (1880); *Studies in Song* (1880); *Tristram of Lyonesse and Other Poems* (1882), passionate verse haunted by the rhythm of the sea; *A Century of Roundels* (1883); *A Midsummer Holiday and Other Poems* (1884); *Marino Faliero*, a tragedy (1885); *Locrine*, a tragedy (1887); a third series of *Poems and Ballads* (1889); *The Sisters*, a tragedy (1892); *Astrophel and Other Poems* (1894); *The Tale of Balen* (1896); *Rosamund, Queen of the Lombards*, a tragedy (1899).

The earlier attitude of defiant revolt against the conventional social order, against kings and priests, prevented his appointment as laureate on the death of Tennyson in 1892, though he was acknowledged as the greatest surviving English poet. In his later years the note of rebellion was less violently sounded, and other feelings, the love of the sea and of little children, held place in his poems. As an artist in verse, by unsurpassed command of the resources of metrical technique, he takes a unique position. He invented many new rhythmic forms, and used none of the old without developing new beauties. His chief defect was the natural outcome of his exceptional facility of utterance and impatience of restraint, so that sense is often subordinate to sound. In criticism he took up the Elizabethan dramatists, though he made excursions elsewhere, not sparing contemporary singers. These essays have been partially collected in *Essays and Studies* (1875), *A Study of Shakespeare* (1880), and *Miscellanies* (1886). Into his prose Swinburne carried something of the passion of his verse. His prose, too, has caught the alliteration, resonance, and undulating rhythm of his verse. He died of pneumonia, April 10, 1909, at the house on Putney Hill, London, where he and Theodore Watts-Dunton (q.v.) had lived for many years.

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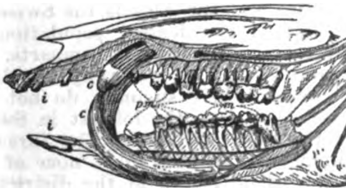
SWINBURNE, William Thomas (1847–). An American naval officer, born at Newport, R. I. After graduating from the United States Naval Academy in 1866, he served on various stations, was promoted to commander in 1896, and commanded the *Helena* in the North Atlantic fleet during the Spanish-American War. He captured the Spanish steamer *Miguel Jovar* and participated in the engagements of Tunas and Manzanilla. In 1899 he joined the fleet under Admiral Dewey at Manila, and later assisted General Lawton in his campaign. Promoted to captain in 1901, he commanded the *Texas* in 1902–04. He was a member of the General Board in 1904–06 and in the latter year was made a rear admiral. Thereafter he was commander in chief of the Pacific squadron until 1909, in which year, after a short period at the Naval War College, he was retired.

SWINDLING. See Fraud.

SWIN′DON. A municipal borough in Wiltshire, England, 77 miles west of London (Map: England, E 5). The old market town, the Svindune of Domesday, is built on an eminence commanding fine views of the surrounding country. The large locomotive and carriage works of the Great Western Railway form the town's chief source of revenue. The old town, which received a charter for a fair from Charles I, still maintains the characteristics of an agricultural centre with corn and cattle markets. Pop., 1901, 45,006; 1911, 50,751.

SWINE (AS. *swin*, Ger. *Schwein*, swine; connected with Lat. *suinus*, relating to swine, from *sus*, Gk. *ὗς*, *hys*, Ger. *Sau*, AS. *sugu*, *sū*, Eng. *sow*). The family Suidæ, containing those cloven-hoofed ungulate mammals whose domesticated races are called hogs or pigs. The swine are closely allied to the Hippopotomidæ on the one hand and to the Dicotylidæ on the other; the latter (peccaries, q.v.), indeed, are sometimes included in the term in popular usage. The three families form a group, Suina. Swine differ from hippopotami in their smaller size, in the terminal nostrils, and mobile, gristly snouts with which they obtain their food (largely roots and herbs) by grubbing in the ground. Each foot has four digits, two of which are functional, while the others, although elevated, are often useful in preventing the foot from too readily sinking into marshy ground. They are generally hairy, the babirussa (q.v.) being an exception. The dentition is complete and of the character exhibited by the accompanying illustration of a hog's teeth. The great canines form tusks, which in the males (boars) become formidable weapons, and in some cases (as the babirussa) are doubly developed. The food consists largely of vegetable matter, but may include tough roots, nuts, etc., and also flesh, fish, shellfish, etc.; the stomach is simple, and there is no cæcum (except in the peccaries). These animals are somewhat gregarious, often gathering into small bands, and some peccaries form large herds. The boars fight terrifically in competition for the favor of the females (sows), and valorously defend their young (which are usually striped); they are also courageous in resisting all foes, so that the hunting of certain species affords exciting sport. The pork is usually nutritious and palatable. The family is not large, and is mainly tropical in its distribution. The Suidæ are confined to the Old World; the Dicotylidæ to the warm latitudes of America. The type genus is *Sus*, of which the wild boar (see Boar) of Europe and Asia is the most prominent species. India and the Malayan region have together three other species, and western Africa possibly a fifth. The African wart-hogs (q.v.) include two species of the genus *Phacochœrus*, distinguished from *Sus* principally by the huge tusks and great protuberances on the face. The Celebesian babirussa (q.v.) represents alone another genus; and the African river hogs close the list with two species. One genus and two species enumerate the peccaries. See Hog for an account of domestic races.



DENTITION OF SWINE.

i, incisors; *c*, canines (tusks); *pm*, premolars; *m*, molars. The nervous system of the teeth is also shown.

Fossil forms of the genus *Sus* are known in rocks of Middle Miocene to Pleistocene time in Europe, India, and Africa. The earliest representatives of the hog family appear in the Eocene of both North America and Europe, and the group reached an important stage of evolution in late Tertiary time. One notable genus, not, however, in the direct line of pig ancestry, is *Elotherium* of the Miocene, which was about the size of a rhinoceros, with large heavy head, massive shoulders, and small hind body and narrow chest, and the body supported on stilted legs that terminated in two-toed feet.

SWINEMÜNDE, svē′ne-mṳn′de. A strongly fortified port and fashionable resort on the Baltic Sea, in the Province of Pomerania, Prussia, on the island of Usedom, 37 miles north-northwest of Stettin (Map: Germany, F 2). The Swine here connects the Stettiner Haff with the sea. There is a good harbor. Formerly ships of deep draft with cargoes for Stettin used to discharge at Swinemünde. The town has valuable fisheries. Pop., 1900, 10,251; 1910, 13,914.

SWINE PLAGUE (Ger. *Schweineseuche;* Fr. *pasteurellose du poro*). It is generally held that the disease of hogs known as swine plague is caused by the filtrable virus of hog cholera and that the bipolar organism (*Bacillus suisepticus*) only plays a secondary rôle, in producing lung lesions, similar to that played by the *Bacillus choleræ suis* in producing intestinal lesions. Consult Hutyra and Marek, *Special Pathology and Therapeutics of the Diseases of Domestic Animals*, vol. i (Am. ed. from 3d rev. Ger. ed. by Mohler and Eichhorn, Chicago, 1912); E. W. Hoar, *A System of Veterinary Medicine*, vol. i (ib., 1913). See Hog Cholera.

SWING, David (1830–94). An American preacher, born in Cincinnati. He graduated at Miami University, Oxford, Ohio, in 1852, and began to study theology, but from 1853 to 1865 was professor of languages in his college. In 1866 he was called to the Fourth Presbyterian Church in Chicago and soon became one of the prominent clergymen of that city. In 1874 he was tried for heresy and acquitted, but, as a consequence, resigned his pastorate and withdrew from the Presbyterian ministry. Many of his congregation sympathized with him, and a new church was organized, meeting at first in a theatre and later in the Central Music Hall, where Dr. Swing continued to preach to one of the largest congregations in Chicago till his death. His preaching, though diverging from the verbal standards of "orthodoxy," was essentially evangelical and spiritual, and marked by intellectual power. Consult J. F. Newton, *David Swing, Poet-Preacher* (Chicago, 1909; reprinted, New York, 1914).

SWINGLE, swĭŋ′g'l, Walter Tennyson (1871–). An American agricultural botanist, born at Canaan, Pa. He graduated from the Kansas State Agricultural College in 1890, and studied abroad in 1895–96 and 1898. He had become in 1891 a special agent of the United States Department of Agriculture, for which he investigated subtropic fruits and established laboratories in Florida; became an agricultural explorer, and (after 1902) had charge of crop physiology and breeding investigations. He made several visits to the Mediterranean countries of Europe, to North Africa, and to Asia Minor, whence he introduced the date palm, pistache nut, and other useful plants, and also the fig insect to make possible the cultivation of Smyrna figs in California. In 1897, with Webber, he originated citranges, a hardy citrous fruit, by means of hybridization. Swingle invented several improvements in high-power microscopes.

SWINGLETAIL. See Thresher Shark.

SWINOMISH, swī-nō′mĭsh. See Salishan Stock.

SWIN′TON. A manufacturing town in Yorkshire, England, 4 miles north-northeast of Rotherham (Map: England, E 3). It has railway, iron, glass, and pottery works. Pop., 1901, 12,217; 1911, 13,654.

SWINTON AND PENDLEBURY, pĕn′d'l-bĕr-ĭ. A town in Lancashire, England, 5 miles northwest of Manchester. Cotton manufacture and brickmaking are its chief industries. Pop., 1901, 27,001; 1911, 30,759.

SWISS CHARD. See Chard.

SWISS FAMILY ROBINSON. A story by the Swiss writer J. R. Wyss, begun by his father and published by him under the title *Der Schweizerische Robinson*. The tale is based on the idea of *Robinson Crusoe*, and has been widely popular in many languages.

SWISS GUARD. A famous regiment of royal bodyguards in France, composed exclusively of Swiss, first constituted by royal decree in 1616. Their fidelity was absolute and on the outbreak of the Revolution of 1789 they became very objectionable to the Parisian mob. On Aug. 10, 1792, the Swiss Guards were called on to defend the palace of the Tuileries against the revolutionists. After gallant resistance to overwhelming numbers, the Swiss were ordered to lay down their arms, and they were then massacred by the infuriated assailants, the few who escaped doing so with great difficulty. It is said that nearly 800 Swiss Guards were slain. In memory of their heroic conduct and brave death the famous Lion of Lucerne (q.v.), designed by Thorwaldsen, was carved in the face of a cliff at Lucerne, Switzerland. A feeble effort to reconstitute the Swiss Guards was made in 1815, and a body with that name was organized. But it was a poor imitation of the old corps and was easily dispersed by the revolutionists in 1830. Another Swiss Guard (Guardia Svizzera), the Papal Guard, consists of 10 officers and 110 men. Only Swiss can enter it and the privates are not allowed to marry. Consult: Lutolf, *Die Schweizergarde in Rom* (Einsiedeln, 1859); Ternaux, *Histoire de la Terreur* (8 vols., Paris, 1863–81); Jaehn, *Die franzoesiche Armee von der grossen Revolution bis zur Gegenwart* (Leipzig, 1873); Pollio et Marcel, *Le bataillon du 10 août* (ib., 1881); H. M. Stephens, *History of the French Revolution* (2 vols., New York, 1886–91).

SWISS POLITICAL PARTIES. See Political Parties.

SWITCHBACK. See Railways.

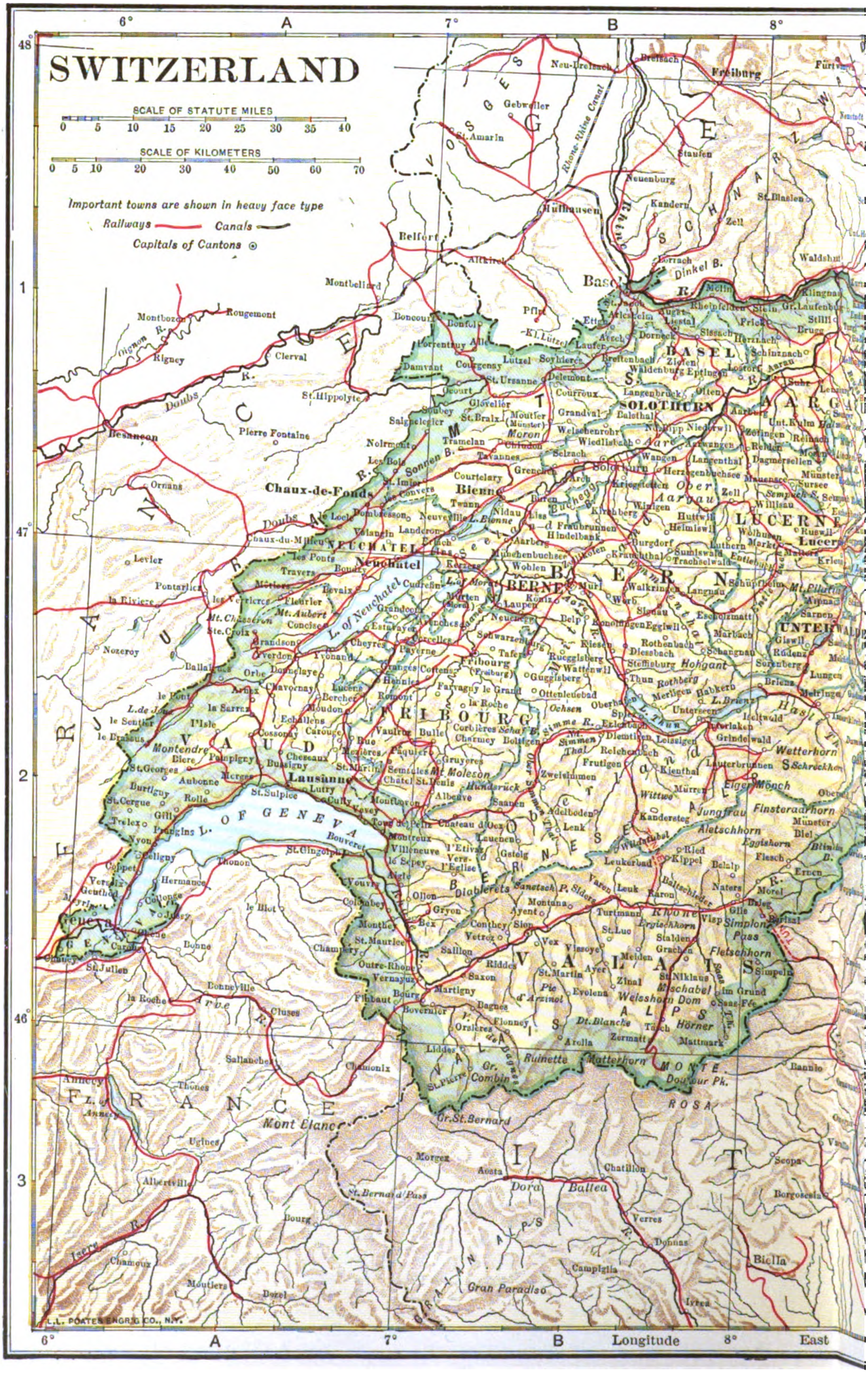
SWITCHMEN'S UNION OF NORTH AMERICA. See Railway Brotherhoods.

SWITHIN, swĭth′ĭn (or, more correctly, Swithun), Saint (?–862). An English ecclesiastic of the ninth century, who was chaplain to King Egbert. In 1852 he was consecrated Bishop of Winchester. Swithin was buried, according to his own desire, in a place outside of his church at Winchester, where passers-by might tread upon his grave and the rain drop on it from the eaves. A century later he was canonized and his body exhumed and buried inside the church. According to the legend this translation, which was to have taken place on July 15, was delayed in consequence of violent rains, which continued without intermission for 40 days. Out of this circumstance arose the belief that if rain falls on July 15 it will continue to rain for 40 days. Consult Chambers, *Book of Days* (new ed., Philadelphia, 1911).

SWIT′ZERLAND (Fr. *Suisse*, Ger. *Schweiz*). A country of Europe extending between lat. 45° 50′ and 47° 45′ N. and long. 6° and 10° 25′ E., bounded on the west by France, on the north by Germany and the Lake of Constance, on the east by Austria-Hungary (Tirol and Vorarlberg) and Liechtenstein, and on the south by Italy and the French Department of Haute-Savoie, from which it is separated by the Lake of Geneva. Area, 15,976 square miles. It stretches over 200 miles east and west and 120 miles north and south. The boundaries are complicated and do not follow natural features, excepting that the Jura Mountains form the natural border between Switzerland and France, and the main crest of the Alps is mainly the border on the south side.

Topography. Switzerland is the most mountainous country of Europe, five-sevenths of the surface being divided between the Alps, which spread over the central and southern sections, and the Jura Mountains which cover the northwestern portion of the country. Between the Jura Mountains and the Alps is the Swiss high plain, the seat of the densest population surrounded by these great natural ramparts. The Jura Mountains form a generally southwest-northeast curve. Their summits do not ordinarily exceed 5000 feet, the loftiest in Switzerland being the Dôle, 5507 feet. The Juras consist of a number of parallel folds, none of them extending the whole length of the district, but covering a width of 20 to 35 miles. Between the ranges are long valleys, transverse gorges connecting one valley with another; and these features produce scenery of great beauty and variety. The slopes are covered with pine forests and an abundance of rich pastures is spread below them, mingling with the fields and vineyards which extend down to the margin of the small lakes that occupy some of the valley bottoms.

The central plain, about 1300 feet in general


SWITZERLAND
SCALE OF STATUTE MILES
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SCALE OF KILOMETERS
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Important towns are shown in heavy face type
Railways
Canals
Capitals of Cantons
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UNTERWALDEN
Basel
Bienne
Neuchatel
Lausanne
Fribourg
Lucerne
Chaux-de-Fonds
Besançon
Belfort
Mulhausen
Freiburg
L. OF GENEVA
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FRANCE
ITALY
VOSGES
SCHWARZWALD
JURA
BERNESE ALPS
PENNINE ALPS
Mont Blanc
MONTE ROSA
Matterhorn
Jungfrau
Finsteraarhorn
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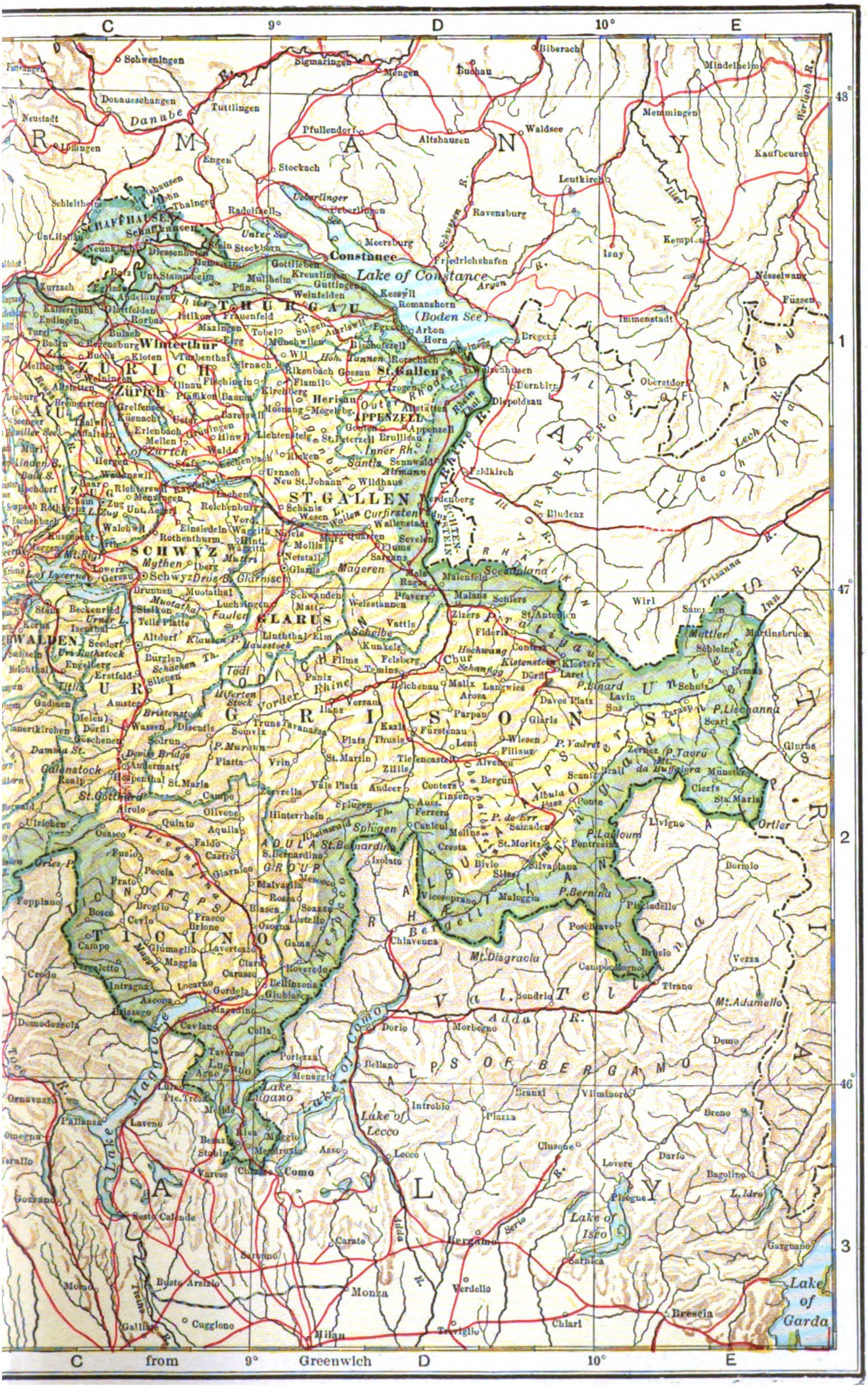
Aare R.
Doubs R.
Rhine R.
Rhone-Rhine Canal
Gr. St. Bernard
Dora Baltea
Gran Paradiso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Pfullendorf
Waldsee
Altshausen
Kaufbeuren
G E R M A N Y
Engen
Stockach
Leutkirch
Iller R.
Schleitheim
Thaingen
Radolfzell
Ueberlingen
Ravensburg
Schussen R.
Kempten
Isny
SCHAFFHAUSEN
Schaffhausen
Unter See
Meersburg
Stein
Steckborn
Constance
Friedrichshafen
Neunkirch
Diessenhofen
Gottlieben
Kreuzlingen
Lake of Constance
Argen R.
Nesselwang
Zurzach
Müllheim
Weinfelden
Kesswil
Füssen
THURGAU
Frauenfeld
Romanshorn
(Boden See)
Immenstadt
Bülach
Winterthur
Arbon
Bregenz
Baden
ZÜRICH
Zürich
Bischofszell
Horn
Rorschach
St.Gallen
Wil
Oberstdorf
Dornbirn
Kloten
Turbenthal
Gossau
Herisau
Rhodes
Outer
APPENZELL
Appenzell
Trogen
Altstätten
Diepoldsau
Rhine R.
ALLGÄU
Lech
Lake of Zürich
Horgen
Wädenswil
Richterswil
Rapperswil
Uznach
St. Johann
Wildhaus
Säntis
Altmann
Inner Rh.
Feldkirch
Bludenz
Ill R.
VORARLBERG
Zug
L. Zug
ST. GALLEN
Werdenberg
LIECHTENSTEIN
Einsiedeln
Churfirsten
Wallenstadt
SCHWYZ
Schwyz
Mythen
Glärnisch
Näfels
Mollis
Sargans
Glarus
Ragatz
Maienfeld
Sessaplana
RHÄTIKON
Trisanna
Inn R.
Lake of Lucerne
Gersau
Brunnen
Muotathal
Luchsingen
GLARUS
Pfävers
Malans
Schiers
St. Antönien
Prättigau
Wirl
Altdorf
Linthal
Elm
Zizers
Fideris
Küblis
Conters
Klosters
Martinsbruck
URI
Tödi
Flims
Chur
Hochwang
Schanfigg
Kistenstein
Dörfli
Davos Platz
Lavin
Süs
Schuls
Scarl
P. Linard
Reichenau
Arosa
Vorder Rhine
Ilanz
Versam
GRISONS
Disentis
Truns
Somvix
Thusis
Fürstenau
Parpan
Lenz
Filisur
Wiesen
P. Vadret
Zernez
P. Tavrü
P. Lischanna
Glurns
Dammа St.
Göschenen
Wassen
Andermatt
Hospenthal
Devil's Bridge
P. Muraun
Platta
Vrin
Tiefencastel
Alveneu
Bergün
Albula Pass
Zillis
Andeer
Tinzen
Scanfs
Zuoz
Ponte
Münster
Sta. Maria
Cierfs
Ofen
Galenstock
Realp
St. Gotthard
Airolo
Olivone
Splügen
Splügen Pass
Hinterrhein
Avers
Samaden
St. Moritz
Pontresina
P. Languard
Livigno
Ortler
ALBULA ALPS
ENGADINE
Upper Engadine
Lower Engadine
Rheinwald
St. Bernardino
ADULA GROUP
Mesocco
Bivio
Silvaplana
Maloja
P. Bernina
Bormio
Faido
Quinto
Ticino R.
Leventina
Biasca
Bregaglia
BERNINA
Vicosoprano
Poschiavo
Chiavenna
Brusio
Campo
Prato
LEPONTINE ALPS
TICINO
Maggia
Bellinzona
Locarno
Lake Maggiore
Ascona
Brissago
Mt. Disgrazia
Val Tellina
Sondrio
Adda R.
Tirano
Vezza
Mt. Adamello
Domodossola
Crodo
Toce R.
Lugano
Lake Lugano
Lake of Como
Dorlo
Morbegno
Bellano
ALPS OF BERGAMO
Demo
Breno
Mendrisio
Chiasso
Como
Lecco
Lake of Lecco
Introbio
Vilminore
Clusone
Lovere
Darfo
Bagolino
L. Idro
Pallanza
Laveno
Varese
Omegna
Varallo
Gozzano
ITALY
Lake of Iseo
Sarnico
Serio R.
Bergamo
Adda R.
Gargnano
Lake of Garda
Sesto Calende
Saronno
Busto Arsizio
Monza
Verdello
Chiari
Brescia
Ticino R.
Cuggiono
Galliate
Milan
Treviglio
AUSTRIA
TYROL

elevation, is steeply walled in between the Juras and the Alps. It is a plain chiefly in contrast with the mountains around it and in other countries would be called an elevated region, thickly studded with picturesque hills. It extends in a southwest and northeast direction from the Lake of Geneva across Lake Constance to Württemberg, and has an average width of about 30 miles. Its hills are due chiefly to unequal erosion, the coarse gravel brought down from the Alps (known as "Nagelflue," often cemented into a hard conglomerate) having been able especially to resist the destructive action of time and weather. The débris from the Alps, with which it is covered to a great depth, forms its soil, but disintegrated granites and gneisses contribute too large a proportion of sand and pebbles to make the soil very rich.

The Alps rising from this central plateau attain altitudes above 15,000 feet. The Swiss Alps are the middle part of the great highland region of south Europe, which extends in the form of a bow from the Gulf of Genoa to the plain of Hungary. They comprise two broad bands differing widely in character. The southern Swiss Alps (south of the Rhine and Rhone) begin in the west in the splendid glacier-covered chain of the Pennine Alps, which have their culmination in Monte Rosa (15,217 feet), inferior in height only to Mont Blanc in France. The Mischabelhorn, the Weisshorn, the Breithorn, and the incomparable pinnacle of the Matterhorn are among the Pennines which extend eastward to the Simplon. Over 30 summits exceed 12,000 feet. East of the Simplon extend the Lepontine Alps, the water parting between the Rhine, the Rhone, and the Po, with many valleys deeply excavated by torrents and crossed by a number of important passes to Italy. Here is the group of St. Gotthard, the central knot of this mountain world. It is the point from which radiate the mighty Alpine ranges that fill the centre and south of Switzerland. The ranges of Ticino from the south, the mountain masses extending from the Simplon in the southwest, the Bernese Oberland from the west, the Titlis group from the north, the Tödi chain from the northeast, and the mighty complex of the Grisons from the southeast, all converge upon St. Gotthard. The Grisons lie east of the Ticino valley and between the Rhine and the Inn, and their snows chiefly feed tributaries of the Rhine, many summits exceeding 10,000 feet. Lastly, south of the Inn and the most eastern group of the southern Swiss Alps are the magnificent peaks of Bernina, whose culminating point is 13,304 feet above the sea. These southern Alps are formed of crystalline rocks, huge masses of gneiss, granite, and other crystalline rocks, cropping out amid schists.

The chains of the northern Swiss Alps are separated one from another by three deep valleys: (1) that of the Aar with the lakes of Brienz and Thun, which carries nearly all the drainage of north Switzerland to the Rhine; (2) the valley of the Reuss with Lake Lucerne; and (3) the Walensee and Lake Zurich. Thus separated the four great groups of the northern Alps are: first, the Bernese Alps (Oberland), the water parting between the Aar and the Upper Rhone, which include the greatest snow mountains of the Alps; first among them the crystalline summits of the Finsteraarhorn (14,026 feet), the Jungfrau (13,672), Mönch (13,465), Eiger (13,040), Wetterhorn (12,150), Schreckhorn (13,385), and others, a compact mass of snowy and rugged peaks with the Aletsch glacier, 16 miles long, the largest of Switzerland's glaciers. More than 20 of these summits rise over 12,000 feet above sea level. Second, the Titlis Alps, to the east of the Bernese Oberland. Third, the Alps of Glarus and Schwyz, also known by the name of their highest summit in the centre, Tödi (11,887 feet). The Rigi (5906 feet), commanding one of the magnificent views of the Alps, stands in the northwest corner of this group on the shores of Lake Lucerne. Fourth, the lower Alps, between Lakes Constance and Zurich, which nowhere reach the snow line. On the whole the southern slopes of the Swiss Alps are steep, but the northern slopes more gradual. Glaciers and perpetual snow cover 800 square miles, or about one-twentieth of the area of Switzerland. These northern Alps are of limestone and are stupendously folded, the folds being driven northwestward and piled up over each other. See ALPS.

Hydrography. Owing to the height of the mountains, the country is well supplied with water. Nearly every valley is traversed by a larger or smaller stream, often interrupted by picturesque waterfalls. The principal system of rivers is formed by the Rhine and its tributaries flowing to the North Sea; the Rhone draining to the Mediterranean; the Ticino which discharges finally into the Adriatic; and the Inn flowing to the Danube and the Black Sea. All the rivers in Switzerland are so rapid that they are almost useless for navigation, though their impetuous character fits them for industrial purposes. The only navigable stream of importance is the Aar tributary of the Rhine, which carries a larger volume of water to that river than the Rhine itself supplies above their point of junction. The Rhone, flowing to the southwest, reaches Lake Geneva as a muddy stream and leaves it to enter France as a clear blue river. The Ticino is the largest river sent down by Switzerland to the Po. It has a larger catchment basin than any other Swiss river and is the least fed by glaciers. The Inn flows east through the deep, narrow valley called the Engadine, and falls into the Danube at Passau, where it is much larger than the Danube itself. The glaciers are a source of perennial water supply, and since they melt most rapidly in summer, the Swiss rivers are fullest at that time of year.

The Alps are the Lake Country of southwest Europe. The lakes are remarkable for size, depth, and the grandeur and beauty of the scenery which surrounds them. Among the 15 important lakes in Switzerland, 11 are in the basin of the Aar and none in the basin of the Inn. Lakes Geneva and Constance, the largest lakes, balance each other at the opposite ends of the country. Lake Geneva, partly in France, is over 200 square miles in area and has a maximum depth of 1000 feet, its bottom extending almost to the level of the Mediterranean. Lake Constance is a little smaller than Lake Geneva, not so deep, lies partly in German territory, and is the filter of the Rhine. Lake Neuchâtel, the largest lake entirely in Swiss territory, lies on the table-land, and hence is not so deep as the lakes in the longitudinal mountain valleys. Lucerne, Zurich, Brienz, Thun, and Bienne are also important lakes. Lake Lugano lies partly in Italy, and only nine miles of Lake

Maggiore belong to Switzerland. The Ticino flows through the latter on its way to the Po.

Climate. The distribution of climate is altitudinal rather than latitudinal. On the central plain and in the lower mountain valleys a temperate climate prevails, the mean annual temperature being about 50° F. The mean temperature diminishes on an average by three degrees for every thousand feet of elevation, so that the climate in the higher valleys is very severe. Ticino, Vaud, and Geneva enjoy an almost Italian climate, with a mean temperature of 51° F. to 53.5° F., in which southern fruits ripen. The snow line has an annual variation and likewise varies with the exposure; the lower limit of perpetual snow is at an altitude ranging from 8500 to 9500 feet. The growth of grain ceases at about 4000 feet. On the higher Alps, which are wrapped in clouds much of the time, the annual precipitation is from 78 to 97 inches; on the central plain it is 33 inches. The foehn, a warm south wind, causes some destruction by rapidly melting the snow and so producing avalanches and inundations. The climate of Switzerland, on the whole, is not favorable to agriculture, but is stimulating and healthful.

Flora and Fauna. The vertical zones of vegetation in the Alps correspond to the horizontal zones of Europe between lat. 46° and the Arctic circle. Olives in a few of the low valleys are succeeded by vines and the plants of middle Europe; then come in succession deciduous trees and grains, conifers, the high pastures, and shrubs and mosses, above which rises the region of perpetual snow. Oaks and chestnuts are abundant only in the more southern valleys, beech trees are numerous up to 4000 feet above the sea, and pines, larches, and fir trees thrive between 4000 and 6500 feet. Agriculture is mainly confined to the regions not above 2500 feet, but the high pastures extend far above the region of tillage.

The ibex and chamois are found in the high mountains, but all wild animals are becoming very scarce, by reason of the increasing number of sportsmen.

Geology and Mineral Resources. The backbone of Switzerland consists of gneiss and granite with outlying strata of the Carboniferous, Triassic, Jurassic, Cretaceous, and Tertiary formations. These strata are all thrown into a succession of gigantic folds, giving rise to great geologic complexity. Four distinct geologic zones, extending across Switzerland from southwest to northeast, are recognized. The limestone Jura region of roughly parallel folds is the first zone. The second is the plain whose rocks are chiefly sandstone covered, to a great extent, by the deposits of the ice invasions. The other zones cover the Alps, the more northern being that of the limestone Alps whose strata are greatly distorted and piled up over one another. The fourth zone consists of the great crystalline masses of the southern Swiss Alps formed of gneiss, granite, and other crystalline rocks and schists. Denudation has reduced the height of the mountains and deepened and lengthened the valleys, the larger rivers having pushed their sources back to the very heart of the mountain groups. The mining industry is of little importance. The only products of importance for export are asphalt of the Val des Travers in the Swiss Jura and hydraulic lime. Salt is worked at Bex. A little iron ore is mined in the Jura ranges, but the iron industries depend upon imports of material. A small amount of anthracite is mined near Bern of Fribourg, but Germany sends nearly 1,000,000 tons of coal to Switzerland every year, and France, Austria, and England also contribute important quantities.

Agriculture and Stock Raising. The soil is distributed among nearly 300,000 peasant proprietors representing more than one-half of the population. Of the total area, 28.4 per cent is unproductive; of the productive area, 35.8 per cent is in meadow and pasture, 29 per cent in forest, 18.7 per cent in fruit, 16.4 in crop and garden. Switzerland derives less support from its agricultural resources than any country of the Continent, excepting Norway. Only Solothurn, Lucerne, Schaffhausen, and Fribourg, among the cantons, produce nearly enough plant food for their own consumption. Wheat is grown up to 2500 feet above sea level, but the crop averages only about 4,000,000 bushels, while over 20,000,000 bushels are imported from other countries, chiefly Russia and the United States. Rye, oats, and potatoes are the chief crops, but potatoes are imported in large quantities. Thousands of tons of vegetables are imported. The cultivation of fruit is in a flourishing condition, and nearly all the cantons manufacture wine or spirits from it, such as the cherry brandy produced at Basel. Wine is produced in five cantons, but not in sufficient quantity to meet the country's demand. Orchards are planted everywhere in sheltered places, and grapes thrive especially in the warmer soils around Lake Geneva and some other lakes and on the southern slopes of the mountains. The warmer cantons of the south also produce chestnuts, almonds, walnuts in abundance, olives, and even lemons. Switzerland is not so rich in timber as formerly, for unscientific forestry has thinned the woods to a large extent; but a large portion of the forest area is now under government supervision. Every effort is being made to restore this source of wealth to its former magnitude; in 1904 there were planted 23,584,000 trees and, in 1914, 18,236,836.

As the climate and soil are especially favorable for hay and pasturage, the animal industries are more important than tillage. In comparison with cattle (1,443,483) the other domestic animals are much inferior in number and importance. Cattle breeding is carried on in all the cantons, and in the higher regions it is the chief and sometimes the only resource of the inhabitants. Switzerland is famous for its cheese, and the chief agricultural industries are the manufacture of cheese and condensed milk. The best cheeses are made in the Emmenthal, Maderanthal, Ufernthal, and in Gruyères. Many Swiss cattle are exported for breeding purposes, while, on the other hand, the great influx of tourists in summer makes it necessary to import an average of about 50,000 beef cattle a year, chiefly from Austria and Italy, to make up for the local deficiency in beef. Goats (341,296) abound in the higher Alpine districts and are reared for their skins, flesh, and milk. In 1911 the horses numbered 144,128; mules and asses, 4717; sheep, 161,414; swine, 570,226. The lakes abound in fish, and pisciculture is promoted by 212 establishments that produce enormous quantities of fry.

Manufactures. Switzerland is a great manufacturing country, though it lacks coal, iron, and seaports. Its advantages are abundant water power, markets in the adjoining countries in which to buy raw materials and sell manufactured products, good connections with seaports, and the diligence, perseverance, and skill of the people. Large quantities of the manufacturing output are produced in the homes. The textile and metal industries are of greatest importance. The cotton industry, which competes even with English manufactures, is centred chiefly in the cantons of Zurich, Glarus, Saint-Gall, and Appenzell. Swiss cotton cloths noted for fineness of texture and excellence of dyes and prints are sent all over the world. The well-known machine-made lace and embroidery industry of Switzerland is centred in Saint-Gall, Appenzell, and Neuchâtel. The great centres of the silk industry are Basel, where all kinds of silk ribbons are produced, and Zurich, where dress goods are woven. Watch making and machinery lead in the metal industries. The most important centres of watch making are Geneva, Chaux-de-Fonds, and Locle. The industry was once very prosperous, but it has suffered of late years from competition of the machine-made watches of the United States. The Swiss, however, have regained a large part of their export trade by the introduction of machinery and the manufacture of the cheaper grades of watches, which they produce by hundreds of thousands every year, five-sixths of them being sold in foreign countries. The manufacture of jewelry and music boxes, wood carving, straw plaiting, leather making, and tanning are also very important industries. The well-known machine works of Zurich, Winterthur, and Geneva export a considerable part of their output.

Commerce. In the special trade, exclusive of specie and bullion, imports and exports in 1902 were valued at 1,128,511,000 and 874,305,000 francs respectively; in 1907, 1,687,427,000 and 1,152,938,000; in 1913, 1,919,816,000 and 1,376,399,000.

The largest imports are grain, cattle, and other foodstuffs, cotton, coal, iron, petroleum, and groceries. Nearly all the exports are manufactures, such as cheese, wine, silk and cotton goods, watches, fine steel and iron goods (instruments, etc.), machinery, jewelry, lace, embroideries, and straw plaiting. Manufacturers do not aim to produce large quantities of cheap stuffs, except that cheap watches have, to a great extent, replaced the finer grades. They aim to make a reputation for the excellence and fineness of their goods. Nine-tenths of the import trade and three-fourths of the export trade are with Europe, chiefly with Germany, France, Italy, the United Kingdom, and Austria-Hungary. The United States sells very little except grain to Switzerland, but its purchases of cotton embroideries, silk goods, cheese, and other Swiss products are important. Switzerland's trade with the United States in three years amounted to:

	1901	1908	1913
Imports from U. S.	$255,360	$646,840	$826,549
Exports to U. S....	15,799,400	24,698,036	23,260,180

Transportation and Communication. In the absence of navigable rivers, international traffic is carried by the railroads. The main arteries are the lines from Lake Constance to Geneva and Basel, and from the north via the St. Gotthard Tunnel to Italy. There were in operation, in 1912, 4917 kilometers (3055 miles) of state railway (exclusive of tramway, etc.). The wagon roads are admirable. Navigation is important on the lakes, where 171 steamboats belonging to 22 companies were plying in 1914.

Banking. The 42 banks had, in 1913, paid-up capital amounting to 244,750,000 francs. The new national bank, with headquarters at Bern and Zurich, opened in 1907 and has exclusive right of issue.

Government. The constitution of 1848, with the important revision of 1874 and subsequent amendments of lesser importance, constitutes the present fundamental law of Switzerland. (For the methods of amending the constitution, see REFERENDUM.) The Swiss state is composed of 25 cantons, with Bern as the capital. The constitution vests the executive power in a Federal Council of seven members elected for a term of three years by the two Houses of the Federal Legislature. Any Swiss citizen who is eligible to either branch of the Federal Legislature may be chosen to the Federal Council, except that not more than one member may be chosen from the same canton. It is the custom to choose members of the Council from the membership of the Federal Legislature and to reelect them continually for a long period of time. The work of administration is divided into seven departments, and one member of the Council is put in charge of each department, but the act of any Councilor is considered to be the act of the Council as a whole. The Council is organized under a president (President of the Confederation) and a vice president chosen by the Federal Legislature from among the Councilors to serve for a term of one year.

The powers and duties of the Federal Council are many and varied. In the domain of legislation it plays an important part, although it has no veto upon the acts of the Legislature. In this domain the Council sustains a relation to the Legislature somewhat like that of the cabinet in the parliamentary system of government. It makes an elaborate report to the Legislature, and although its members cannot at the same time be members of the Legislature, they have access to its sessions, take an active part in the deliberations, introduce legislative proposals, give their opinions upon various measures, and exert a great influence upon the work of legislation. It prepares the budget and advocates its adoption by the Legislature and takes the lead in the discussion of all important measures introduced by the government. The Federal Council also has a wide power of action in judicial affairs. It has, e.g., the settlement of a large class of administrative controversies which in other continental countries is intrusted to special administrative courts. It has a large supervisory power over the cantonal administration, particularly when the cantons are engaged in administering federal law. In addition to the above-mentioned functions the Council has the other powers usually exercised by a nation's executive.

The strictly legislative powers of the government are vested in a Federal Assembly (Bundesversammlung), consisting of two Houses, viz., the National Council (Nationalrat) and the Council of Estates (Ständerat). The two Houses hold separate sessions in all legislative matters and joint sessions for the exercise of certain electoral and judicial functions. There is full equality between the two Houses in all matters whatsoever. The Council of Estates is composed of 44 members, or two from each canton. In three cantons which are divided, each half canton chooses one member. The tenure, amount of compensation, qualifications, mode of election, and the relations which they bear to their constituents are matters which the federal constitution does not regulate, but are left to the determination of each canton, with the result that the greatest variety of provisions prevails. The terms of members vary from one to four years. The Council of Estates elects its own president and vice president under the limitation that neither office can be filled from a canton which furnished the president for the session preceding. The National Council, or popular chamber of the Legislature, consists of members chosen by direct universal suffrage for a term of three years. The federal constitution apportions the members of the National Council according to population on the basis of one représentative for every 20,000 inhabitants. In those districts which choose more than one representative the members are chosen on a general ticket. The Council elects its own officers subject to the limitation that the president and vice president must be chosen from the body of the Council and are ineligible to succeed themselves for the ensuing term. The president, in addition to his vote as a member, has a casting vote in case of a tie. The members of the National Council receive a compensation from the federal treasury. The Federal Assembly holds two regular sessions annually, beginning in June and December, each lasting about one month. The discussions take place in French, German, or Italian, according to the convenience of the speakers, while all formal readings occur in both French and German. The two Chambers meet jointly to settle conflicts of jurisdiction between the federal authorities, to grant pardons, and to elect the Federal Council, the Supreme Court, the Chancellor, and the commander of the army. The ordinary legislative power of the Federal Assembly is very wide and extends to many subjects which in the United States are left to the regulation of the States.

The judicial power of the Confederation is vested in a Supreme Court or Federal Tribunal consisting of 14 judges and a number of supernumeraries elected for a term of six years by the Federal Assembly, which also designates a president and a vice president of the court for two years. The court is divided into three sections, each of which holds a session in one of the five judicial districts into which Switzerland is divided. The seat of the court is at Lausanne in the Canton of Vaud. The jurisdiction of the Federal Court in the domain of public law extends to conflicts of authority between the Confederation and the cantons, to disputes between cantons of a public-law nature, and to complaints of the violation of individual constitutional rights. In civil matters of private law its jurisdiction extends to suits between the Confederation and the cantons or between the cantons themselves, or suits against the Confederation or between the cantons and private individuals or corporations. The Federal Tribunal is also a court of appeal from the decisions of the cantonal courts where the amount in dispute exceeds 3000 francs (about $600). Its criminal jurisdiction extends to cases of high treason against the Confederation or violence against the federal authorities, to offenses against the law of nations, to political offenses which cause disorder and lead to armed intervention, and to certain minor offenses.

For purposes of local government the political divisions and subdivisions of Switzerland are cantons, districts, and communes. Each canton has its own constitution and local government. With a few exceptions there is a unicameral legislative body called the Great Council, whose members are elected by popular suffrage, as a rule, for a term of three or four years. It enacts laws, votes the taxes, and supervises the administration. In the four cantons of Uri, Unterwalden, Glarus, and Appenzell primary assemblies of all the voters, in many respects like the New England town meeting, take the place of a legislative body. Such assemblies are known as the Landsgemeinden. The chief executive authority in the cantons is a council whose membership varies in number from five to nine. The same may be said of the term of service and the mode of election. At present the members are chosen by popular vote in a majority of the cantons; in the others they are chosen by the local legislatures. In all the cantonal constitutions except that of Fribourg the referendum (q.v.) as a means of legislation has a prominent place. The initiative likewise plays an important part in local legislation. In all the cantons except Geneva constitutional amendments may be initiated by popular petition, and in all except Fribourg, Lucerne, and Valais the same right exists in the case of ordinary statutes.

The cantons are divided into districts. The chief executive and administrative authority in the district is a sort of prefect either popularly elected or chosen by the cantonal Council. A subdivision of the district is called the commune (Gemeinde). In some of these the popular town meeting is the chief organ of government; in the others there is a local legislative assembly popularly elected. In all, the chief executive authority is a small council consisting of a president or mayor and not less than four members.

Finance. The Confederation derives most of its revenue from the customs, though considerable income is derived from posts, telegraphs, and state property and investments. The proceeds of the alcohol monopoly is divided among the cantons, one-tenth of the amount being used to combat the spread and evil effects of alcoholism. The revenue and expenditure in 1911 were 98,044,100 and 98,296,046 francs respectively; in 1912, 102,338,649 and 100,933,098. The public debt on Jan. 1, 1912, amounted to 122,350,985 francs, most of it bearing 3½ per cent interest. The standard of value is gold. The monetary unit is the franc, par value 19.295 cents. Metric weights and measures are used.

Army. There is no standing army, but a truly national militia, and the defense of the Republic rests with its citizens. The constitution prescribes military liability for every citizen from his twentieth to his forty-eighth year. Exemptions are limited, including only certain federal officials; postal, telegraph, hospital, and prison employees; the police force, clergymen, and teachers. Service, though compulsory, is not accepted unless the candidate is qualified physically, mentally, and morally, as determined after examination by a duly constituted commission. Those who cannot pass the examination pay a special tax ranging from 6 to 3000 francs, depending on value of income and property. About 50 per cent of those required to report are rejected. Rejection is regarded as a misfortune. Service, though compulsory, is sought, not avoided, and is regarded as an honor as well as a patriotic duty. Another important advantage is the intense interest of the Swiss in rifle shooting. Practically every town has its rifle club and rifle matches, finally culminating in the national competition.

Regular training does not begin until the age of 20, but there exist in all the cities and towns cadet corps for the training of boys between 14 and 20, membership in which is voluntary. Examinations for the regular training take place at the age of 19. If chest measurement is not up to requirement, the candidate is reëxamined in subsequent years. If physically unfit for full military service, a man is assigned to the auxiliary troops if the defect is slight; otherwise he is freed from service entirely. All such rejected men, unless called to the colors, pay the military tax up to the age of 40. All successful candidates, at the age of 20, are assigned to that branch of the service for which they are best suited, as determined by their previous occupation or business. These candidates in their first year are sent to one of the recruit schools, where they are fully armed and equipped (with the exception of underwear, a flannel shirt, and two pairs of shoes, which are provided by the recruit), and are there trained in the duties of the branch of the army to which they are assigned, for these periods: 65 days for infantry, engineers, and foot artillery; 75 days for field artillery; 90 days for cavalry; 60 days for sanitary and supply troops. At the end of the school term the man takes home his entire equipment and arms and is required to keep them in serviceable condition for the yearly inspection. While on military duty a man receives 50 centimes (10 cents) a day; on war service considerably more.

The Swiss army is divided into three classes: Auszug or Elite, the Landwehr, and the Landsturm. A soldier belongs from the age of 20 to 32 in the Auszug or Elite (first line) of the army. After the first year of this period, spent as above indicated, soldiers in the Elite, other than the cavalry, are called out six times, for a service lasting from 11 to 14 days. Cavalry stays only 10 years in the Elite, but are called out eight times for periods of 11 days each. Service in the Landwehr is from the ages of 32 to 40, the soldier being called out but once, for a period of 11 days. He then passes to the Landsturm until the age of 48. This class is armed and has received training in the previous classes. The unarmed or auxiliary Landsturm comprises all other males between 20 and 50 whose services can be made available in war for noncombatant duties. Every year in which he has no active service each man with his full equipment and arms reports, at a designated place, for inspection by the military authorities.

Provision is made by the government for any families that may be left in need during the service of the head of the family. Every man in military service is insured by the government against accident and sickness.

The field army consists of 6 divisions, 3 cavalry brigades and 3 mountain brigades, organized from the Elite troops. Each division is recruited from its own territorial district. A division consists of 3 brigades, each of 2 regiments of 2 or 3 battalions each; 1 cyclist company; 1 machine-gun detachment; 12 batteries of field artillery; 2 howitzer batteries; 2 squadrons of cavalry; and 1 battalion of engineers. A cavalry brigade consists of 2 regiments; a mountain brigade of 2 or 3 battalions, 2 mountain batteries, and a company of engineers. Total, 106 infantry battalions, 72 field batteries, 12 howitzer batteries, 9 mountain batteries, and 8 cavalry regiments (each of 3 squadrons), besides 12 squadrons of divisional cavalry. There is a paper organization for forming these 6 divisions into 3 army corps. Total combatants in the field army are estimated at 140,000. In addition there is a separate force of 21,000 for frontier duty. Adding to these the trained and organized Landwehr and Landsturm contingents, Switzerland's army on initial mobilization should amount to about 260,000. Behind this first line is an unorganized Landsturm reserve of about 260,000 men, a part of whom are armed. Arms: infantry, Swiss repeating rifle; field artillery, a Q. F. shielded Krupp 7.5 cm. gun; heavy artillery, 8.4 and 12 cm. guns.

Population. The population, as calculated for June 30, 1912, was 3,831,220. The census of Dec. 31, 1910, showed 3,765,123 inhabitants, while the legal population was returned at 3,753,293 (1,845,529 males, 1,907,764 females); of the legal population, 552,011 were foreigners. Legal population according to previous censuses: 1900, 3,315,443 (of whom 383,424 foreigners); 1888, 2,917,754 (229,650); 1860, 2,510,494 (114,483). The following table shows by cantons the area and the legal population according to the censuses of 1900 and 1910. The 1910 census showed that German was the vernacular of 2,594,298 of the inhabitants; French, 793,264; Italian, 302,578; Romansh, 40,122; other, 23,031. The larger communal populations as calculated for June 30, 1913, were: Zurich, 200,600; Basel, 137,500; Geneva, 135,000; Bern, 90,800; Saint-Gall, 80,000; Lausanne, 69,400; Lucerne, 41,500; Chaux-de-Fonds, 38,600; Winterthur, 25,800; Neuchâtel, 24,100; Bienne, 24,000; Fribourg, 21,200.

CANTONS	Area sq. miles	Population	
		1900	1910
Zurich	667.6	431,036	503,915
Bern	2,657.7	589,433	645,877
Lucerne	576.2	146,159	167,223
Uri	414.8	19,700	22,113
Schwyz	350.6	55,385	58,428
Obwalden	190.3	15,260	17,161
Nidwalden	106.1	13,070	13,788
Glarus	264.3	32,349	33,316
Zug	92.7	25,093	28,156
Fribourg	645.2	127,951	139,654
Solothurn	305.6	100,762	117,040
Basel-Stadt	14.3	112,227	135,918
Basel-Land	164.9	68,497	76,488
Schaffhausen	115.0	41,514	46,097
Appenzell Ausser-Rhoden	93.6	55,281	57,973
Appenzell Inner-Rhoden	66.6	13,499	14,659
Saint-Gall	777.5	250,285	302,896
Grisons	2,746.5	104,520	117,069
Aargau	541.9	206,498	230,634
Thurgau	388.3	113,221	137,917
Ticino	1,086.3	138,638	156,166
Vaud	1,240.5	281,379	317,457
Valais	2,021.3	114,438	128,381
Neuchâtel	308.7	126,279	133,061
Geneva	108.9	132,609	154,906
Total	15,945.3	3,315,443	3,753,293

Education and Religion. Instruction is compulsory and is rigidly enforced in the Protestant, but not in the Roman Catholic, cantons. The pupils number over 700,000, of whom 544,152 were in the primary schools in 1911. Among the famous institutions are the universities of Zurich, Bern, Geneva, Fribourg, Basel, Lausanne, and Neuchâtel, and the Federal Polytechnic at Zurich, which attracts pupils from all parts of Europe. In religion there is complete liberty of conscience. In 1910 Protestants numbered 2,107,814; Roman Catholics, 1,593,538; Jews, 18,462; others, 33,479.

Ethnology. Such human remains of the prehistoric Swiss as have been found in their lake dwellings (q.v.) ally the ancient people with the short-headed Celtic or Alpine race. Racially Switzerland is now overwhelmingly Alpine or Celtic, especially in isolated portions, with local invasions of northern and southern types. Great confusion is caused by the conflict between racial characters and environmental influences. Especially in stature is this true, the Teutonic element being shorter instead of taller.

History. In Roman times the country was inhabited by two races—the Helvetii, supposed to have been Celts, in the northwest; and the Rhætii, who were said to be of common stock with the Etruscans, in the southeast. The Helvetii, having migrated into Gaul, were conquered by Julius Cæsar in 58 B.C., who forced the remnant of them to return to their homes. (See CÆSAR, *De Bello Gallico*, i, 1–29.) Before the close of the same century the Rhætians were subdued by the armies of Augustus. When the German invasions took place, the Alemanni gained possession of the country east of the Aar, while the Burgundians settled in western Switzerland. About the close of the fifth century the Alemanni were conquered by the Franks, and their territory became a part of the Frankish dominion. Another Teutonic people, the Ostrogoths, took possession of the part of the country occupied by the Rhætii, which nearly corresponded to Grisons, but their rule was of short duration. The Burgundians embraced Christianity about the end of the fifth century; the Alemanni retained their old pagan creed until the seventh century, when the band of Irish monks which had entered Gaul under St. Columban (q.v.) came among them, converted the people in vigorous fashion, and founded abbeys and churches, which survive to our own time. Switzerland made great progress under the rule of the Franks. After the dissolution of the great Carolingian realm the bulk of Switzerland was included in the Duchy of Alemannia, which became part of the German Kingdom, while the southwestern portion of the country was included in the Kingdom of Transjurane Burgundy. In 1033–34 this Burgundian portion passed under the rule of the German emperors, so that from this time the whole of Switzerland belonged to the Holy Roman Empire. In the early part of the Middle Ages feudalism flourished in the Swiss highlands even more than elsewhere. In the twelfth century the dukes of Zähringen rose to great power in Switzerland. They did much to check civil wars and to promote the prosperity of the towns. In 1178 they founded Fribourg and in 1191 Bern. On the extinction of the line of Zähringen (1218) their allodial possessions passed to the counts of Kyburg, while a number of cities were released from feudal overlordship. In the latter part of the thirteenth century the counts of Savoy extended their domination into western Switzerland. At this time the counts of Hapsburg became a great power in the land, and in 1264 the house succeeded to the bulk of the possession of the counts of Kyburg. At this time there were a large number of petty sovereignties in Switzerland. Prominent among the ecclesiastical princes were the bishops of Basel and Geneva and the abbot of Saint-Gall. The great towns were united in self-defense, and many of them obtained charters as free Imperial cities. The Hapsburg rule soon became burdensome and tyrannical, and the resistance which opened the long struggle that was to end in Swiss independence began in the three Forest Cantons—Uri, Schwyz, and Unterwalden. Uri had received a special charter of liberties from the Emperor Frederick II in 1231 and Schwyz in 1240. They had leagued themselves together in behalf of the Emperor somewhat later. Thus they were accustomed to the idea of a mutual league when after the death of the Emperor Rudolph they sought to resist the Hapsburgs. In 1291 they allied themselves into a perpetual league, which came to be known as the Eidgenossenschaft. Subsequently they entered into an alliance with Zurich and the coalition of which it was the centre. Unterwalden received a charter similar to that of its associates from the Emperor Henry VII. In 1315 hostilities opened between Frederick of Hapsburg and the Eidgenossen, and the latter won the decisive battle of Morgarten (q.v.). The Forest Cantons then renewed their pact by a fundamental agreement which was for five centuries the basis of the political life of independent Switzerland. Lucerne (1332), Zurich (1351), Glarus and Zug (1352), and Bern (1353), entered the Confederation. Fresh wars followed with Austria, whose power in Switzerland was shattered by the victories of the confederates in 1386 at Sempach and in 1388 at Näfels. In 1415 the people of the cantons became the aggressors, invading Aargau and wresting it from Austria. Half a century later they made themselves masters of Thurgau. Swiss independence clashed with the ambitions of Charles the Bold of Burgundy. In 1476 they overthrew his armies at Grandson and Morat, and it was with the aid of Swiss mercenaries that René of Lorraine overwhelmed Charles the Bold at Nancy in 1477. In 1481 the towns of Fribourg and Solothurn were admitted into the confederacy. In 1499 the Emperor Maximilian I made a final attempt to bring Switzerland once more within the bounds of the Holy Roman Empire. He sought to draw men and supplies from the inhabitants for his Turkish war, but in vain, and was defeated in desperate engagements. Basel and Schaffhausen (1501) and Appenzell (1513) were then received into the Confederation, and its true independence began. The abbacy of Saint-Gall and the cities of Saint-Gall, Mülhausen, and Bienne became associated states with a vote in the Diet. Geneva, Neuchâtel, Valais, and Grisons also became associated states, but without a vote. In the early part of the sixteenth century the Swiss soldiers, who had become the most famous infantry in Europe, played a great, if not glorious, rôle as mercenaries in the Italian wars. After fighting successfully on the side of Milan against the French they suffered a terrible defeat at the hands of Francis I at Marignano in 1515. In 1516 they concluded the so-called Perpetual

Peace with France, after which they fought on the French side. In the course of these wars a number of Italian towns and districts (in the present Canton of Ticino) were annexed to Switzerland.

The Reformation (q.v.), which was inaugurated by Zwingli in 1519, brought dissension in the Confederation. Zurich in 1523 adopted Zwingli's opinions and was followed by Bern and other cantons of the north. The Forest Cantons remained attached to the Church of Rome. War broke out in 1531 between the Catholics and Protestants, and a small body of Zurichers was defeated at Kappel. Zwingli, who was with them as their chaplain, was slain. In 1536 Bern wrested the Pays de Vaud from the dukes of Savoy and annexed it to its own territory. In the same year Calvin settled at Geneva, which had succeeded in emancipating itself completely from the jurisdiction of Savoy and of its bishop, and the reformed doctrines spread throughout western Switzerland. During the Thirty Years' War Bern, which had become, since the conquest of Vaud, the leading canton, and Zurich contrived to maintain the neutrality of Switzerland; and in the Peace of Westphalia, in 1648, the country was formally declared to be wholly independent of the German Empire.

The complex fabric of the Swiss Confederation, with the division into two hostile religious camps, the relation between governing cantons and subjected districts, the selfish assertion of local and class interests, and the absence of any firm bond of union, was not conducive to a healthy political development. The constitution of the larger cantons became more and more aristocratic. In Zurich, Schaffhausen, and Basel the governing councils were elected by the corporations; and in Bern, Fribourg, Solothurn, and Lucerne a few families had acquired permanent rule. The French Revolution had its effect in Switzerland as elsewhere. In 1798 the country was occupied by the French, who were aided by the dissensions between the democrats and aristocrats. The old cantonal system was abolished, and the Helvetic Republic was organized. In 1803, at the dictation of Napoleon and under the Act of Mediation, the cantonal system was reëstablished, with 19 cantons, six new ones being constituted—Saint-Gall, Grisons, Aargau, Thurgau, Ticino, and Vaud. After this Switzerland enjoyed peace under an orderly government and began to recover prosperity. The Congress of Vienna (1814–15) recognized the independence of Switzerland, and her perpetual neutrality and the inviolability of her territory were guaranteed by the Great Powers. The new Confederation was divided into 22 cantons (three new cantons, Geneva, Valais, and Neuchâtel, being constituted), each of which was represented in a diet, which was appointed to hold its annual meetings alternately at Bern, Zurich, and Lucerne. Three of these cantons were divided into half cantons, thus making in all 25 cantonal governments. A half canton has the same power in local government as a whole canton. In federal affairs, however, it has only half the weight. The constitution of the Confederation was the so-called Pact of 1815. By the terms of this pact emphasis was put upon the cantons, not on the Confederation. The cantons retained all power not expressly granted to the Diet. They had their own postal systems and coinage. Questions of liberty of the press, public meeting, and religion were left to the cantons. The old abuses, however, which had crept into the constitutions of the cantons were revived, and representation in most of them became based on property qualifications. Officials, the aristocracy, and the clergy joined to oppose innovations and succeeded in doing so until the revolution of 1830 in France. From that year until 1848 Switzerland passed through a long crisis. There was strife between the democratic and aristocratic elements and then between the Catholics, who in some of the cantons retained ancient special privileges, and the Protestants, who formed a majority of the Swiss people. In Aargau a struggle took place between the Liberals and the Ultramontane party, which was settled by an unsatisfactory compromise. In Valais, where universal suffrage had put power into the hands of the reactionary party, a war took place, in which this party was victorious. It then ruled with a strong hand and forbade Protestant worship within the canton. In Lucerne the Ultramontane party so persecuted its political opponents that the latter were compelled to leave the canton. In 1844 a proposal was made in the Diet to expel the Jesuits, the chief object of Protestant attack; but that body declined to act. The Radical party then determined to resort to force; they organized bodies of armed men, called free corps, which invaded the Catholic cantons, but were defeated. The Catholic cantons then formed a league, named the Sonderbund, for defense against the free corps. There was a general clamor for its suppression, but in the Diet only 10½ votes out of 22 were in favor of that measure. The ruling party in Geneva had been with the majority, and this conduct led to a revolution in that city. One vote was thus gained against the Sonderbund, Saint-Gall added another, and a majority in the Diet in 1847 declared the illegality of the Sonderbund and decreed the expulsion of the Jesuits. The federal forces under General Dufour defeated those of the Sonderbund; the leagued cantons were made liable for all the expenses of the war, the Jesuits were expelled, and the monasteries were suppressed. An attempt was made by diplomatic notes to intimidate the Swiss government, but the revolutions of 1848 prevented further interference. This same period of civil strife was also one of intellectual and material development. The results of these stormy but profitable years were seen in part in the constitution of 1848, which bound the Confederation more firmly together and gave it at last an efficient government. It transformed Switzerland into a federal union resembling in many respects the United States. This transformation was opposed not only by the conservative cantons, but also by the reactionary governments of the surrounding countries. During the revolutionary years 1848–49 fugitives from these countries came to Switzerland, and their presence increased the irritation. Serious trouble with Prussia was barely averted in 1857, in a dispute over the Canton of Neuchâtel. This territory had fallen to Prussia by inheritance in 1707, and in 1815 it became a canton of Switzerland, with Prussia reserving her sovereign rights. Through the intervention of the French Emperor Napoleon III, Prussia was persuaded to renounce all rights of sovereignty in Neuchâtel, and so trouble was averted.

Since 1848 Switzerland has made notable

progress along political and economic lines. To the outside world the most interesting development has been in the evolution of certain processes of lawmaking. (See REFERENDUM.) The Swiss have sought to perfect the representative system by making it express the popular will more exactly. The device adopted is called proportional representation, by which minorities are given weight in the Legislature in proportion to their numbers. This practice is followed in several cantons. The revision of the constitution in 1874 established greater centralization in the legal and military systems and conferred upon the federal government more extensive powers in regard to railroads, water works, forest regulations, industry, and education. In addition the optional referendum was introduced, by which federal laws must be submitted to popular vote if required by 30,000 Swiss citizens or by eight cantons. Under the lead of the Radical party, which has controlled the National Council since 1848, the Swiss have recently adopted a programme looking in the direction of state Socialism. In 1898 the federal government began the purchase of national railways, and by 1909 all of the five great railway lines became national property. In 1908 an amendment empowering the federal government to enact regulations concerning trades and handicrafts was adopted. In 1911, after several years of consideration, the National Assembly passed a bill providing for workingmen's insurance against accident and sickness, which was ratified the following year by the referendum.

For the effect of the European War of 1914 in Switzerland, see WAR IN EUROPE.

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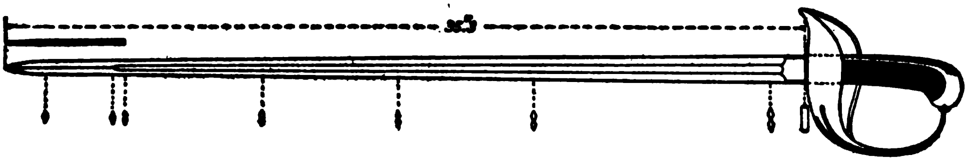
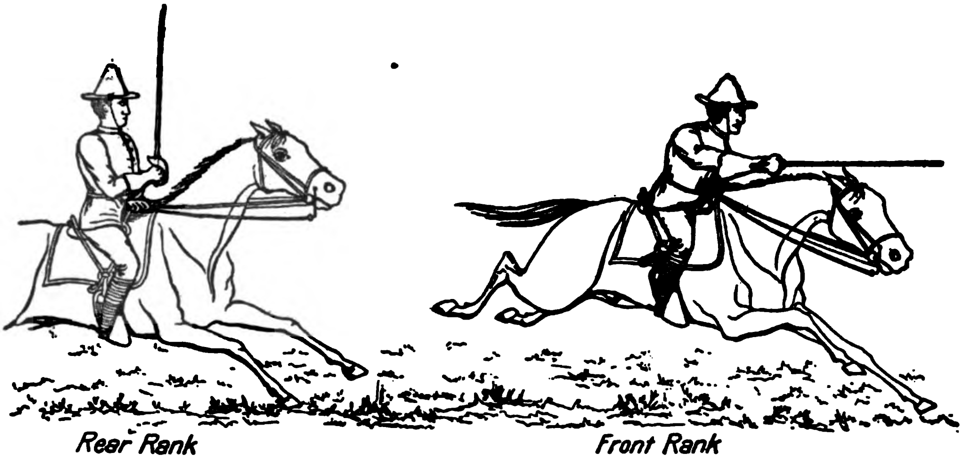
SWIV'ELLER, DICK. A lively young man in Dickens's *Old Curiosity Shop*, flowery in language and untidy in dress.

SWOBO'DA, HEINRICH (1856–). An Austrian classical scholar, born in Vienna. He studied at the universities of Vienna and Berlin. In 1891 he became professor of history, in 1899 professor of Greek antiquities and epigraphy, and in 1911 professor of ancient history in the University of Prague. Meanwhile he had studied in Athens (1881–82, 1890), Rome (1886–87), and Asia Minor (1902). His publications include: *Thukydideische Quellenstudien* (1881); *Griechische Volksbeschlüsse* (1890); *Beiträge zur griechischen Rechtsgeschichte* (1905); *Griechische Geschichte* (3d ed., 1907); a revision of K. F. Hermann, *Griechische Staats-Altertümer*, vol. iii (1913).

SWORD (AS. *sweard*, Dutch *swaard*, Dan. *swaerd*, a sword, allied to Skt. *çaru*, a spear or dart). In its general sense, every steel weapon of offense or defense larger than the dagger or poniard; in modern military usage the term "sword" is used to describe the infantry or straight weapon, and "sabre" for the slightly curved weapon of the cavalryman. Although the distinction is clearly marked in Germany by the employment of *Degen* for the straight sword and *Säbel* for the curved weapon, the custom with other nations is to employ a single word for both. The sword always has been a personal weapon, so much so that in the prose and poetry of all nations it is often endowed with human as well as superhuman qualities. To surrender the sword has always been a token of submission, and the breaking of it a most impressive ceremony of degradation, while to kiss the sword is even to-day with Orientals the highest form of oath and homage. The first sword was undoubtedly of hard wood, and from the widely scattered area in which it has been known, its employment must have been practically spontaneous among all the peoples whose stage of civilization rendered possible its use. Wooden swords were part of the equipment of the Indians of Virginia, according to Capt. John Smith. Greek literature refers more frequently to the spear and bow than to the sword, as also the Roman and Hebrew writings. According to the testimony of the Greek works of art, the leaf-shaped blade sword was the one used by the Greeks in historical times, although the Greeks, almost alone of the ancient peoples, held the sword in but slight estimation. The ancient sword was usually worn on the left side suspended by a belt from the shoulder, although it was sometimes slung more forward, bringing the hilt in the front, or else suspended from a girdle around the waist. With the Egyptians the sword of bronze was carried in its leather scabbard in front of the body and thrust in the sword belt in a sloping direction from right to left. The Assyrians seem to have possessed the weapon most nearly approaching the sword of to-day. It was straight and narrow and apparently designed for thrusting as much as for cutting. The pointed sword of the Roman legionaries was invariably successful when opposed to the pointless weapons of their enemies. On the other hand most Asiatic nations to this day continue to use the sword as a cutting weapon, its curved shape usually preventing any use of the point. Thus the swords, military and civil, of to-day may be said to be descended from the European straight sword and the Eastern *scimitar* or *tulwar*. Under FENCING will be found the history of the sword up to the present day.



UNITED STATES ARMY CAVALRY SWORD—MODEL 1913.

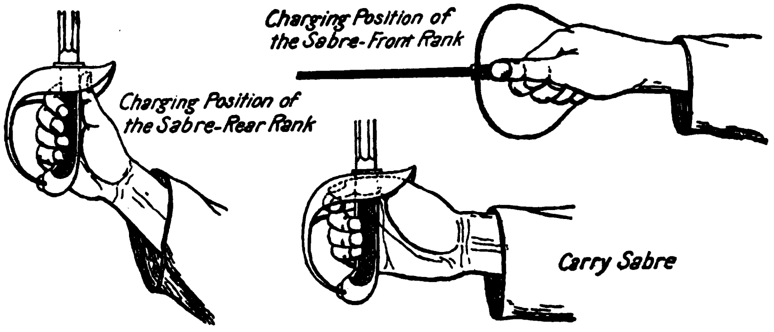


USE OF SABRE IN CAVALRY CHARGE.

Asia has been more prolific in the matter of variety of blades than has Europe, e.g., the *yataghan* of the Mohammedan races with its double curve is a compact and formidable weapon, as also is the *kukri* of the Gurkhas (q.v.), which resembles the *yataghan* except that it is considerably broader in the blade. The *patá*, a long straight-hilted sword, is found in the south of India, while in the north the *katár*, a broad-bladed weapon with a crossbar handle, was for a long time in favor. The Japanese swords are many in number and characteristic to a degree of the Japanese people. They may be classified as two-edged swords called *tsurugi*, and one-edged swords called in general *katana*. The *tsurugi* is the primitive weapon of Japan and is now rarely met with except as an ornament in temples. It was from 28 to 40 inches long and about 2½ or 3 inches wide and in the middle up to ⅝ of an inch thick. It ended in a sharp point and often thickened and broadened towards the point. It was evidently designed more for cutting than for thrusting. The *katana* or one-edged sword is also a cutting rather than a thrusting weapon, of several lengths. It is a much more handy sword than the *tsurugi*. The *katana* proper is from 2 feet, 6 inches to 2 feet, 9 inches long and was the common straight sword of the Japanese military class. The *tautó* or short sword was the weapon allowed to be worn by the tradesmen and all others not allowed to wear the *katana*. The *kuwaiken* is a small sword worn by the ladies of the military class.

The modern military sword is so constructed as to combine all the advantages of cutting and thrusting. The thrust is regarded as by far the most effective attack, but as it demands considerable skill and coolness, and as the average soldier (who in modern campaigns will in the majority of instances have been hastily taken from civil life) cannot be always counted upon to remember his training and will very naturally use the cut, it has led to the compromise above described. A good sword is required to be sufficiently elastic to permit of its being bent, or to resist a heavy blow without breaking or other injury, and also to be strong enough to deliver a thrust without bending too much. Equally important is the requirement that it be as light as possible, consistent with the strength required, and that it be well balanced.

The military blades of to-day are all closely similar in design. They are straight or nearly straight, but sufficiently heavy towards the point to enable the soldier to deliver a very effective cut. The French government in 1899 adopted a long sword designed only for thrusting. It is 35 inches in length of blade from hilt to point and weighs 2 pounds, 6 ounces, without the scabbard, which latter is made of steel, with a wood lining. In 1913 the United States army adopted a similar straight sword as the weapon of the cavalryman. The new sword has a blade 35⅞ inches long, is two-edged, tapering gradually to a sharp point. The guard is much larger than the old sabre and is solid, covering and protecting the hand. The weight is 2 pounds, 8 ounces. The balance is excellent. The scabbard is of wood covered with leather. It is designed to be used principally as a thrusting weapon, the cavalryman leaning well forward with head low and arm extended, so that the point is in advance of the horse's nose. The thrust is more easily executed than the cut, causes less exposure to the body, is rapidly executed, and is the most dangerous and the most difficult to parry of all the sabre strokes. The German cavalry sword is 32½ inches long from hilt to point and weighs 2 pounds, 8½ ounces, without the scabbard. The scabbard, like that of the French and British, is of steel with wood lining. The British cavalry officer's sword measures 35 inches from hilt to point and weighs, without the scabbard, 2 pounds, while the sword of the trooper measures 33½ inches and is 2 pounds, 10¼ ounces in weight. The British infantry officer's sword measures 32½ inches from hilt to point and weighs, without scabbard, 2 pounds, 3 ounces. In the United States army the sword proper has been abolished, and a single form of sabre is now worn by all officers. These are issued in lengths of 30, 32, and 34 inches. Consult Sir R. F. Burton, *Book of the Sword* (London, 1884). See CAVALRY; FENCING; TACTICS, MILITARY, and references there given.


Charging Position of the Sabre-Front Rank
Charging Position of the Sabre-Rear Rank
Carry Sabre

METHOD OF HOLDING SABRE.

SWORD, ORDER OF THE. A Swedish military order of merit, with seven classes, founded in 1522 and renewed by Frederick I in 1748. The decoration is a white cross of eight points, the arms separated by golden crowns. The blue medallion shows a bared sword surrounded by three crowns. The reverse bears a sword with a laurel wreath and the legend *Pro Patria.*

SWORDBILL. See HUMMING BIRD, and Plate of HUMMING BIRDS.

SWORD DANCE. A dance in which the use of a sword plays the characteristic part. Such dances, held in military attire and serving as exercises of youth, were probably a feature in the life of all ancient peoples. In Greece a dance of this character was known under the name of Pyrrhic, and in Athens such a performance was said to have been instituted by Athena. Tacitus describes the youths of Germany as dancing naked over a bare blade, and 15 centuries later a particular form of the sword dance was described by Olaus Magnus as belonging to Denmark. This special dance was widely diffused and has survived in Germany, England, and Scotland. In it the number of performers was commonly six, with a leader; the movements were various, consisting of a march with weapons erect, directing them towards the centre of the ring, grasping the neighbor's blade by the hilt and point, forming the swords into a shield or rose and dancing with them in that form, leaping over and under the brands, and the like.

SWORDFISH. One of several fishes having an elongated snout, serviceable as a weapon; specifically, the single representative of the family Xiphiidæ, related to the mackerels and common in the warmer parts of the Atlantic and occasional in the Pacific Ocean. This fish has a round, very muscular body (see Plate of SPEARFISH AND SWORDFISH), with large fins and a crescentic tail of extraordinary size and power, so that it is able to move with extreme speed and force. As the young grow, the fore part of the body and the head increase steadily in girth in proportion to posterior parts, and the upper jaw grows more and more elongated until it finally forms a flattened, sharp-edged sword composed of the consolidated vomer, ethmoid, and premaxillary bones and coated with a finely granulated hide. This weapon is about half as long as the body and becomes so strong that it may be driven far through the planking of a rowboat or even a sailing vessel, as has repeatedly happened, probably by accident. The swordfish reaches its largest size off the coast of New England, where in midsummer it comes near shore in pursuit of schools of herring, mackerel, menhaden, and other gregarious fishes upon which it mainly feeds, striking right and left. The average size in the Atlantic is about 7 feet in total length and 250 pounds in weight, but there are authentic records of fish more than twice that size. The flesh is of excellent flavor, and the capture of a swordfish is reckoned fine sport. Their spawning habits are little understood, and where they spend the winter, when they disappear from the American coast, is unknown.

Several other large related fishes are called swordfish, among them the sailfish and spearfish (qq.v.) of the family Istiophoridæ, the large handsome papagallo (*Nematistius pectoralis*) of the Pacific coast of tropical America, and the cutlass fish (q.v.). The best general account of the swordfish and swordfishing is by G. B. Goode, *Fishery Industries*, sec. i (Washington, 1884).

SWORDFISHING. The catching of swordfish is pursued in summer both for profit and sport off the coast of New England, especially in the neighborhood of Nantucket, and is often the occasion of exciting incidents. Small, swift vessels are employed, provided with a short bowsprit, at the outer end of which is set a small platform and a strong iron stanchion surmounted by a circular horizontal band at the height of a man's waist. The fisherman, standing within this contrivance, with a connecting strap buckled behind him, is held safely in spite of the pitching of the vessel, while both his arms are left free. A swordfish having been sighted at the surface, where it is feeding on menhaden or similar prey, the schooner bears down upon it until the fisherman is able to throw a barbed spear or a heavy grain into its body. To this spear a line is attached fastened inboard, and if a successful strike is made, the crew gradually haul the struggling fish near enough to be knocked on the head and disabled, if necessary. As the swordfish is big and strong, and is armed with formidable weapons in its sword and its powerful tail, strength, skill, and agility are sometimes required to overcome and secure it. Consult G. B. Goode, *Fishery Industries*, sec. i (Washington, 1884), and C. F. Holder, *Marvels of Animal Life* (New York, 1885).

SWORD OF DAMOCLES. See DAMOCLES.

SYB'ARIS (Lat., from Gk. Σύβαρις). A celebrated Greek colony in Magna Græcia (q.v.). It was situated in northeastern Bruttium, between the river Crathis (*Crati*) and Sybaris (*Coscile*), about 3 miles from the Tarentine gulf. It was founded by Achæans and Trœzenians before 700 B.C., and it soon acquired control of territory extending entirely across the peninsula. Sybaris was a great mercantile city, with strong democratic tendencies. The luxury of the inhabitants became proverbial. During the sixth century B.C. the city had attained a circumference of more than 5 miles and ranked with Miletus as one of the most powerful of Grecian cities. The party strife which disturbed so many of the Greek mercantile communities raged here also, and towards the end of the century we find the city in the hands of a tyrant, Telys, supported by the popular party. A Crotonian noble who married Telys's daughter was exiled by his townsmen, and they also gave asylum to a large body of the banished nobles of Sybaris. The refusal of a demand for their surrender led to a war between the two cities, in which the Crotonians, in spite of inferior numbers, won a great victory, which was followed by internal strife in Sybaris, leading to the easy capture of the city (c.510 B.C.). The victors razed it and turned the bed of the Crathis over the site. The few survivors withdrew to their colonies, Scidros and Laos, on the west coast. Excavations were undertaken by the Italian government in 1879 and 1887, and two extensive necropolises were found; the site of the ancient city was not exactly determined. Consult *Notizie degli Scavi*, published by the Reale Accademia dei Lincei (Rome, 1879–88), and P. Orsi, *Atti del congresso di scienze storiche*, vol. v (ib., 1904).

SYBEL, zē'bel, HEINRICH VON (1817–95). A German historian, born at Düsseldorf, Dec. 2, 1817. He studied four years at Berlin and at Bonn and in 1841 published the *Geschichte des ersten Kreuzzugs*. In 1844 he was professor at Bonn and two years later went to Marburg. It was there that he wrote his *Geschichte der Revolutionszeit von 1789 bis 1795* (1853–58), an important work. In 1856 he became professor at Munich, where he founded the *Historische Zeitschrift*, and in 1861 became professor at Bonn. He was director of Prussian archives in 1875 and had access to the most valuable material for his chief work, *Die Begründung des deutschen Reichs* (Munich, 1889–94; trans. by Perrin, New York, 1890–97). His point of view is distinctly Prussian. Sybel was from 1862 to 1864 and from 1874 to 1880 a member of the Prussian Diet and in 1867 was elected to the Constituent Reichstag of the North German Confederation. He died at Marburg, Aug. 1, 1895. His minor writings were published as *Vorträge und Aufsätze* (Berlin, 1885) and *Vorträge und Abhandlungen* (ib., 1897). Consult *Allgemeine deutsche Biographie*, vol. liv (Leipzig, 1909).

SYBEL, LUDWIG VON (1846–). A German archæologist, born at Marburg. He studied at Marburg, Munich, Bonn, and Göttingen and became professor of archæology at the University of Marburg in 1877 and rector there in 1906. His publications include: *Ueber Schliemanns Troja* (1875); *Die Mythologie der Ilias* (1877); *Katalog der Skulpturen zu Athen* (1881); *Kritik des ägyptischen Ornaments* (1883); *Weltgeschichte der Kunst im Altertum* (2d ed., 1903); *Christliche Antike* (I. *Einleitendes, Katakomben*, 1906; II. *Skulptur, Architectur*, 1909).

SYC'AMORE. A city and the county seat of Dekalb Co., Ill., 57 miles west by north of Chicago, on the Chicago Great Western and the Chicago and Northwestern railroads (Map: Illinois, G 2). It has some manufactures, which include brass products, farm implements, fences, gray iron castings, insulated wire, canned goods, etc. It has a Carnegie library and the Episcopalian Female Seminary. Pop., 1900, 3653; 1910, 3926.

SYCAMORE, or SYCOMORE (OF., Fr. *sycomore*, from Lat. *sycomorus*, from Gk. *συκόμορος*, *sykomoros*, mulberry tree, from *σῦκον*, *sykon*, fig + *μόρον*, *moron*, *μώρον*, *mōron*, black mulberry), *Ficus*. A genus of generally large, long-lived trees of the family Moraceæ, mostly natives of Africa and Asia. The Egyptian sycamore (*Ficus sycomorus*), supposed to be the sycamore of the Bible, is a large spreading tree often planted for shade in Egypt and western Asia, where it is abundant in forests. The figs are top-shaped and grow in clustered racemes on the trunk and oldest branches. They are sweet, well-flavored, and somewhat aromatic. The sycamore of western Europe is a species of *Acer* or maple (q.v.); those of North America, where it is one of the largest deciduous trees, are various species of *Platanus*, the plane (q.v.) tree.

SYCAMORE INSECTS. The sycamore or plane tree is comparatively free from insect attack, for although several caterpillars feed upon the leaves of the tree, none seems specifically confined to it. The leaves sometimes turn brown and fall from the attacks of colonies of one of the lace bugs (*Corythuca fimbriata*), and the seed balls are attacked by a true bug (*Melanochilus numideus*), which punctures the leaves and passes the winter in a half-grown condition thrust down between the seeds in the ball. Only one borer seems specifically confined to this tree, but *Chalcophora campestris* is found burrowing into dead limbs and trunks and may hasten the death of an otherwise diseased tree. Consult A. S. Packard, *Insects Injurious to Forest Trees* (Washington, 1890).

SYCO'SIS (Neo-Lat., from Gk. *σύκωσις*, *sykōsis*, figlike excrescence on the flesh, from *σῦκον*, *sykon*, fig). A chronic skin disease characterized by an eruption of pustules or papules, each one pierced by a hair, generally limited to the bearded face. It is commonly called barber's itch and is caused by the entrance into the hair follicles of a variety of staphylococcus, either albus, aureus, or citreus. Tinea sycosis or pustular eczema may be mistaken for it. Zinc, oil of cade, carbolic acid, ichthyol, sulphur, and betanaphthol are all recommended for its relief.

SYDENHAM, sĭd'en-*a*m. A residential section and parliamentary subdistrict of Lewisham Borough, metropolitan London, 8 miles southeast of St. Paul's Cathedral (Map: London and Vicinity, F 8). It is of world-wide celebrity in connection with the Crystal Palace (q.v.), which was reërected here in 1854. Pop., 1901, 43,630; 1911, 49,758.

SYDENHAM, Charles Edward Poulett Thomson, first Baron (1799–1841). A British-Canadian statesman. He was born at Wimbledon, Surrey, England. In 1815–17 and 1821–23 he was in St. Petersburg, connected with the branch establishment of his father's business, in 1819–21 and after 1823 was identified with the London house of the firm. His political associations were Liberal. In 1826 he was elected to the House of Commons for Dover and afterward for Manchester. In 1830 he was appointed Vice President of the Board of Trade in the cabinet of Earl Grey, and in 1834 became President. During his parliamentary career he procured tariff changes in the direction of free trade, tried to abolish the usury laws, helped to improve banking and factory legislation, and was prominent in negotiating commercial treaties with foreign countries. Continuing ill health compelled him to resign his seat in the House of Commons, and in 1839 he was appointed Governor-General of Canada. Lord Durham (q.v.) had reported in favor of the legislative union of Upper and Lower Canada under responsible government, and Thomson was sent out to assist in the task. He was eminently successful in accomplishing the union. In 1840 he was created Baron Sydenham of Kent and Toronto. On Sept. 4, 1841, he met with an accident from which he died at Kingston on the nineteenth of the same month. Consult G. P. Scrope, *Memoir of Lord Sydenham* (London, 1843), and Adam Shortt, *Life of Lord Sydenham*, in the "Makers of Canada Series" (Toronto, 1908). See Canada, *History*.

SYDENHAM, Thomas (1624–89). A great English physician, often called the English Hippocrates. He was born at Wingford Eagle, educated at Magdalen and All Souls colleges, Oxford, in Montpellier, France, and at Cambridge, where he graduated in medicine. About 1650 he established himself in practice in London, and soon became the foremost physician of his time. In the Civil War he was a captain of horse under Cromwell. Although his name is inseparably connected with our present knowledge of many diseases, he is especially to be remembered as the one who introduced cinchona in the treatment of malaria, and who first differentiated scarlatina and measles, classified chorea, and expounded gout. From the last-named disease he himself died. Sydenham was the first in England to place diagnosis and therapeutics upon sound bases, emphasizing the great importance of bedside experience. In his prescriptions he avoided the ridiculous compounds of his time, recommending vegetable decoctions; but, naturally, he was a strong believer in bloodletting. The use of tincture of opium (Sydenham's laudanum) was introduced by him. His *Processus Integri* (1692) was long the standard book for English practitioners. A collection of his works was published in English (1785); and the Sydenham Society of London, founded for the purpose of printing meritorious medical works, put forth his complete works in Latin in 1846, and in English in 1848. Consult R. G. Latham, *Memoir*, prefixed to a translation of Sydenham's *Works* from the Latin (London, 1848).

SYDENHAM'S CHOREA. See Chorea.

SYD'NEY. The capital of New South Wales and the oldest city in Australia, on the southern shores of Port Jackson (Map: New South Wales, F 3). It is situated about 8 miles from the sea, and the sound (Port Jackson) round which the city is built forms a fine harbor, where the largest vessels can safely anchor. Its bold and rocky shores, alternating with fine beaches, present a succession of picturesque and beautiful landscapes. The narrow entrance is marked by two lighthouses. The port of Sydney has upwards of 23 miles of wharves. On Cockatoo Island are two large government dry docks; Mort's dry dock at Balmain is capable of accommodating the largest vessel trading to the port. The city is defended by modern forts and batteries, and is the chief Australian naval station. The suburbs include 41 municipalities.

The climate of Sydney is salubrious to a degree. The city has a mean temperature of 63°. The average rainfall is about 48 inches. The sandstone rock upon which the city is built affords a valuable material for building. The streets in the older parts of the town are narrow and irregular; in the newer portions they are modern, and the size and style of the buildings are second only to those of the principal cities of Europe. The University of Sydney stands on a commanding height. There are three suffragan colleges affiliated to the university—St. Paul's, St. John's, and St. Andrew's, representing respectively the Anglicans, Roman Catholics, and Presbyterians. St. Mary's Cathedral is a handsome building, and the Anglican cathedral of St. Andrew is also a fine structure. Noteworthy are the residence of the Governor, the museum, the National Art Gallery, the exchange, the customhouse, the town hall, the post office, the public grammar school, and the theatres. Sydney has a mechanics' institute equipped with all the educational and recreative conveniences of an institution of its kind. The Y. M. C. A. is similarly furnished.

There are fine botanical gardens, and a number of public parks, of which the Sydney Centennial Park is the chief. There are 747 acres of park lands in the city of Sydney, or 26 per cent of the city proper. In the suburbs and municipalities are large areas devoted to parks. Water is brought from the Cordeaux, Cataract, and Nepean rivers, and is carried to the Prospect Reservoir. The water works and abattoirs are municipal property. The very complete electric tramway service is owned by the State government. The manufactures comprise wagons, glass, pottery, boots and shoes, carriages, stoves, and tobacco, and there are car shops, distilleries, and breweries. At various points within a radius of from 30 to 100 miles large quantities of coal are mined for domestic consumption as well as for export. Its central position makes Sydney the permanent emporium of the British dependencies in the Southern Hemisphere. It maintains its position as the outlet for the products and commerce of extensive pastoral and mineral districts.

The first party of British settlers that reached Australia landed at Botany Bay on Jan. 18, 1778. The spot which had been selected being found unsuitable, it was abandoned a few days afterward, and the infant settlement was transferred to a point about 7 miles farther to the north, the place where Sydney now stands. The choice of the new locality was chiefly determined by the circumstance of a stream of fresh water found there, flowing into the deep inlet known as Sydney Cove, one of the numerous bays into which the basin of Port Jackson is divided. After the abolition of convict transportation the growth of Sydney was rapid. The installation here, on Jan. 1, 1901, of Lord Hopetoun as first Governor-General of the Australian Commonwealth consummated the federation of Australia. The population of Sydney with suburbs in 1861 was about 95,000; in 1881, 237,300; in 1891, 399,270; in 1901, 488,382; in 1911, 636,-353. The municipality of Sydney (2880 acres) had 111,801 inhabitants in 1901 and 112,921 in 1911.

SYDNEY. A city and the capital of Cape Breton County, Nova Scotia, Canada, on Sydney harbor, on the Intercolonial and the Sydney and Louisbourg railways, 276 miles from Halifax (Map: Nova Scotia, K 4). It is connected by steamship with Montreal, Quebec, Halifax, and Newfoundland. It is an important manufacturing city, steel works employing 4000 men being located here, besides many other manufacturing industries. The value of the manufactured output in 1910 was placed at $9,395,-017, as compared with $631,396 in 1900. Pop., 1901, 9009; 1911, 17,723.

SYDNEY, ALGERNON. See SIDNEY, ALGERNON.

SYDNEY MINES. A town in Cape Breton County, Nova Scotia, Canada, situated on Sydney harbor, and on the Intercolonial Railway (Map: Nova Scotia, K 4). It is connected with North Sydney by electric railways. Over 3500 men are employed here in collieries, blast and open-hearth furnaces. Pop., 1901, 3191; 1911, 7470.

SYDOW, zē'dō, EMIL VON (1812-73). A distinguished German cartographer, born at Freiberg, Saxony. He entered the Prussian army in 1829, and in 1838 began to publish his excellent schoolroom maps. Detailed to Berlin in 1843 as a member of the Military Examination Committee, he was subsequently intrusted with the geographical lectures at the Military Academy, which he resumed in 1860. Attached to the great general staff, he was made director of the geographic-statistical department in 1867 and colonel in 1870. His cartographic work comprises: *Methodischer Handatlas für das wissenschaftliche Studium der Erdkunde*, 30 maps (4th ed., 1870); *Schulatlas in 42 Blättern* (32d ed., 1880); new ed. by Wagner, entitled *Sydow-Wagner, Methodischer Schulatlas*, 63 main and 50 accessory maps (16th ed., 1913); *Oro-hydrographischer Atlas*, 25 maps; and others. He contributed the reports "Ueber den kartographischen Standpunkt Europas" to *Petermanns Mitteilungen* (1857-72), and created the valuable book of reference *Registrande der geographisch-statistischen Abteilung des Grossen Generalstabs* (Berlin, 1870-83).

SYENE, sī-ē'nē. The ancient name of Assuan (q.v.), a town of Egypt.

SY'ENITE (Lat. *syenites*, from *Syene*). An igneous rock of granitic texture, composed essentially of alkali feldspar and mica, hornblende, or augite (mica syenite, hornblende syenite, augite syenite). It differs from granite in that it contains normally no quartz. Types of rock intermediate between the two, i.e., with a small quartz content, are known as quartz syenites. In some syenites the mineral nephelite is associated with the feldspar, constituting the class of nephelite syenites. The rock is used as a structural stone, but has not the same importance as granite, owing to its more limited occurrence. See NEPHELITE.

SYKES, sīks, FREDERICK HENRY (1863-). An American college president. He was born at Queensville, Ontario, graduated at Toronto University in 1885, and was scholar and fellow of Johns Hopkins University in 1891-95. He held various teaching positions up to 1903, and subsequently was professor of English literature and director of extension teaching at Columbia University (1903-10); director of technical education and professor of English, Teachers College, Columbia (1910-13); and after 1913, the first president of the Connecticut College for Women. His publications include, besides several books on English composition: *French Elements in Middle English* (1899); *Syllabus of Lectures on Shakespeare* (1903); *Lectures on the History of English Literature in the Nineteenth Century* (1904). He edited various English texts, and was appointed general editor of Scribner's "English Classics Series."

SYKES, GEORGE (1822-80). An American soldier, born at Dover, Del. He graduated at West Point in 1842, served in the Seminole and Mexican wars, and was brevetted captain for gallant conduct at Cerro Gordo. He fought in the first battle of Bull Run, as a major in the Federal army; was commissioned brigadier general of volunteers in September, 1861, took part in the Peninsular, in the second Bull Run, and in the Antietam campaigns; was commissioned major general of volunteers in November, 1862; fought at Fredericksburg and Chancellorsville; and commanded the Fifth Corps at Gettysburg. In March, 1865, he was brevetted brigadier general in the regular army for his services in the battle of Gettysburg and major general in the regular army for his services during the war. He was mustered out of the volunteer army in January, 1866, but remained in the regular army first as lieutenant colonel and then as colonel until his death in 1880. A monument has been erected in his honor at West Point.

SYKES, Olive Logan. Best known by her maiden name. See Logan, Olive.

SYLLA. See Sulla.

SYL'LABUS ERRO'RUM (Lat., catalogue of errors). A document published by Pius IX in 1864, condemning eighty doctrines which it calls "the principal errors of our times." The text of the document and an English translation are given in Schaff, *Creeds of Christendom* (New York, 1877–78). The Syllabus gave rise in England to a famous controversy between Gladstone and Newman. Consult W. E. Gladstone, *Vaticanism* (London, 1875), and J. H. Newman, *Letters to the Duke of Norfolk* (ib., 1875). The name "syllabus" is also used for the decrée of Pius X, 1907, condemning modernism in 65 propositions. See Modernism.

SYL'LOGISM (Lat. *syllogismus*, from Gk. συλλογισμός, reasoning, conclusion). The name of a logical operation when expressed in a certain form in accordance with the principles of formal logic. When we reason, or get at truth by means of inference, we are said to proceed either inductively (see Induction) or deductively. Deductive reasoning, when formally and methodically expressed, takes the form called the syllogism. "This thing will sink in water, for it is a stone," is a deductive argument, but not formally stated; this is called an enthymeme (q.v.). The complete form is, "Stones sink in water; this is a stone; therefore, this sinks in water." Such a form as this is called a syllogism.

A perfect syllogism requires (1) that there should be three, and no more than three, propositions (see Proposition); these are the conclusion, or the matter to be proved, and two others that are the means of proving it, called the premises; and (2) that there should be three, and no more than three, terms, viz., the subject and the predicate of the conclusion, and one, called the middle term, which must occur in both premises, being the connecting link for bringing the two other terms together in the conclusion. The predicate of the conclusion is called the major term, because it is in its extension (q.v.) the largest of the three; the subject of the conclusion is the minor term, as being the smallest in extension. The major and minor terms are called extremes. The three terms appear in the premises in this manner: the major term and the middle term appear in one premise, called the major premise; the middle term and the minor term in the minor premise. In the syllogism above stated the terms are "(a thing that will) sink in water" (major), "this thing" (minor), "stone" (middle); the premises are, "stones sink in water" (major), "this thing is a stone" (minor); the conclusion is, "this thing sinks in water." Other requisites for a complete syllogism are that (3) one premise at least must be affirmative; that (4) if one premise be negative, the conclusion must be negative; that (5) the middle term must be distributed (= taken in the whole of its extension) in at least one premise; that (6) an extreme, if undistributed in a premise, may not be distributed in the conclusion. Any syllogism which violates any one or more of these six syllogistic rules is invalid. There are two other rules which are derivative: (7) one premise at least must be universal; (8) if one premise be particular, the conclusion must be particular also. Any syllogism which violates either of these rules violates also one or more of the first six rules given above. For the discussion of the question as to the evidence of these canons, see Logic.

Categorical syllogistic forms are divided into figures, and each figure into moods, which are the distinct syllogistic forms, the principle of division being as follows: The figure is determined by the function of the middle term, in the two premises; it may be the subject of the major premise and the predicate of the minor (first figure); the predicate in both (second figure), the subject in both (third figure), the predicate of the major and the subject of the minor (fourth figure). The fourth figure did not belong to the original scheme of Aristotle, and it is usually considered as both unnatural and unnecessary, being only an awkward inversion of the first. The syllogisms of each figure are said to differ in mood, or according to the quality and the quantity of the propositions—i.e., according as these are affirmative or negative (quality), universal or particular (quantity).

A conditional or hypothetical syllogism has a conditional judgment as a major premise, and a minor premise which either categorically asserts what appears as a mere supposition in the protasis of the major premise, or denies the apodosis in the major premise. The conclusion in the former case categorically asserts the truth of the apodosis; in the latter case denies the truth of the protasis. Examples: If A is B, C is D; but A is B; hence C is D (*modus ponens*). If A is B, C is D; but C is not D; hence A is not B (*modus tollens*). A disjunctive syllogism may be illustrated by the arguments: A is either B or C; but it is B; hence it is not C; or A is either B or C; but it is not B, hence it is C.

A conditional syllogism whose conditional major premise presents some sort of alternative is called a dilemma. We may have these cases: Either (*a*) alternative consequences may be asserted to follow upon a single condition (or combination of conditions), or (*b*) alternative conditions may be asserted to determine a single consequence (or combination of consequences); or (*c*) an alternative may be presented between a condition with its consequence and another condition with its separate consequence. If alternative consequences are asserted to follow upon a single condition, then it is possible to have a valid conditional syllogism either when a minor premise affirms the condition, warranting as conclusion the affirmation of the alternative consequence; or when a minor premise denies conjunctively (neither—nor) the alternative consequences, warranting as conclusion the denial of the antecedent. If alternative conditions are asserted to determine a single consequence, it is possible to have a valid syllogism when a minor premise either categorically affirms one of the conditions or disjunctively affirms both conditions, in either case justifying as conclusion the affirmation of the consequent; or when the minor premise categorically denies the consequent, justifying as conclusion the conjunctive denial of the conditions. If the major premise presents an alternative between a condition with its consequence and another condition with its separate consequence, a valid syllogism obtains when the minor premise either disjunctively affirms the two conditions, justifying the disjunctive affirmation of the two consequences, or when the minor premise conjunctively or disjunctively denies both consequences, justifying a conjunctive or disjunctive denial respectively of the two antecedents.

Many logicians maintain that syllogistic logic is a useless formalism, for no one, it is claimed, actually reasons in the syllogistic manner. Consult: Knight Dunlap, "A Theory of the Syllogism," in University of California, *Publications: Philosophy*, vol. i (Berkeley, 1904); Franz Hillebrand, *Die neuen Theorien der kategorischen Schlüsse: eine logische Untersuchung* (Vienna, 1891); G. Rodier, "Les functions du syllogisme," in *L'Année philosophique*, vol. xix (Paris, 1909); also references under Logic. See also Conversion; Dilemma; Fallacy; Obversion.

SYLPHS (Neo-Lat. *sylpha*, probably from Gk. *σίλφη*, *silphē*, sort of beetle; so called as being a spirit flying in the air). In the fantastic system of the Paracelsists, the elemental spirits of the air, who, like the other elemental spirits, hold an intermediate place between immaterial and material beings. They eat, drink, speak, move about, beget children, and are subject to infirmities like men; but, on the other hand, they resemble spirits in being more nimble and swift in their motions, while their bodies are more diaphanous than those of the human race. They also surpass the latter in their knowledge, both of the present and the future, but have no soul, and when they die nothing is left.

In common usage, the term "sylph" has a feminine signification, and is applied to a graceful maiden. How this change of meaning occurred is not certain, but it is possibly owing to the popularity of Pope's *Rape of the Lock*. Consult Paracelsus' *Liber de Nymphis, Sylphis, Pygmæis et Salamandris et Cæteris Spiritibus* (Basel ed. of Paracelsus' works, 1590).

SYL'VANITE. A telluride of gold and silver occurring with other tellurides in the Cripple Creek district of Colorado.

SYLVES'TER. The name of two popes. Sylvester I, Pope 314–335. His reign was the first in the new period of Church freedom under Constantine. In his pontificate the Council of Nicæa was held, which he did not himself attend, but sent two legates to represent him. Numerous unhistorical legends, especially concerning his relations to Constantine, have clustered about him; concerning them, consult J. J. I. Döllinger, *Fables Respecting the Popes in the Middle Ages* (Eng. trans., New York, 1872; 2d Ger. ed., Stuttgart, 1890); and see Donation of Constantine. His works are in Migne, *Patrologia Latina*, viii.—Sylvester II, Pope 999–1003, Gerbert by name. He was born at Aurillac in Auvergne about 940. He became head of the cathedral school at Rheims, which grew to eminence under his direction. In 983 he was made abbot of Bobbio on the nomination of Otho II, but returned to Rheims, of which he was chosen Archbishop in 991. Four years later, the deposition of his predecessor having been declared invalid, he went to Magdeburg on Otho III's invitation, and accompanied him to Italy, where he became Archbishop of Ravenna in 998, and Pope in the following year. He was a strict reformer, and was considered the most learned man of his age. The Gobar numerals, the ancestors of our modern numerals and due to the western Arabs, owe much of their prominence, if not their introduction into Europe, to Sylvester. His writings are reprinted in Migne, *Patrologia Latina*, cxxxix; also by Olleris (Paris, 1867); his letters have been translated into French (Riom, 1847). Consult: Karl Hock, *Histoire du Pape Sylvestre II et de son siècle* (trans. from Ger. by J. M. Axinger, Paris, 1842); Schultess, *Die Sagen über Silvester II* (Hamburg, 1893); Lux, *Sylvesters II Einfluss auf die Politik Ottos III* (Breslau, 1898); H. K. Mann, *Lives of the Popes*, vols. iv, v (London, 1910); and the book of Döllinger referred to above.—The name was also borne by two antipopes, Sylvester III, who contested the papal throne with Benedict IX in 1044, and Sylvester IV, who was put up by the Imperial party to oppose Paschal II in 1105.

SYLVESTER, James Joseph (1814–97). One of the foremost English mathematicians of the nineteenth century. He was born in London, of Jewish parents, and received his early education in a Jewish school. He then attended the Royal Institution school in Liverpool, and thence proceeded to St. John's, Cambridge (1831). As a Jew he was barred from taking a degree, and it was not until the passing of the Tests Act that he obtained his B.A. at Cambridge (1872). He studied at the Inner Temple after leaving Cambridge, and was called to the bar in 1850. Sylvester was appointed professor of natural philosophy at University College, London, in 1837, and was elected fellow of the Royal Society in 1839. In 1841 he was appointed professor of mathematics in the University of Virginia, but soon after (1845) returned to England, where he took up the work of an actuary. In 1855 he became professor of mathematics at the Royal Military Academy at Woolwich, where he remained for 15 years. In 1877 he became the first professor of mathematics at Johns Hopkins University, which position he held for seven years, returning to England to accept the Savilian professorship of geometry at Oxford. He founded the *American Journal of Mathematics* and was for some years its editor.

Sylvester's contributions were almost exclusively in the form of memoirs in scientific journals and the proceedings of various societies. They are devoted chiefly to the theories of algebraic forms (see Forms), in which he was the recognized leader of the mathematical world. He and Cayley (q.v.) contributed more than any of their contemporaries to the theory of invariants, and he may be said to have practically created the vocabulary of the subject. He also published a work on *Laws of Verse* (1870), a subject in which he always showed an interest. Consult Sylvester's *Collected Mathematical Papers* edited by H. F. Baker (3 vols., New York, 1904–10); obituary notices in various scientific journals in 1897; and Franklin, *Address Commemorative of Sylvester* (Baltimore, 1897).

SYLVESTER, Joshua (1563–1618). An English poet, born in the north of Kent. His life was divided between poetry and trade. He is mainly known for a translation, or rather paraphrase in translation (1592), of the *Semaines* (Weeks), a sacred epic by Du Bartas (q.v.). The translation had considerable influence upon Milton. Of Sylvester's original verse, all is forgotten except the beautiful sonnet beginning "Were I as base as is the lowly plaine" (in Palgrave's *Golden Treasury*). Consult his *Works*, ed. A. B. Grosart, Chertsey Worthies Library (2 vols., London, 1878).

SYLVESTER DAGGERWOOD. A one-act play by George Colman the Younger, produced in 1795, a shorter form of *New Hay at the Old Market*, brought out in the same year.

SYL'VICUL'TURE. See FORESTRY.

SYL'VITE. See POTASSIUM.

SYL'VIUS. The Latinized name of Jacques Dubois (1478–1555), a French anatomist, born near Amiens. He studied in Paris and afterward was a lecturer on anatomy there. His anatomical discoveries and his invention of injection for use in dissection cause him to be remembered. The Sylvian fissure, the Sylvian aqueduct, and the Sylvian artery were named in his honor. His *Opera Medica* were published at Geneva in 1630.

SYM'BIO'SIS (Neo-Lat., from Gk. *συμβιωσις*, life together, from *σύν*, *syn*, together + *βιος*, *bios*, life). That condition in which two or more dissimilar organisms live together in an intimate life relation. Various types of symbiosis depend upon the type of relation existing between the organisms, the so-called symbionts.

1. Mutualistic symbiosis, or mutualism, is that condition in which each party to the symbiosis seems to derive advantage therefrom. This relation has perhaps not been proved to exist in plants, though it seems likely that mutualism exists between the legumes and the bacteria of their root tubercles. Many believe that lichens show true mutualism, the fungus symbiont supplying nitrogenous substances or other materials absorbed from the substratum, and the alga symbiont the carbohydrates. See MYCORRHIZA.

2. Antagonistic symbiosis, or parasitism, is that condition where one symbiont gains at the expense of the other. There are many illustrations of this in nature. For example, the parasitic fungi and seed plants may be regarded as securing food from their host plants, but not giving an equivalent in return, as is the case in perfect mutualism.

3. A somewhat intermediate condition is illustrated by contingent symbiosis, or helotism (q.v.). Some writers hold that lichens illustrate this type, the idea being that there is not a mutual exchange between the alga and the fungus symbiont. The fungus is supposed to gain, but the alga is supposed neither to lose nor gain.

Symbiosis may be more or less intimate. In conjunctive symbiosis the symbionts are blended together so as to form a single body, as best illustrated by the lichens. In disjunctive symbiosis the symbiosis is more temporary, or the symbionts are less completely blended, as illustrated by ectotrophic mycorrhizas.

Relations which are, perhaps, not to be regarded as symbiosis, but which nevertheless bear a close similarity to it, are frequently found. Saprophytism differs from parasitism only in that the host plant, so to speak, is dead. Recently a new life relation has been recognized, such as is found in the Indian pipe (*Monotropa*); in which case there is a root fungus which derives its food materials saprophytically from the soil. *Monotropa*, not being a green plant, gets nearly all of its food material from the fungus. Hence the relation of the two organisms taken together is saprophytism. The mutual relation of the pair is, however, symbiosis, and the whole relation may be called symbiotic saprophytism. This term may be applied to all of the mycorrhiza plants.

Among animals forms of symbiosis are to be found. An example of social symbiosis is the case of a polyp (*Epizoanthus*) or a sea anemone (*Adamsia*), which grows on the shell inhabited by a hermit crab. Klebs states that when the crab changes its shell it seizes the anemone and carries it off to its new home. The term *physiological symbiosis* may be applied to cases among the lowest organisms where certain algæ (Zoöxanthellæ) often live in Radiolaria (q.v.), while similar green and yellow plants inhabit the stomach epithelium of many actinians, corals, and worms. As Hertwig says, the Zoöxanthellæ are nourished by the carbon dioxide which is formed by the animal tissues, and breathe out oxygen, which in turn serves as food for the animal. They also form starch and other carbohydrates, and there is nothing to prevent any surplus thus formed from becoming food for the animal. A remarkable case of symbiosis, involving a structural modification, is that of a carpenter bee (of the Oriental genus *Koptorthosoma*) and a certain mite. A special chamber, with a small orifice for entry, exists in the abdomen of the bee, in which the Acari are lodged. Here it is a little difficult to draw the line between symbiosis and the parasitism, e.g., of the itch mite which burrows under the skin between the fingers.

Social Symbiosis. Wheeler applies this term to the relations between ants and the various beetles, crickets, cockroaches, etc., which live at their expense. Of those beetles (*Claviger*, *Paussus*, etc.) that live in ant and termite nests certain ones seem to be tolerated or ignored by the ants. So completely agreeable to the ants is the presence of certain of the Staphylinidæ that the ants regurgitate food which they give to the beetles, and the beetles in the same manner share their supply with hungry ants. The ants feed the larval beetles with as much care as they do their own larvæ. They even clean the young beetles by licking them. See ANT; BEE; COMMENSALISM; EPIPHYTE; INSECT; LICHEN; MUTUALISM; PARASITE; ROVE BEETLE; TERMITE.

Consult: *Nature*, vols. xvii, xxv (London, 1882); Brandt, in *Archiv für Anatomie und Physiologie* (Leipzig, 1882); *Mittheilungen der zoologischen Station, Naples*, vol. iv (Naples, 1883); Oskar Hertwig, *Die Symbiosis* (Jena, 1883); Frederick Keeble, *Plant-Animals: A Study in Symbiosis*, in "Cambridge Manuals of Science and Literature" (Cambridge, 1912). For symbiosis in insects, see the papers of Forel, Wasmann, Wheeler, etc.

SYM'BOLISM (from *symbol*, from Lat. *symbolus*, *symbolum*, from Gk. *σύμβολος*, *σύμβολον*, mark, token, signal, sign). The use of symbols, not merely those of the figures of speech (see RHETORIC, FIGURES OF), but those of all language, since the word symbolizes the idea and the idea symbolizes the thing. Any word has always at least two meanings, one of which is more remote and archaic than the other, as is seen in the word "spirit," which, used in its religious sense, has not now, as it once had, the meaning "breath." Corresponding to this double or multiple meaning possessed by all except the most elemental words such as "mother," there is found to be in the human psyche a double stream of mentality, the conscious and the unconscious; and just as the ordinary person is ignorant of the vanished or obsolete meanings of all the words he uses, so he is generally uninformed concerning the stream of the unconscious (q.v.), which modern psychology, particularly the branch of it called psychoanalysis (q.v.), has begun to investigate. (See PSYCHOTHERAPY.) Symbolism may then be defined as the deeper meaning possessed by words and things, by virtue of which they become dynamic. The more symbolic a thing is the more effect it will have upon human action. The significance or dynamic power of any symbol depends naturally upon the individual's knowledge of its history; in other words, it acquires significance in proportion as its history which has been in the unconscious is brought more and more into consciousness.

Conscious symbolism, that in which two things are represented alike in some respect, is universal from the imagery of poetry to the slang of the street, from the customs of the most developed religion to the habits of the lowest order of human life. The flag as the symbol of nationality, the cross as symbol of Christianity, the dove as symbol of the Holy Ghost, are all signs of whose implied similarities both members are easily recalled to consciousness.

The symbols of the unconscious, however, are based upon a similarity, only one member of which is available for consciousness. We know that our conduct is socially serviceable or not, very frequently without realizing why we are drawn towards unsocial acts by the archaic and antisocial nature of the unconscious, which is constantly prompting us to take satisfaction in acts which are typical only of the lower and more remote and archaic stages of the evolution of human conduct. According to this modern view of symbolism many phenomena hitherto unexplained have been cleared up. Thus much of human abnormality, as manifested in crime and in many diseases, is seen to be but the conscious member of a symbolism, the other member of which is in the unconscious and is furnishing the impulsive force whose maladjustment to the requirements of human society as at present organized is the cause of the social and individual maladies. Hysteria is thus recognized as a regression to modes of mental reaction on the stimulus of environment, a regression which is due to the influence of the unconscious, and insanity of many kinds is seen to be an archaic type of conduct and is treated accordingly and with increasing success.

Symbolism is most important in the history of art, especially of Christian art. Obviously no doctrine of religion can take form in outward act without some kind of symbolism; and accordingly every detail of the ancient Roman Catholic or Eastern rites is so planned as to suggest to the worshiper one or another aspect of abstract truth. In the plan and construction of the older churches the same idea is carried out as in their cruciform shape. Early Christian art represented Jesus under numerous symbols, among the commonest being the lamb, the fish, and the Greek letters Alpha and Omega (the beginning and the end). Similarly, the olive branch denoted peace; the palm, triumph; and the anchor, faith or hope. In later art each one of the saints depicted may be recognized by some appropriate symbol, e.g., St. Andrew by a cross in the shape of an X, or St. Dominic by the lily and the star above his forehead. Consult: C. E. Clement (Mrs. Waters), *Handbook of Legendary and Mythological Art* (15th ed., Boston, 1883); R. P. Knight, *The Symbolic Language of Ancient Art and Mythology* (new ed., New York, 1892); M. A. Pottenger, *Symbolism* (Sacramento, Cal., 1905); M. E. Tabor, *Saints in Art* (New York, 1908); Harold Bayley, *The Lost Language of Symbolism* (2 vols., Philadelphia, 1913); H. Silberer, *Probleme der Mystik und ihrer Symbolik* (Vienna, 1914); White, "Symbolism," in *Psychoanalytic Review* (New York, 1916).

For the symbols used in mathematics, see SYMBOLS, MATHEMATICAL; FINGER SYMBOLISM; and for the use of the term "symbolism" in a restricted literary sense, see SYMBOLISTS. For words as symbols, see SEMASIOLOGY. For the use of the fish as a symbol of Christ, see ICHTHYS.

SYMBOLISM, FINGER. See FINGER SYMBOLISM.

SYM'BOLISTS. The name of a class of writers which sprang up after 1880 notably in France and in connection with verse. The Symbolists regard symbolism as the expression of an idea by the introduction of a being or an object merely for the purposes of such expression. The characteristic means are the allegory, transposition, and allusion. The Symbolists were in effect reactionists against realism. They concern themselves with general truths in contrast with actualities. They court erudition, adore the metaphysical and mysterious, and especially exalt the magic power and charm of music. Identified with the influence of Wagner, they seek music in language and accordingly the sonorousness of words; they suggest but do not name. Dreams, visions, and mythological tales are their proper subjects, and lyricism their favorite form of poetic expression. In their aim to unify and blend the arts and the functions of the senses, the extremists among them, like Arthur Rimbaud, associated the vowels with colors, etc. The metrical reforms of the French Symbolists have resulted in making French verse more free, more subtle, intimate, and musical. The Symbolists, despite vagaries, have left a permanent and desirable mark. Their general influence has been for the exclusive, the refined, the delicate, and the mystic beauties of the supernatural. Their verse has represented idealism, religious sentiment, a return to the ancient, and an inherent preference for solemn or fatalistic themes. Verlaine, Mallarmé, and Maeterlinck are the most noteworthy of the French and Belgian Symbolists. Among Symbolist plays those of De Curel may be noted. Symbolism reaches also into the domain of contemporary painting. (See PAINTING, *Modern Painting*.) The term Décadent began to be derisively applied, in France, about 1882 to the group of young poets who later called themselves Symbolists. The word Symbolist represents all that proved to be durable in *décadentisme*.

The term *décadent* is sometimes used to-day, loosely, to designate by way of ridicule all modern writers, like Ibsen and D'Annunzio, whose themes at times have been atavistic, their characters degenerate, and their theories of art more or less subversive.

The Young Symbolists or Décadent poets, as they called themselves, in France merit distinctive notice for the rôle which they played in connection with the development of the Symbolist school or movement. Their literature may be said to have been born of the demoniacism of Baudelaire, the exaggerated realism in Zola, the haughty pessimism and gorgeous indifference of Leconte de Lisle, and the overrefining neurosis of the Goncourts, against all which influences, except that of Baudelaire, the Décadents nevertheless revolted wholly or in part like unnatural children. As for Baudelaire, they adoringly adopted him as their particular sire and model. Their more immediate avatars were Verlaine and Mallarmé. Among the Décadents of Paris there developed two general groups. The less serious class associated their verse with the *chanson populaire.* They did not shrink from repulsive themes, brutal *cochonneries,* Rabelaisian wit, the authors glorying in the extravaganzas of eccentrics writing for the pavement public. Their songs were put forth in all sorts of loose, unkempt forms of verse. To whet their own morbid inspirations, they drank absinthe and used hashish and morphine. They celebrated the effects of dissipation and disease and were proud to belong among the *poètes maudits.* They were noisy poseurs, often most ingenious and clever and always surprising. Their cafés, notably the Chat Noir, were long frequented by a public greedy for the latest sensation.

It was the more serious class of Parisian Décadents who became a part of the Symbolist movement. They were the delicate and aristocratic brothers of the song writers. They reflected the same traits and motives, but in a more fine-grained, literary, and enlightened manner and in the higher forms of verse. They, too, identified themselves with urban life and exalted its factitious stimulations and the elaborate and refined corruptions of an excessive or declining civilization. They disdained the natural, the simple, the rural, the healthful. They were rare æsthetes, dwelling in Baudelaire's "artificial paradises," with anæmic, satiny complexions, victims of goaded nerves, supreme egoists, in search of the unusual, the abnormal, and the difficult. They prided themselves on being *savants mystificateurs* and were distinguished by *maladive* airs and effeminate graces. What few ideas these poets, in their effaced cult of Hartmann and Buddhism, harbored and expressed, were voluntarily involved in mystic complexity, in obscurantism. They wished to substitute sensations for ideas and art for morals. Their theories and practices in the more intimate matter of the art of poetry, however, stood out as interesting and original. It was their aim always to suggest and to mask, never to name or expose. They employed the semieffects, the neutral tones, and relied on pale motives, evaporative *nuances,* and on lingering, caressing extenuations of results. More conspicuous was their ambitious confusing of the functions of the senses, insisting on color in music and on music in color, and finding forms and perfumes in both. Their main purpose in this sphere was to interpret emotions as music and to marry it to poetry, as devoted Wagnerians. They sought to wed the flow of harmonies to liquid verse, to emphasize floating indecisions and extremely mobile sensuousnesses, earning thereby the name of Déliquescents. In all this they courted the neurotic, the psychical, the supernatural, and reacted against the materialistic and plastic cults of the realists and the Parnassians.

The most tangible of their innovations lay in their forms of verse—their *vers brisés*—in which they displayed attempts at blank verse or rhymed prose and strove to expand the formal and contracted limitations of French versification. They wrote "familiar alexandrines" and verse of more than 12 feet; they discarded the cæsura at the hemistich, and the alternating process of male and female rhymes. In fact, rhymes and fixed forms were generally abandoned for assonances, cadences, repetitions, and for polymorphous lines which were meant to be the tonal and visible counterpart and representation of the themes versified.

The Décadents of Paris were specifically little more than curiosities; but in their connection with symbolism they were not without effect on literature and art. Indeed, it may almost be said that the Décadents were merely the Symbolists who failed. Among those who have been for one reason or another or at various times associated in France, in the public mind, with *décadentisme* may be mentioned (to name a few among many) Maurice Barrès, De Régnier, Gustave Kahn; the two Belgians Maeterlinck and Rodenbach; the Greek Moréas; the Americans Vielé-Griffin and Stuart Merrill. The Théâtre Libre was also to some extent identified with the Décadents. In other continental countries may perhaps be cited the Swede Ola Hansson, the Norwegian Hjalmar Christiansen, the Austrian Hermann Bahr. In England Aubrey Beardsley (q.v.), with his fantastic, unwholesome pictorial art, was considered a conspicuous Décadent. There have been no very characteristic echoes in English poetry, because blank verse, *vers libre,* etc., were not new to it. Consult: G. Pellissier, *Etudes de littérature contemporaine* (Paris, 1898); Arthur Symons, *The Symbolist Movement in Literature* (London, 1899); Gustave Kahn, *Symbolistes et décadents* (Paris, 1902); André Barre, *Le symbolisme* (ib., 1911); Rémy de Gourmont, *Le livre des masques: portraits symbolistes, gloses et documents sur les écrivains d'hier et d'aujourd'hui* (2 vols., ib., 1914). See SYMBOLISM.

SYMBOLS, MATHEMATICAL. The various signs and abbreviations used to facilitate mathematical expression. They are of the following kinds:

- Of value.
  - Hindu and other numerals. See NUMERALS.
- Of operation.
  - Addition, $+$, Σ.
- Subtraction, $-$.
  - Multiplication, as in $a \times b$, $a \cdot b$, $(a + b)$, $\lfloor\underline{a}$ or $a!$
  - Division, as in $a \div b$, $a:b$, a/b, $x^{-n} = \frac{1}{x^n}$.
    - % (per cent, per C, per hundred, as in $6\% = \frac{6}{100}$). Similarly, $^0\!/_{00}$, per mil, per thousand, per M.
  - Involution, as in x^n.
  - Evolution, as in $x^{\frac{1}{n}}$ or $\sqrt[n]{x}$.
  - Differentiation, d, δ, D.
  - Integration, $\int$.
  - Binomial coefficient $\binom{n}{k}$, for $\frac{n(n-1)\ldots\ldots(n-k+1)}{k!}$.
- Of function.
  - $f(x)$, $F(x)$, for f — function of x, F — function of x; $\phi(x, y, \ldots\ldots)$, for phi-function of $x, y, \ldots\ldots$
- Of quality.
  - Positive number, $+a$.
  - Negative number, $-a$.
  - Absolute value, $|a|$.
  - Imaginary, ai for $a\sqrt{-1}$.
- Decimal, as in 3.2 (U. S.), 3·2 (England), 3,2 (Continental).
- Of relation.
  - Equality, $=$, $::$.

Indentity, ≡.

Inequality, as in $a < b$ (a less than b), $a > b$ (a greater than b), $a \nless b$ (a not less than b), $a \ngtr b$ (a not greater than b), $a \neq b$ (a not equal to b).

Of continuation.

. . . . , as in $a, a^2, a^3, \ldots\ldots$

Of deduction.

∵ (since).

∴ (therefore).

Of aggregation.

( ), [ ], { }, ——.

Of denominate numbers, as in $10, 3° 4′ 15″ (degrees, minutes, seconds), £20 3s. 2d. (pounds, shillings, pence), cwt. (100 lbs.), and various abbreviations.

Of geometry.

∠, ∡ (angle, angles).

⊥ (perpendicular to).

|| (parallel to).

∼ or = (congruent to).

∽ (similar to).

= (approaches as a limit).

△, ▲ (triangle, triangles).

⊙, Ⓢ (circle, circles).

□, ⊡ (square, squares).

▭, ▭ (rectangle, rectangles).

▱, ▱ (parallelogram, parallelograms).

⌒ (arc).

a (radians).

The question of the origin and development of mathematical symbols is a large one, and science has not yet given satisfactory answers at many points. The probable origin of the remarkable digits 1 . . . . 9 is discussed under NUMERALS. The origin of zero is unknown, there being no authentic record of its history before 400 A.D. The extension of the position system below unity is attributed to Stevin (1585), who called tenths, hundredths, thousandths, ... *primes*, . . *sekondes*, *terzes*, and wrote subscripts to denote the orders; thus, 4.628 was written $4(_0)\ 6(_1)\ 2(_2)\ 8(_3)$. But Pellos (1492) used a period to set off the decimal part of a number, and a bar was used for this purpose by Rudolff (1526), Cardan (1539), Cataneo (1546), and various other writers. The first man who seems to have fully comprehended the significance of this separation of the integral and decimal parts was Rudolff, in whose *Exempelbüchle* of 1530 an example in compound interest is solved, and full use is made of the decimal fraction. Kepler (1571–1630) used the comma to set off the decimal orders, and Bürgi (1552–1632) and Pitiscus (1612) in their tables used the decimal fraction in the form 0.32, 3.2, but they also used other methods of indicating decimals. Although the early Egyptians had symbols for addition and equality, and the Greeks, Hindus, and Arabs symbols for equality and for the unknown quantity, from earliest times mathematical processes were cumbersome for lack of proper symbols of operation. The expressions for such processes were either written out in full or denoted by word abbreviations. The later Greeks, the Hindus, and Jordanus indicated addition by juxtaposition; the Italians usually denoted it by the letter *P* or *p* with a line drawn through it to distinguish it as an operation, but their symbols were not uniform. Pacioli, for example, sometimes used *p* and sometimes *e*, and Tartaglia commonly expressed the operation by *ø*. The German and English algebraists introduced the sign +, but spoke of it as *signum additorum* and first employed it only to indicate excess. Subtraction was indicated by Diophantus by the symbol ⋔. The Hindus used a dot, while the Italian algebraists denoted it by *M* or *m* with a line drawn through the letter. The symbols $\overline{m}$ and *de* were, however, used by Pacioli. The German and English algebraists were the first to use the present symbol and described it as *signum subtractorum*. The symbols + and − appeared first in print in an arithmetic of Widman (1489). The symbol × for "times" is due to Oughtred (1631). To Rahn (1659) is due the sign ÷ for division used in the English-speaking countries; Harriot (1631) used a period to indicate multiplication, and Descartes (1637) used juxtaposition. Leibnitz in 1688 employed the sign $\frown$ to denote multiplication and $\smile$ to denote division. Division among the Arabs was designated variously by $a - b$, a/b, $\frac{a}{b}$, but Clairaut (1760) made familiar the form $a : b$. Descartes made popular the notation a^n for involution and Wallis defined the negative exponent. The symbol of equality, =, is due to Recorde (1557), and the symbols >, <, for greater than and less than, originated with Harriot (1631). Viëta (1591) and Girard (1629) introduced various symbols of aggregation. The symbol ∞ for infinity was first employed by Wallis in 1655. The symbols of differentiation dx and of integration $\int$ as used in calculus are due to Leibnitz, as is also the symbol ∼ for similarity, as used in geometry. The symbolism *ø*, *f*, *F*, as used in theory of functions, is due to Abel. Consult M. B. Cantor, *Vorlesungen über Geschichte der Mathematik* (2d ed., Leipzig, 1900); "Vorschläge zur Vereinheitlichung der mathematischen Bezeichnungen im Schulunterricht," in the *Schriften des deutschen Ausschusses für den mathematischen und naturwissenschaftlichen Unterricht* (ib., 1913), where an extended list of symbols is given.

SYMBOLS OF THE FOUR EVANGELISTS. See EVANGELISTS, SYMBOLS OF THE FOUR.

SYME, sɪm, JAMES (1799–1870). A Scottish surgeon, born in Fife, and educated at the University of Edinburgh. He was lecturer (1823–32) and professor (1833–69) of surgery at his alma mater, after having served as demonstrator under Liston and, for a short time, as the latter's successor. He was the inventor of the mackintosh waterproof cloth. He was clinical professor from 1829 to 1833 in Minto House Hospital, which he founded at his own expense. In 1861 he was appointed surgeon in ordinary to the Queen in Scotland. He was one of the ablest teachers and operative surgeons of his time. He devised resection of the joints, Syme's amputation of the foot, and excision of the lower jaw. Syme was the father-in-law of Lord Lister (q.v.). He was the author of many valuable works, including *The Excision of Diseased Joints* (1831); *Principles of Surgery* (1832; Ger. trans.); *Diseases of the Rectum* (1838); *Pathology and Practice of Surgery* (1848); *Stricture of the Urethra and Fistula in Perineo* (1849; 2d ed., 1855). Consult R. Paterson, *Memorials of the Life of James Syme* (Edinburgh, 1874).

SYMINGTON, sɪm'ĭng-ton, WILLIAM (1763–1831). A British inventor, born at Leadhills. In 1786 he constructed a working model of a steam road carriage, and afterward patented a steam engine in which he obtained rotary motion by chains and ratchet wheels. In 1788 he and

Patrick Miller used an engine constructed on the lines of this patent to propel a small pleasure boat on Dalswinton Loch. In the following year they experimented on a larger scale on the Forth and Clyde Canal and succeeded in attaining a speed of 7 miles an hour. As the type of engine used was imperfect, however, Symington in 1801 patented another in which a piston rod guided by rollers was connected by a rod to a crank attached to the paddle-wheel shaft. In the following year he fitted out a boat called the *Charlotte Dundas,* which proved able to tow two barges a distance of 19½ miles in six hours. The Duke of Bridgewater, Symington's patron, was so well pleased with the boat that he ordered eight others to be constructed. Unfortunately the Duke died soon afterward, the order was canceled, and Symington died in poverty.

SYMMACHUS, sĭm′mȧ-kŭs. Pope, 498–514. He was born in Sardinia, and was chosen to fill the vacancy left by the death of Anastasius II. A minority, however, of the Byzantine faction, set up as a rival the archipresbyter Laurentius. As a result of the schism bloody encounters took place, and the Ostrogothic King Theodoric, although an Arian, was appealed to and gave his voice for Symmachus. Theodoric, being again appealed to, caused the Bishop of Altinum to administer the affairs of the Church for a time and left the decision to a synod. In its fourth session the synod (502) finally decided in favor of Symmachus. In vindication of the action of the synod the deacon Ennodius, afterward Bishop of Ticinium (Pavia), gave clear expression to the principle that the Pope (Ennodius is among the first to limit this title to the Bishop of Rome) is above every human tribunal and is responsible only to God himself. Later councils during Symmachus' pontificate condemned all interference of laymen in the election of popes and regulated the disposition of goods belonging to the Church.

SYMMACHUS, GREEK VERSION OF. See BIBLE, *Versions.*

SYMMACHUS, QUINTUS AURELIUS (c.345–410). A Roman orator, scholar, and statesman. He was educated in Gaul, and, after holding several lesser offices, became prefect of Rome (384) and, seven years later, consul. A sincere pagan in an age when classic paganism was almost extinct, he proved a pattern of its virtues and strove to regain for it a place of honor in the state. Symmachus' extant writings consist of 10 books of letters (*Epistolarum Libri X*) and the fragments of nine orations. The best editions of Symmachus' entire works are by Seeck, in *Monumenta Germaniæ Historica: Auctores Antiquissimi,* vol. vi (Berlin, 1883), and Kroll (Leipzig, 1893). Consult: Morin, *Etudes sur la vie et les écrits de Symmaque, préfet de Rome* (Paris, 1847); Sir Samuel Dill, *Roman Society in the Last Century of the Western Empire* (London, 1899); T. R. Glover, *Life and Letters in the Fourth Century* (London, 1901); Martin Schanz, *Geschichte der römischen Litteratur,* vol. iv, part i (2d ed., Munich, 1914); M. S. Dimsdale, *A History of Latin Literature* (New York, 1915).

SYM′METRY (Lat. *symmetria,* from Gk. *συμμετρία,* from *σύμμετρος, symmetros,* having a common measure). A term used in geometry to express a characteristic property of two congruent or quasicongruent figures which have a certain relation with respect to a point, line, or plane. Two systems of points, A_1, B_1, C_1, ..., A_2, B_2, C_2, ..., are said to be symmetric with respect to an axis when all lines $A_1 A_2$, $B_1 B_2$, ... are bisected at right angles by that axis. Two figures are said to be symmetric with respect to an axis when their systems of points are symmetric with respect to that axis. A figure is said to be symmetric with respect to an axis when the axis divides it into two symmetric figures. Two systems of points A_1, B_1, C_1, ..., and A_2, B_2, C_2, ..., are said to be symmetric with respect to a centre O when all lines $A_1 A_2$, $B_1 B_2$, $C_1 C_2$, ..., are bisected by O.

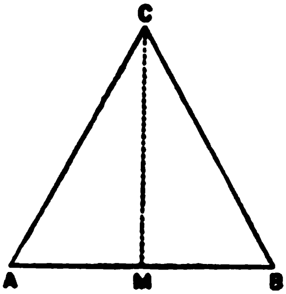
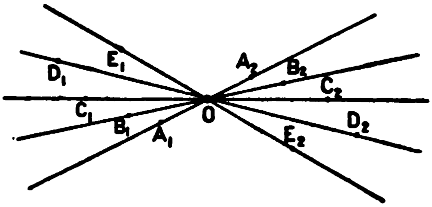
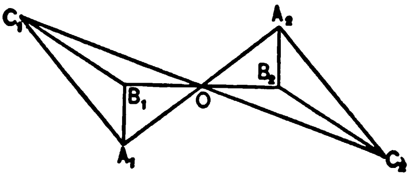


FIGURE SYMMETRIC WITH RESPECT TO AN AXIS.



POINTS SYMMETRIC WITH RESPECT TO A CENTRE.



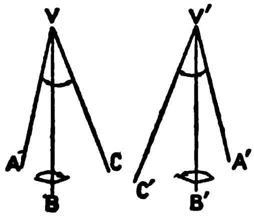
SYMMETRICAL TRIANGLES.

Two figures are said to be symmetric with respect to a centre when their systems of points are symmetric with respect to that centre. For example, in the figure triangles $A_1 B_1 C_1$, $A_2 B_2 C_2$ are symmetric with respect to O.

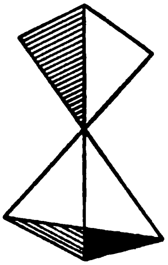
Figures of three dimensions besides being symmetric with respect to an axis or a centre may be symmetric with respect to a plane. For example, the sphere is symmetric with respect to its centre, with respect to any diameter as axis, and with respect to any diametrical plane as a plane of symmetry. Symmetric polyhedral angles may be considered as quasicongruent and are such as have their dihedral angles equal, and the plane angles of their faces also equal, but arranged in reverse order.

Thus, in the following figure, V and V' are symmetric trihedral angles, the letters showing the reverse arrangement. Opposite polyhedral angles are such that each is formed by producing the edges and faces of the other through the vertex, and are symmetric. The theory of symmetric figures is closely related to that of similarity (q.v.).

In algebra, an algebraic function is said to be symmetric with respect to certain letters when these letters can be interchanged without changing the form of the expression. For example, $x^2 + 2xy + y^2$ is symmetric as to x and y, because if x and y are interchanged it becomes $y^2 + 2yx + x^2$, which is the same as the original expression.



SYMMETRIC POLYHEDRAL ANGLES.



OPPOSITE POLYHEDRAL ANGLES.

A knowledge of symmetry and homogeneity (q.v.) is of great value in factoring. For example, to factor $f(x, y, z) = x(y^3 - z^3) + y(z^3 - x^3) + z(x^3 - y^3)$. The expression vanishes for $x = y$, hence $x - y$ is a factor by the remainder theorem (q.v.). But $f(x, y, z)$ is symmetric with respect to x, y, z, therefore $y - z$, $z - x$, are also factors. And $f(x, y, z)$ being homogeneous of the fourth degree, it must contain another factor of the first degree; but such a homogeneous symmetric factor can be $x + y + z$ only. Whence the literal factors are $x - y$, $y - z$, $z - x$, $x + y + z$.

SYMMETRY. The general tendency in animals towards a symmetrical arrangement of parts. Thus, man is bilaterally symmetrical, i.e., the external parts or limbs are arranged in pairs on each side of his body. So with the annelid worms, the lobster, centipede, and scorpion. On the other hand, this symmetry is wanting in some of the internal organs—those which are single. Haeckel has elaborated a scheme of fundamental forms of which the following is a summary.

1. *Anaxial or symmetrical* forms, with no fixed central point or definite axis (many Protozoa and most sponges).

2. *Homaxial or spherical* animals have the fundamental shape of a sphere, the parts of the body being arranged concentrically around a fixed central point (a few spherical Protozoa, chiefly Radiolaria).

3. *Monaxial or Radial Symmetry.*—In polyps, owing to their becoming fixed in larval life, the digestive canal opens upward, the parts being arranged around the single or main axis, radiating from it. In cross section the radial symmetry is seen to be very marked. The parts are like reëntering wedges and were called by Agassiz spheromeres (cœlenterates and echinoderms).

4. *Bilateral Symmetry.*—Here the parts are symmetrically arranged on each side of the main or sagittal axis (annelid worms, arthropods, vertebrates).

Internal and External Segmentation. This is due to the division of the body into segments, indicated externally by infoldings of the integument (annelids, tapeworms, arthropods). The external signs of segmentation may be effaced or wanting. Thus in man the body is segmented only internally; in the lancelet the muscles are arranged segmentally and can be seen on the outside of the body. In the annelid worms (earthworm, etc.) not only is the body segmented externally, bearing setæ or parapodia on each segment, but the nerve ganglia, nephridia, or segmental organs, the vascular arches or transverse arteries, and the septa of the body, i.e., the partitions between the segments, are repeated metamerically.

Homonomous and Heteromerous Segmentation. The earthworm, the galley worm (*Julus*), and the centipedes afford examples where the trunk segments are for the most part alike in size and appearance, and bear similar locomotive setæ or jointed appendages. In most crustacea and insects, as well as in the higher vertebrates, heteronomy prevails. Homonomy is characteristic of the more primitive forms, heteronomy of later more specialized types. Thus, the transfer of parts headward in crabs (cephalization), due to the excessive development of certain of the head segments and the atrophy of those behind, brings about a decided irregularity in the size and shape of the segments. Heteronomy is thus accompanied by a division of physiological labor due to the specialization of the segments and their appendages. It is owing to the hypertrophy of certain segments and partial or total reduction and even in some cases loss of segments or portions of segments, with their appendages, that the varied forms of arthropods are produced.

SYMMETRY, LAW OF, IN MINERALOGY. See MINERALOGY.

SYMONDS, sĭm'ŭnz, JOHN ADDINGTON (1840–93). An English critic and literary historian, born at Bristol, Oct. 5, 1840. From Harrow he passed to Balliol College, Oxford, where he graduated with distinction. He began the study of law, which ill health compelled him to abandon, settled at Clifton, and began literary work in earnest. Subsequently he passed much time on the Continent, and for several years lived at Davos, in Switzerland, always in uncertain health, and often in imminent danger of a complete breakdown. *Our Life in the Swiss Highlands* (1891) tells charmingly of his mountain home. He died in Rome April 19, 1893. Symonds's reputation rests mainly on *The History of the Italian Renaissance* (7 vols., 1875–86) and the excellent translations of the *Vita di Benvenuto Cellini* (1887) and the *Sonnets of Michelangelo and Campanella* (1878). Other striking books are the *Introduction to the Study of Dante* (1872); *Shakespeare's Predecessors* (1884); *Essays Speculative and Suggestive* (1890); *In the Key of Blue* (1893); and *Walt Whitman* (1893). Symonds also contributed to the "English Men of Letters" a life of Shelley (1878) and one of Sir Philip Sidney (1886). Besides all these and much other miscellaneous work, he composed a considerable body of verse, admirable in technique but wanting in inspiration. This includes *Many Moods* (1878), *New and Old* (1880), *Animi Figura* (1882), and *Vagabunduli Libellus* (1884). Both his verse and his prose show the thorough interpenetration of his nature by the culture and the ideals of the Renaissance period with which he was so familiar. He was celebrated as a fascinating conversationalist; Stevenson, who passed some time at Davos with him, has commemorated him in the essay on "Talk and Talkers" in *Memories* *and Portraits*, under the name of Opalstein. Consult also the biography by Horatio Brown (London, 1895), and V. Brooks, *J. A. Symonds: A Biographical Study* (New York, 1914).

SYMONS, sīm′onz, Arthur (1865–). An English author, born in Wales. He attended several private schools and traveled in France and in Italy. He wrote for the *Athenæum* and the *Saturday Review*, and was editor of the short-lived *Savoy* (1896). As a literary critic, Symons is seen to advantage in *Studies in Two Literatures* (1897), dealing with contemporary English and French writers. These essays possess a charm and finish recalling Walter Pater. He published also: *An Introduction to the Study of Browning* (1886); *The Symbolist Movement in Literature* (1899); *Cities* (1903); *Studies in Prose and Verse* (1904); *Spiritual Adventures* (1905); *Studies in Seven Arts* (1906); *William Blake* (1907); and *The Romantic Movement in English Poetry* (1909). His verse comprises: *Days and Nights* (1889); *Silhouettes* (1892); *London Nights* (1895); *Amoris Victima* (1897); *Images of Good and Evil* (1900)—all showing a marked influence of the school of French Symbolists. His *Collected Poems* (1901) contains, with some new verses, all he wished to preserve from earlier volumes. In 1913 appeared *The Knave of Hearts: 1894–1908* (poems), in 1915 *Tragedies*, in 1916 *Figures of Several Centuries*. Consult P. E. More, *Shelburne Essays, First Series* (New York, 1904).

SYMONS, (George) Gardner (1861–). An American landscape painter. He was born in Chicago, and studied at the Art Institute there, and in Paris, Munich, and London. His work, which represents chiefly snow scenes, displays decided technical ability, carefully related masses, and excellent composition, but a somewhat limited color scheme. Good examples are to be found in most public museums, including "Winter Sun" and the "Top of the Hill and Beyond" in the Chicago Art Institute; "Opalescent River" in the Metropolitan Museum, New York; "Snow Clouds," Corcoran Art Gallery, Washington; "Snowclad Fields in Morning Light," Toledo Museum; and "Sorrow," Cincinnati Museum. Later works are "Winter Evening" (1914) and "Melting Snow" (1915). In 1909 he was awarded the Carnegie prize of the National Academy of Design, of which he was elected a member in 1911. He received the prize and gold medal awarded by the National Arts Club in 1912, and in 1914 was elected to the National Institute of Arts and Letters.

SYMONS, George James (1838–1900). An English meteorologist, born in London. From 1857 until his death he was meteorological reporter to the registrar-general, and after 1860 issued 39 annual volumes of statistics (British Rainfall) on observations, at first from 168 stations in England and Wales, but finally from 3528 stations in Great Britain and Ireland. In 1863 he started the issue of a monthly rain circular, which in 1866 developed into the *Monthly Meteorological Magazine*. Symons was president of the Meteorological Society in 1880 and in 1900.

SYMONS DISK BREAKER AND PULVERIZER. See Grinding, Crushing, and Pulverizing Machinery.

SYM′PATHET′IC INK. See Ink.

SYM′PATHY. Literally a feeling together, a feeling for or with. The term is used to denote both the various modes in which a certain instinct or disposition is consciously realized, and also this instinct itself. In lower forms of animal life the instinct appears in the tendency to congregate or to live together. When the instinct is first represented in consciousness, it is touched off by a perception, and its realization is a feeling or emotion. Later in the development of the human organism, the primitive instinct is reënforced by acquired tendencies which result from continued propinquity, from the entertainment of similar ideals and aspirations, from community of language, customs, etc. Ideas, as well as perceptions, now release the disposition; and as a result our sympathies are, as we say, broadened; they extend beyond persons to animals and things. Finally, alongside of the fundamental tendency to feel with or for, there develops a particular tendency to feel in the place of another person or thing. This feeling is called "empathy." We empathize, e.g., when we become the hero in the story, when we shrink from the blow given to another, when we feel the insecurity of a column which appears too weak to bear its load. The distinction between sympathy and empathy cannot always be clearly drawn; we often sympathize and empathize at one and the same time.

Sympathy is sometimes regarded as the fundamental social instinct; and when the feeling is accompanied by the desire to do something for others, it becomes the source of altruism (q.v.). Empathy forms the basis of important theories in Æsthetics (q.v.). Consult: for Sympathy, Alexander Bain, *Emotions and Will* (New York, 1889); William James, *Principles of Psychology* (new ed., 2 vols., ib., 1905); William McDougall, *Introduction to Social Psychology* (London, 1908); T. Ribot, *Psychology of the Emotions* (2d ed., New York, 1911). For Empathy, Vernon Lee, *The Beautiful* (Cambridge, 1913); E. B. Titchener, *Beginner's Psychology* (New York, 1915).

SYMPET′ALÆ. One of the two great groups of dicotyledons (q.v.).

SYMPHON′IC POEM. See Programme Music.

SYM′PHONY (Lat. *symphonia*, from Gk. *συμφωνία*, unison of sound, harmony, from *σύμφωνος*, *symphōnos*, agreeing in sound, harmonious). In music, a word used in two different senses: (1) the instrumental introduction and termination of a vocal composition, sometimes called *ritornello;* (2) a composition for a full orchestra, consisting generally of four movements. The most usual though not unvarying order of movements is a brilliant allegro, frequently ushered in by a slow introduction, an adagio or andante, a scherzo with its trio, and the finale, again an allegro. For the origin of the modern symphony we must go back to the beginnings of opera early in the seventeenth century, when the name *Sinfonia* was given to the short instrumental prelude which preceded the opera. The early history of the symphony is, therefore, that of the overture (q.v.). About the middle of the eighteenth century composers began to write separate *sinfonie* exclusively for concert performance. The three parts of the older overture, which had then only a loose connection, were entirely detached and became separate movements. Stamitz (q.v.) introduced a fourth movement, the minuet (q.v.), which he inserted before the finale. He also adopted for the first movement the sonata form (q.v.). By individualizing the separate instruments and grouping them in families Stamitz established the symphony orchestra and thus made the symphonic form practically what it is to-day. Haydn and Mozart adopted the form of Stamitz and filled it with their genius. Beethoven extended the form considerably, particularly the development section of the first movement, and replaced the minuet by the more elaborate scherzo (q.v.). On the merely formal side there has been no further development since then. The works of later masters, notably those of Schumann, Brahms, and Tchaikovsky, prove that details may be altered without affecting the fundamental principles. The Symphonic Poem (q.v.) is not a development of the Symphony. Consult: M. Brenet, *L'Histoire de la Symphonie* (Paris, 1882); S. Bagge, *Die Symphonie in ihrer historischen Entwicklung* (Leipzig, 1884); F. Weingartner, *Die Symphonie nach Beethoven* (3d ed., Berlin, 1909; Eng. trans. by Dutton, Boston, 1904); T. W. Surette, *The Development of Symphonic Music* (ib., 1915). See BEETHOVEN; BRAHMS; STAMITZ.

SYM'PHYSIS. See JOINT.

SYMPLEGADES, sĭm-plĕg'ȧ-dēz (Lat., from Gk. *Συμπληγάδες* (the islands), that strike together, from *σύν*, *syn*, together + *πλήσσειν*, *plēssein*, to strike). Two mythical floating islands in the Pontus Euxinus, which dashed against each other until they became fixed when the Argo made its way between them. See ARGONAUTS.

SYMPO'SIUM (Lat., from Gk. *Συμπόσιον*, banquet). 1. A philosophical treatise by Xenophon, discussing the nature of love and friendship, and depicting the character of Socrates, who is one of the speakers. 2. A dialogue by Plato, intended probably as a corrective of the similar work of Xenophon. Its subject is the nature of love, and Socrates and Alcibiades are among the speakers.

SYMP'TOM (from Gk. *σύμπτωμα*, *symptōma*, chance, mischance, symptom, from *συμπίπτειν*, *sympiptein*, to fall in with, happen, coincide). A medical term denoting a phenomenon by which a physician judges of the presence of disease. A group, or syndrome, of symptoms enables the physician to judge directly of the nature of and to identify the disease, or to decide upon the lesions or morbid tissue changes, and then determine what disease is present. This decision is called a diagnosis. (See PATHOLOGY.) Symptoms are objective, including those perceived by the physician and found upon examination, such as heart murmurs, rise of temperature, etc.; or subjective, including those perceived only by the patient, as pain, ringing in the ears, etc. Symptoms are pathognomonic when they are sure signs of a certain disease.

SYMP'TOMAT'IC ANTHRAX. See BLACKLEG.

SYNÆSTHESIA, sĭ'nĕs-thē'sĭ-ȧ. Secondary or concomitant sensation. The term covers those abnormal cases in which a stimulus arouses not only its appropriate sensation but also a concomitant sensation or image. The most frequent form is colored hearing (q.v.). Others are colored taste, colored pain, pressure, and temperature; one case of tasted sound (gustatory-tactual audition) has been reported. The theories are of two kinds: psychological and physiological. The former include theories based on normal associations, or associations through the intermediation of a sense feeling. The latter posit some abnormal condition in the brain, particularly in the cortex. The facts that colored hearing is an hereditary trait, and that synæsthesias are more frequent in the child and the adolescent than in the adult individual, make the physiological view the more plausible. Consult references under COLORED HEARING.

SYN'AGOGUE (Gk. *συναγωγή*, *synagōge*, assembly, from *συνάγειν*, *synagein*, to bring together, from *σύν*, *syn*, together + *ἄγειν*, *agein*, to lead; corresponding to Heb. *kĕnĕsĕth*, assembly, and *beth ha-keneseth*, the house of assembly). The name used in Greek cult societies to designate a "meeting" for religious purposes as well as a "society," but also in general to denote a "gathering," such as a symposium, or an "association," such as a barbers' union; in the Greek version of the Pentateuch as a translation of *'edah*, "congregation" in distinction from *kahal*, which is rendered *ἐκκλησία*, *ecclesia;* in the New Testament as a designation of the Sabbath assembly (Acts xiii. 43) and of the houses where the Jews assembled for worship (Acts xv. 21); in Philo, Josephus, and other writers as a synonym of *προσεύχη*, *proseuchē*, house of prayer; and in modern times as a title of a Jewish house of worship. Jews who lived in foreign lands and did not feel free to build regular temples, as those of Elephantine (see ELEPHANTINE PAPYRI), Leontopolis (see ONIAS'S TEMPLE), and Shechem (see SAMARITANS) did, must at a comparatively early time have assembled in specially designated houses for worship without the sacrifice of animals on the Sabbath. But the earliest known reference to such a house occurs in an inscription recording the dedication of a proseuche in the time of Ptolemy III and Berenice (c.230 B.C.). Josephus mentions a synagogue or temple in Antioch in the time following Antiochus Epiphanes (*Bell. Jud.*, vii, 3, 3). Whether Ps. lxiv. 8 refers to synagogues is doubtful, and there is no allusion in 1 or 2 Maccabees to the burning of synagogues in Jerusalem in the time of Antiochus IV. According to Acts vi. 9 there were synagogues in Jerusalem of the Libertines, i.e., probably the "freedmen," descendants of the Jews sent by Pompey as slaves to Rome and then emancipated, the Cyrenæans, Alexandrians, Cilicians, and Asiatics (from Asia Minor). In the time of Jesus there were synagogues in Nazareth and in Capernaum; the latter, at Tell Hum, was excavated in 1905 by the Deutsche Orient-Gesellschaft. The synagogues of Galilee, described by Renan, were apparently somewhat younger; the best preserved is that of Kafr Bir'im, those of Kasyun come from the time of Septimius Severus. Philo found synagogues in Rome, Paul many in all parts of Asia Minor, Macedonia, and Greece. Babylonian synagogues are mentioned in the Talmud; they are outside of such cities as Nehardea and Mahuza, and do not seem in any instance to be earlier than the Christian era. In 1883 the ruins of an ancient synagogue were found at Hammam Lif near Carthage.

Synagogues were erected from the common funds or free gifts of the community and supported by taxes and donations. Regarding their architecture, in Palestine the Græco-Roman model of public buildings was followed, though with some essential modifications. Abundant ornamentation was an exterior and interior feature. The larger synagogues were divided by rows of pillars into several aisles; some had porticoes in front. In later times in Europe the

Romanesque style was adopted, and now Moorish architecture is frequently the model. Little is known of any special law respecting the construction of these buildings, save that the faces of the worshipers should be directed towards Jerusalem; that, in accordance with the verse in the Psalms, there should be a slight descent of a step or two on entering; that the building should stand, if feasible, on slightly elevated ground, or be somehow made visible from afar. Within at the extreme eastern end was the holy ark or chest (*tēbāh*), containing several copies of the Pentateuch, from which the periodical readings were chanted. In front of this was the stand of the public reader of the prayers, not far from which was suspended the everlasting lamp. On a raised platform in the middle of the synagogue was the place of the reader or preacher. The women (not counted as members of the congregation) sat separated from the men.

The affairs of the synagogue were administered by a board of ancients or elders, at whose head stood a chief or principal (*Rōsh ha-keneseth*, *archisynagogos*). The chief was not a scribe, though taking rank immediately after the scribes. The officiating minister, whose office it was to recite the prayers aloud, was called *shĕlîach ṣibbūr* (messenger of the community). The *chazzān* had general charge of the sacred place and its books and implements. He had to present the scroll to the reader, received it back after the reading was finished, rolled up the scroll and deposited it in the chest, and it was he who announced the advent of the Sabbath or of a holy day from the roof of the synagogue with a thrice repeated trumpet blast. During the week days he had to teach the children of the town or village. He had to be initiated by a solemn imposition of hands. The name of *chazzān*, however, at a later period, came to designate the officiating minister, and it has retained that meaning until this day. Almoners or deacons, who collected or distributed the alms, possibly the same as the *baṭlanim* .(idle men), whose office in relation to the synagogue cannot be exactly determined, but who had always to be ready for the purpose of making up the requisite number of 10 worshipers were further attached to the general body of officials. The third, sixth, and ninth hours of the day were the times appointed for daily worship; the more special days were Monday and Thursday, when the judges sat and the villagers came to town, and Saturday, on which the forms of some of the prayers were altered according to the occasion.

The reading from the Scriptures, though in Hebrew, was coupled in the synagogues of Palestine and Babylonia with a translation or paraphrase in the current Aramaic idiom, and presumably in the synagogues of Egypt a Greek translation was employed, but the chief prayers were always pronounced in Hebrew, though the Talmud admits the use of other languages in worship. Besides the prayers and the readings, a feature of early synagogue worship was the exposition of the law or of the lesson of the day by a competent person. In course of time a more elaborate liturgy developed. The oldest complete ritual, known as *siddur* (arrangement), dates from the year 880 A.D. and was compiled by a Rabbi Amram. In the liturgy as finally evolved two distinct elements are discernible: the *Shema'* (Hear, O Israel, etc.), being a collection of the three passages (Deut. vi. 4–9; xi. 13–21 and Num. xv. 37–41) expressive of the unity of God and of His government over Israel, put together without any extraneous addition; and the *Tĕphillāh*, or prayer, consisting of a certain number of supplications, with a hymnal introduction and conclusion, followed by the priestly blessing. The single portions of this prayer gradually increased to 18, and the prayer itself received the name of *Shĕmōneh 'esrēh* (eighteen). For a long time the prayers were recited only by the reader, the people joining in silent responses and amens. These readers by degrees—chiefly from the tenth century—introduced occasional prayers of their own, and ultimately religious doctrine, history, saga, angelology, and mysticism, interspersed with biblical verses, are found put together in a mosaic of the most original and fantastic, often grand and brilliant, often obscure and feeble kind. The ritual differed in different countries. At the beginning of the nineteenth century a movement began in Germany for the reform of the ritual and gradually spread to other countries. At first the changes consisted in the shortening of certain prayers, the omission of others, and the introduction of German, English, or French by the side of the Hebrew.

The synagogues contributed more than anything else to the steadfast adherence of the people to their religion and liberty as long as there was any possibility of keeping both intact. At the same time they gradually undermined the priestly and aristocratic element that gathered around the temple, its gorgeous worship and kingly revenues. Their importance as a place of instruction as well as a place of worship was of profound influence on the development of Judaism. Both primary and advanced instruction in the Scriptures and subsequently in Talmudic literature was given in the synagogue, and in the early centuries of the Christian era legal decisions were likewise announced there. The synagogue could also be used as the place of mourning for prominent members of the community, and there are instances on record of the use of synagogues for political gatherings. In Babylonia travelers were accommodated in the synagogue and ate their Sabbath meals there. In view of these various uses to which the synagogue was put, it is not surprising that it became in the Middle Ages the centre of the religious and intellectual life of the Jews and in a measure of their social life as well. The "reform" movement within Judaism as well as the extension of the intellectual interests of the Jews has resulted in narrowing the influence and scope of the synagogue to purely religious affairs, though in orthodox Jewish communities in eastern Europe and in the Orient the former status of the synagogue is still in large measure maintained.

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SYNAGOGUE, The Great (Heb. *ha-keneseth ha-gĕdôlāh*). A designation of the assembly described in Neh. viii–x. The 85 elders enumerated in Neh. x. 2–29 were supposed to have formed a body to whom the Law was transmitted from the prophets and by whom it was handed down to Antigonus of Soko (*Pirke Aboth*, i, 1 ff.). Tradition afterward increased their number to 120. Their labors were thought to have been completed in one generation, but according to the faulty chronology of later Jewish writers this generation covered the entire period from the return of the exiles to Alexander. Hence Zerubbabel, Jeshua, Nehemiah, and Mordecai are regarded as "men of the Great Synagogue" as well as Ezra, the signers of the covenant, and Simon the Just. They are said to have written Ezekiel, Daniel, Esther, and the Minor Prophets, which probably means that they edited and gave recognition to these books. The distinction between *midrash*, *halakoth* and *haggadoth* is ascribed to them, as well as the introduction of the Purim festival and the institution of the Shemoneh 'Esreh and the other prayers and benedictions. The spirit and tendency of their work is expressed in the sentence ascribed to them in *Pirke Aboth*, i, 12: "Be careful in pronouncing opinion; have many pupils; put a fence about the Law." When the chronological error was perceived, the Great Synagogue was conceived of as a permanent institution during the Persian period, and many more functions were assigned to it. Some sort of a council dealing with the sacred text and the ritual may indeed have existed from the time of Ezra, but Kuenen has shown that the conception of the Great Synagogue grew out of the account in Neh. viii–x. Löw's suggestion that the idea came from the assembly described in 1 Macc. xiv. 25 ff. is less plausible. The notion that the Great Synagogue fixed the canon does not seem to appear before Elias Levita in the sixteenth century. Consult: A. Kuenen, *Over de mannen der groote synagoge* (Amsterdam, 1876); D. Hoffmann, "Ueber die Männer der Grossen Versammlung," in *Magazin für die Wissenschaft des Judenthums*, vol. x (Berlin, 1883); S. Krauss, "The Great Synod," in *Jewish Quarterly Review*, vol. x (London, 1898); W. Bacher, in *The Jewish Encyclopædia* (New York, 1905); Emil Schürer, *Geschichte des jüdischen Volkes*, vol. ii (4th ed., Leipzig, 1907; Eng. trans. of 1st ed., New York, 1896); R. T. Herford, *Pharisaism* (ib., 1912).

SYNAGOGUE OF THE LIBERTINES. See Libertines.

SYN'CHONDRO'SIS. See Joint.

SYN'CHRONIZER. A device used in electric-power stations for indicating when an alternating-current generator is operating at the same frequency as others with which it is desired to connect it in parallel in the same circuit. Also for determining whether the voltages

of two circuits are in phase with each other. It is called also a synchronism indicator or synchroscope, although this last term is applied to an instrument that shows whether a generator that is to be synchronized is running too fast or too slow. One type of synchronizer consists of a small motor having its field windings connected to one of the generators to be synchronized and its armature to the other. By means of an arrangement of two armature coils, one of which has a reactance in its circuit, a rotating field is produced which causes the armature to move in one direction or the other by an amount depending upon the difference in phase between the two circuits and indicating by a pointer attached to the end of the armature whether the machine to be synchronized is running fast or slow. Another kind indicates synchronism by means of two incandescent lamps so connected between the two circuits as either to light up or remain dark when put in circuit between them. Consult K. W. E. Edgcumbe, *Industrial Electrical Measuring Instruments* (New York, 1908); J. A. Haraden, "Operation and Installation of Switchboard Synchronism Indicators," in *General Electric Review*, vol. xvi (Schenectady, N. Y., 1913); C. M. Jansky, *Electrical Meters* (New York, 1913); N. E. Funk, "Operation of Frequency Changers," in *Transactions of the American Institute of Electrical Engineers*, vol. xxxii (ib., 1913). See Dynamo-Electric Machinery.

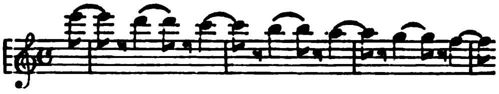
SYN'CHRONOUS CONVERTER. See Dynamo-Electric Machinery.

SYNCHRONOUS MOTORS. See Dynamo-Electric Machinery.

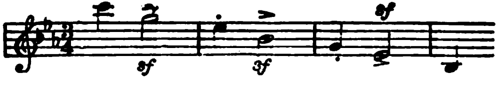
SYN'CHROSCOPE. See Synchronizer.

SYN'CLINE (from Gk. *συγκλίνειν*, *synklinein*, to lean together). A term used in geology for the structure formed by the bending of strata into a basin of downward fold, the limbs of the fold dipping towards each other and meeting at a line called the synclinal axis. Where the strata dip downward from all sides a peculiar type of syncline arises, known as a geologic basin; in this case the synclinal axis is reduced to a point. The syncline, structually, is the complement of the anticline (q.v.). See Geology.

SYN'COPA'TION (from Lat. *syncopatus*, p.p. of *syncopare*, to syncopate, from *syncope*, from Gk. *συγκοπή*, *synkopē*, a cutting short). In music, the joining together of two similar notes by means of a tie, so that the accent intended to fall on the second (strong beat) comes on the first (weak beat). The effect produced is that of contra-tempo. The following example is from Beethoven's overture "Lenora No. 3":



The effect of syncopation can also be produced by merely shifting the accent by means of *sforzando* marks, as in the scherzo of the *Eroica Symphony:*



The North American Indians made extensive use of syncopation, and in this were followed by the Southern negroes. In fact, the music of nearly every savage or semicivilized nation shows traces of syncopated rhythm.

SYNCOPE, sĭṉ'kô-pê. See Fainting; Heart, Diseases of the.

SYN'CRETISM (from Gk. *συγκρητισμός, synkrētismos*, combination against a common enemy, from *συγκρητίζειν, synkrētizein*, a word whose etymology is unknown). A term used: (1) according to Plutarch, in ancient times, politically, to designate the custom of the Cretans or others of disregarding all internal dissensions whenever a controversy with a foreign country occurred; (2) in the sixteenth century, philosophically, to denote the efforts made to reconcile opposing systems; (3) in the seventeenth century, theologically, first by Pereus in his *Irenicon*, and afterward to describe the views of Calixtus and his followers, who sought to heal the schism in the church by making the traditions of the first five centuries of equal authority with the Bible, and by adopting the Apostles' Creed as the common basis of all Christian denominations and a sufficient definition of true Christianity; (4) most frequently, of the efforts made in ancient times, especially in the second to the fourth century A.D., to simplify religion by identifying various gods or various aspects of the same god. In the teaching of the Neoplatonists syncretism did much to encourage belief in a single god. See Henotheism.

SYNCRETISM. See Etymology, Figures of.

SYNCRETISTIC CONTROVERSY. See Calixtus, Georg.

SYN'DIC (from Lat. *syndicus*, from Gk. *σύνδικος, syndikos*, advocate, public officer). A name which has at different times and in different countries been given to various municipal and other officers. In Geneva the chief magistrate was formerly called the syndic. The syndics of cities in France, under the old régime, were officers delegated by the municipality as agents or mandatories; the various trading companies in Paris and the university had also their syndics; and in the University of Cambridge the same name is applied to members of special committees of members of the senate appointed by grace from time to time for specific duties. In Italy the mayors of towns are called syndics.

SYN'DICALISM. A form of revolutionary labor unionism, deriving its name from the general term *syndicat* applied to the labor union in France, where the movement especially flourishes. Syndicalism is opposed, on the one hand, to old-line trade unionism, and on the other hand to political socialism. Its ideal is the direct assumption by organized bodies of workers of full control over all industries. It does not work for collectivism, or the ownership and operation of industries by the state, but in so far as its programme is defined it proposes to vest control of the mines in the mine workers' organization, of the railways, in the railway workers' union, etc. Syndicalism has no faith in reform through parliamentary action, nor does it have faith in revolutionary insurrections. It seeks first to wean the capitalist from his interest in property through curtailment of profit by means of strikes, boycotts, and sabotage (q.v.), and finally to overturn the weakened capitalistic system through the general strike.

Revolutionary syndicalism in France may be said to date from the labor congress of Marseilles in 1892 when Aristide Briand offered a resolution condemning insurrection and urging the general strike as a means of destroying the existing economic order. The motion was lost, but was carried in the congress of Nantes in 1894. In 1897 antagonism to parliamentary socialism gained dominance over the movement. At the Congress of Limoges in 1895 a permanent organization had been created under the name of Confédération Générale du Travail, a federation of national and regional unions, which was reorganized and strengthened in 1902. Since 1906 the Confédération has sought to extend the industrial principle of unionism at the expense of the trade principle. Trade unions proper are no longer admitted to the Confédération.

The strength of revolutionary syndicalism in France is not easily estimated. The membership of unions affiliated with the Confédération Générale du Travail exceeded half a million in 1914. But a majority, probably, were out of sympathy with the more radical points in the syndicalist programme. The control of the extremists is largely due to the peculiar plan of representation, whereby a local unit having thousands of members is placed on an equal footing with one having only a few score. Thus the larger and more conservative unions are without proportionate representation.

In Italy a similar movement was organized in 1906 in the Confederazione Generale del Lavoro, but it fell under the control of the parliamentary Socialists. In 1912 a syndical union, representing the economic movement as opposed to the political, was organized. This union lays claim to more than 100,000 adherents. Syndicalism has also made headway in Spain and Greece, and there are sporadic traces of it in Latin America. In England a development in the same direction set in with the New Unionism of 1885, which sought especially to organize the unskilled workmen, such as the dockers, gasworkers, seamen, and discarded the benefit features of the older trade unions. At first the New Unionism sought to attain its ends through political means, but by 1910 had lost faith in parliamentary action and, like French syndicalism, reposed its hopes in direct action, boycotts, and strikes and ultimately in the general strike. The nearest analogy to syndicalism in the United States is the Industrial Workers of the World (q.v.). Consult: Guy-Grand, *La philosophie syndicaliste* (2d ed., Paris, 1911); Sir Arthur Clay, *Syndicalism and Labour* (New York, 1911); J. R. Macdonald, *Syndicalism* (London, 1912); J. G. Brooks, *American Syndicalism* (New York, 1913), containing a bibliography. See Labor Organizations; Trade Unions.

SYNECDOCHE, sĭ-nĕk'dô-kê. See Rhetoric, Figures of.

SYN'ECOL'OGY. That branch of the science of plant ecology that relates to plants as they are associated in communities. See Ecology of Plants.

SYN'ERGISM (from Gk. *συνεργία, synergia*, coöperation). The name given to a doctrine of theology which teaches that in the work of conversion the will of man is not wholly passive, but can coöperate, through consent, with the Divine Spirit. In the time of the Reformation Melanchthon (q.v.) and his school were inclined to this view, while the strict Lutherans opposed it and charged its advocates with favoring Pelagianism (q.v.). In 1557 and later the question was hotly discussed, Pfeffinger and Strigel taking the lead on the Synergistic side, Flacius and Amsdorf (qq.v.) on the opposite. The Wittenberg divines in general favored the doctrine, the Mansfield divines opposed it. Finally it was condemned in 1580 in the third article of the Formula of Concord. See CONCORD, BOOK OF.

SYNE'SIUS (Lat., from Gk. Συνέσιος) (c.370–?). A Neo-Platonic philosopher and Christian bishop. He was born at Cyrene in Lybia, and studied philosophy in Alexandria, under Hypatia, to whom he was ever warmly devoted. His life illustrates the combination of Neo-Platonism and Christianity characteristic of the fourth century. Synesius was made Bishop of Ptolemais in 410, against his own desire, and with the apparent stipulation that he should not be obliged to give up his wife or his philosophy, but he administered his see with fidelity. Neither the time nor the place of his death is known. Synesius' writings include about 150 letters; *Egyptian Tales, or on Providence*, a sort of historical allegory of the providential government of the world; a defense of the philosophic life, *Dio* (after Dio Chrysostom); a humorous work, called *Praise of Baldness*, suggested by Dio's *Praise of Hair;* and ten *Hymns*, partly pagan and partly Christian. His character is well portrayed in Charles Kingsley's *Hypatia*, in which Synesius figures. His works are in Migne, *Patrologia Græca*, lxvi. Consult: H. V. M. Druon, *Etudes sur la vie et les œuvres de Synésius* (Paris, 1859); R. Volkmann, *Synesius von Cyrene* (Berlin, 1869); A. Gardner, *Synesius of Cyrene* (London, 1886); W. S. Crawford, *Synesius the Hellene* (ib., 1901); T. R. Glover, *Life and Letters in the Fourth Century* (Cambridge, 1901).

SYNGE, sĭng, JOHN MILLINGTON (1871–1909). An Irish dramatist, born at Newtown Little, near Rathfarnam, and educated at Trinity College, Dublin. From 1892, the year of his graduation from college, until a decade later, he studied music in Germany and languages, for which he had a gift, in Germany, France, and Italy. He rambled about, settling finally at Paris, where he devoted himself to French literature, and sought to make himself a literary critic. During the ten years referred to he frequently returned to Ireland, and, after 1899 and until 1903, he made annual sojourns in the Arran Islands, with a view to following up the suggestion made by his friend William Butler Yeats (q.v.) in 1899 that he abandon criticism and write of the primitive life of the Arran Islanders which had never been brought into literature. In 1893 he took up his abode in Ireland, and devoted himself enthusiastically to the interests of the Abbey Theatre, Dublin, becoming one of its three literary advisers. Fortunately Synge had a small competence, which made him free to study, and to roam in Ireland and on the Continent as his restlessness prompted. He is beyond question the best of the dramatists of the Irish Literary Revival (see IRISH LITERATURE, *Irish Literature in English*), as his *Playboy of the Western World* (produced 1907), and his tragedy, *Deirdre of the Sorrows* (produced 1910), attest; and the contention that his *Playboy* is the best comedy in English since Sheridan may eventually be justified. In addition he wrote the excellent short plays, *The Shadow of the Glen* (produced 1903), *Riders to the Sea* (produced 1904), *The Will of the Saints* (produced 1905), and *The Tinker's Wedding* (produced 1909). Primarily a dramatist, Synge wrote also, and notably, sketches of social types and of the manners and customs of the Arran Islands, of Wicklow, and of West Kerry; and a little sheaf of poems which, if not important as poetry, are a sidelight on their author's personality. Everything of Synge's which his literary executors thought worthy of inclusion is contained in his *Works* (4 vols., Dublin, 1910). Consult: W. B. Yeats, *J. M. Synge and the Ireland of his Time* (New York, 1911); P. P. Howe, *Synge: A Critical Study* (London, 1912); Francis Bickley, *Synge and the Irish Dramatic Movement* (Boston, 1912); Maurice Bourgeois, *Synge and the Irish Theatre* (London, 1913), the most substantial study; John Masefield, *John M. Synge* (New York, 1915).

SYN'OD (Lat. *synodus*, from Gk. *σύνοδος*, assembly). A term applied almost exclusively to ecclesiastical assemblies convoked for the discussion and decision of ecclesiastical affairs. Synods or church councils are of five kinds: ecumenical, general, national, provincial, and diocesan or local. By the law of the Roman Catholic church the decrees of a national or provincial synod must be submitted to the Pope, and unless confirmed by him, or suffered to pass for two years without condemnation, are not held valid. The term "synod" also describes courts in the Presbyterian system of church government which rank above the presbytery, and are either subordinate to a General Assembly or themselves constitute the supreme court of the church. The courts above the classes in the Dutch and German Reformed churches are called synods. In the organization of the Lutheran churches the synod is the highest representative body. Two of the Eastern churches have preserved the synod. The Holy Governing Synod of All the Russias is the highest ecclesiastical authority of the Russian church. The orthodox national church of the Kingdom of Greece is also governed by a synod of archbishops and bishops independent of the jurisdiction of any patriarch. For other conciliar organizations, see COUNCIL.

SYNOD'IC (Lat. *synodicus*, from Gk. *συνοδικός*, *synodikos*, relating to a conjunction, from *σύνοδος*, *synodos*, assembly). In astronomy, the synodic period is the time which elapses between two successive conjunctions (q.v.) of a planet with the sun, as seen from the earth. In the case of the moon, the synodic period is therefore the time elapsing between two successive new moons. See MOON.

SYN'OD OF DORT. See DORT, SYNOD OF.

SYNODS OF EPHESUS. See EPHESUS, COUNCILS OF.

SYN'ONYM (Fr. *synonyme*, Lat. *synonymum*, from Gk. *συνώνυμον*, *synōnymon*, having the same meaning, from *σύν*, *syn*, together + *ὄνομα*, *onoma*, name). A word which nearly coincides in meaning with another, as clear, transparent; bright, limpid; fair, cloudless; lucid, perspicuous; patent, obvious; visible, evident. There is in most cases a slight individual shade of meaning in each synonym. Development of synonyms is one first of convergence and then of divergence, but the meanings are originally quite distinct. In semasiological evolution, however (see SEMASIOLOGY), the particular words which tend to become synonymous overlap in meaning. This may then continue till the words become identical in meaning. In this case the result is suppression of one of the terms, either complete or partial. The latter process gives the so-called composite inflection, illustrated in such English verbs as *am, be, was,* or *go, went,* in which verb roots originally distinct have coalesced. But, if synonyms do not become identical, they tend to become so specialized in meaning with respect to each other that they not only retain their original distinctions, but frequently develop others. The main stylistic use of synonyms is to give variety and accuracy of diction.

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SYNO'VIAL MEMBRANE and FLUID (from Neo-Lat. *synovialis,* from *synovia,* lubricating fluid secreted by a synovial membrane, so called because it resembles the white of an egg, from Gk. *σύν, syn,* together + Lat. *ovum,* egg). In every joint in which a considerable range of motion is required, the osseous segments (or contiguous extremities of bones) are separated by a space, which is called the cavity of the joint. The end of each of the bones entering into the composition of the joint is incrusted by a layer of articular cartilage adapted to its form, and the entire cavity of the joint is lined by a delicate membrane, which is termed the *synovial membrane,* which secretes a peculiar viscid matter, termed *synovia,* or *synovial fluid,* for the purpose of lubricating the inner surface. A synovial membrane is a closed sac, like the pleura, for example, with an attached and a free surface, the latter being smooth and moist. The minute structure of a synovial membrane is much the same as that of serous membranes elsewhere. (See HISTOLOGY.) A very simple form of synovial membrane—anatomically known as a *bursa*—is employed to facilitate the gliding of a tendon of a muscle or of the integument over a projection of bone. It consists of a sac connected by areolar tissue with the neighboring parts, and secreting a fluid in its interior. These sacs are sometimes prolonged into *synovial sheaths,* which surround long tendons, such as those of the flexor and extensor muscles of the fingers and toes. In felon (q.v.), when inflammation extends to one of the sheaths, and gives rise to the formation of adhesions, the motion of the inclosed tendon is destroyed, and a permanently stiff finger is the result. See SYNOVITIS.

The synovial fluid consists of water holding in solution mucin, albumen, fat, and inorganic salts.

SYN'OVI'TIS (Neo-Lat., from *synovia*). Inflammation of a synovial membrane. Although inflammatory processes involving joints frequently start in an inflammation of the synovial membrane, they rarely confine themselves to this membrane, but involve surrounding tissues. For this reason (especially in discussing the pathology of joints), the term "synovitis," which properly means inflammation of the synovial membrane only, has been to some extent displaced by the term "arthritis," which signifies inflammation of the joint in general, including the synovial membrane.

Acute Arthritis is usually an exudative inflammation and may be serous, sero-fibrinous, or suppurative. In serous arthritis there is congestion of the synovial membrane with a serous exudate into the joint cavity. With the subsidence of the inflammation the serum may be absorbed and the joint return to normal condition, or, becoming infected, may pass on to suppuration. The acuteness of the condition may pass off and the joint go on to a chronic inflammation. In sero-fibrinous arthritis there is in addition to the serum more or less fibrin in the joint cavity. Suppurative arthritis is an infectious condition due to the presence of bacteria. The exudate is purulent, while the synovial membrane is usually thickened, dull, and infiltrated with pus cells. Both simple (serous) and suppurative arthritis may accompany or follow some one of the infectious diseases, as, e.g., pyæmia, puerperal fever, gonorrhœa, diphtheria, and scarlet fever. Acute rheumatic arthritis or acute articular rheumatism is usually an exudative inflammation in which the exudate is serous in character and in which there is a successive involvement of different joints. Dry synovitis is characterized by a scanty exudate, and a deposit of fibrin on the serous surface, which usually evinces a very marked tendency towards organization, and consequently adhesions of contiguous surfaces with rapid ankylosis of the joint.

Chronic Arthritis. The most important forms of chronic arthritis are simple chronic arthritis, arthritis deformans, rheumatic arthritis, gouty arthritis, and tuberculous arthritis. In simple chronic arthritis there is a serous exudation into the joint cavity; the synovial membrane is thickened, pale, and rough. The exudate may be clear and watery, or cloudy from the presence of minute particles of fibrin or of lymphoid or endothelial cells. In that peculiar form of chronic inflammation of the joints known as arthritis deformans there is a combination of destruction of parts of the joint with new bone formation which leads to extensive deformities. The joints most commonly involved are those of the fingers, hips, knees, and feet. In gouty arthritis there is a deposit of urates in and about the joints. These deposits take place in the cartilages and in connective tissue and in the ligaments around the joints or even in subcutaneous tissue. The deposit may be in the form of crystals or of whitish concretions. In tuberculous arthritis the lesion is that of a tuberculous inflammation modified by the nature of the tissues in which the inflammation occurs. The tuberculous process frequently spreads to and involves the bone, resulting in extensive changes in the bones themselves.

Tenosynovitis is an inflammation of the synovial membrane sheathing the tendon of a muscle, and may follow an injury or any of the conditions provocative of arthritis. Treatment of synovitis or arthritis depends upon the cause. In the acute serous or serofibrinous varieties rest, alternate hot and cold affusion, extension of the limb so as to separate the surfaces, and exercise with the joint immovable may be all that is necessary. In some cases passive motion is desirable, to break up adhesions, after prolonged rest in a splint. In some exudative, especially in suppurative, cases the joint is aspirated and the fluid drawn off. Rheumatic and gouty arthritis yields to the salicylates, alkalies, lithia salts, or other internal medicine used in rheumatism or gout. In tuberculous cases the joint is opened and the tuberculous nidus scooped out, or the joint is resected in some instances. Deforming arthritis usually leaves permanent deformities. Sometimes operative procedures, undertaken after the inflammation has ceased, will correct these deformities in part. Consult L. W. Ely, *Diseases of the Bones and Joints* (New York, 1914).

SYN'TAX. See GRAMMAR; PHILOLOGY.

SYNTAX, FIGURES OF. Intentional deviations from the ordinary construction of words. The principal figures of syntax are: anaphora, the repetition of the same word or grammatical form at the beginning of successive clauses, as "*Without* tumult, *without* arms, *without* injury the insurrection was quelled." Anastrophe, a transposition of words, as "Rolled the thunder" for "The thunder rolled." Brachylogy, the use of a concise mode of expression, as "The eye of a horse is bigger than an elephant," i.e., than (the eye of) an elephant. Chiasmus, a crosswise arrangement of words, where a second and corresponding set of words are stated in inverse order to those of the first set, as "Begot by butchers, but by bishops bred." Enallage, the substitution of one part of speech, or of one inflectional form of a word, for another, as "They fall *successive* and *successive* rise." Epanastrophe, the repetition of the end of a clause at the beginning of the next, as "The mouse ran up *the clock, the clock* struck one." Epiphora, the repetition of a word at the end of successive clauses (the reverse of anaphora), as *Lælius navus erat, doctus erat.* Epízeuxis, emphatic repetition of a word, as

"*Alone, alone,* all, all *alone,*
Alone on a *wide, wide* sea."

Hendiadys or hendiadyoin, the presentation of one idea by two coördinate words or phrases, as "A couch strewn with *purple and tapestry,*" i.e., with purple tapestry. Hypallage, the use of one case for another, the transference of an epithet from its proper subject to another, as *Tyrrhenus tubæ clangor* (Tyrrhenian clang of the trumpet) for *Tyrrhenæ tubæ clangor* (clang of the Tyrrhenian trumpet). Hyperbaton, the transposition of words or clauses, as *Valet atque vivit* (he is well and alive) for *Vivit atque valet* (he is alive and well). Pleonasm, the use of superfluous words. Polysyndeton, pleonasm in the use of conjunctions (the reverse of asyndeton). Prolepsis, introduction of an epithet or a word before it is logically applicable, as "I know *thee,* who thou art." Syllepsis, the agreement of an adjective or verb with only one of two or more words with which it is linked, as *Rex et regina beati.* Synesis, a construction of words according to the sense they convey rather than by strict requirements of grammatical rules, as "Philip went down to Samaria and preached Christ unto *them.*" Tmesis, the separation of parts of a word, as in Ennius' famous line, *Saxo cere comminuit brum,* or in "The love of God *to* us *ward.*" Zeugma, the use of a word in two or more connections, though it is applicable to only one of them. See ALLITERATION; ELLIPSIS; PHILOLOGY, *Syntax;* RHETORIC, FIGURES OF.

SYN'THESIS (Lat. *synthesis,* from Gk. *σύνθεσις,* composition, combination). See ANALYSIS.

SYNTHESIS, CHEMICAL. The building up of compounds from their elements. The synthetic methods of chemistry are of the greatest importance in several respects. First, they may serve to test the correctness of analyses or even, in certain cases, replace analytical methods altogether. For example, if there were any doubt as to water being composed of eight parts of oxygen and one of hydrogen, or if water could not be analyzed at all, its exact composition could be demonstrated by causing oxygen and hydrogen to combine. In fact it was the synthesis of water by Cavendish that first indicated its chemical nature and exact composition. (See CHEMISTRY, historical section.) Secondly, synthetic methods may, and very often do, serve to reveal the complex chemical constitution of compounds of carbon. It is explained under CARBON COMPOUNDS (q.v.) that one of the basal principles employed in determining the constitution of compounds is the assumption, itself well founded on facts, that, when a given compound undergoes a moderate chemical change, the greater part of each of its molecules remains unaffected: an atom, or a group of atoms, may be replaced by another, but the linking of the remaining atoms is not changed. Thus, by the action of chlorine on acetic acid, the latter may be gradually transformed into monochloracetic acid, dichloracetic acid, and trichloracetic acid, one, two, or three atoms of hydrogen in the molecule of acetic acid being replaced by one, two, or three atoms of chlorine; but the remaining atoms (carbon, hydrogen, and oxygen) are linked in the chloracetic acids in the same manner as in acetic acid itself. On this principle the constitution of a compound becomes known if it is produced by synthesis from compounds of known constitution. In this connection it may be well to observe that the definition of the term "synthesis" must not be taken to mean the production of compounds from their elements directly. Thus, when it is said that ordinary alcohol can be produced synthetically, it does not mean that alcohol can be made by the direct union of carbon, hydrogen, and oxygen. The synthesis of alcohol consists of the following steps: carbon and hydrogen are caused to unite into acetylene (q.v.); acetylene is caused to unite with hydrogen into ethylene; ethylene is caused to unite with sulphuric acid to form ethylsulphuric acid; and the latter by reaction with water yields alcohol. The two compounds employed, viz., water and sulphuric acid, can also be made by starting with their elements; and so it may be said that ordinary alcohol can be made with nothing to start with but elementary substances, and this is what is meant by "the synthesis of alcohol from its elements." Finally, many synthetic processes have acquired great importance industrially. In 1868 Graebe and Liebermann built up by synthetic processes the substance called alizarin (q.v.), which occurs naturally in madder root and which gives the latter its chief value as a dyestuff. This artificial alizarin is now made on an enormous scale and has almost entirely displaced madder in dyeing and calico printing. In 1880 Adolf Baeyer accomplished the synthesis of indigo. Antipyrin, a substance much used in medicine, and saccharin, a substance several hundred times sweeter than sugar, are entirely the products of synthesis.

Yet while most of the known carbon compounds can be produced synthetically, some of the most important organic substances, including the proteins and many carbohydrates, still remain unsynthesized, and hence but imperfectly understood, and must still be obtained ready-made from nature. The synthetic methods employed in the preparation of a large number of carbon compounds are mentioned under the special names of those compounds. Consult: P. E. M. Berthelot, *La synthèse chimique* (Paris, 1876; Ger. trans., Leipzig, 1877); Louise, *Synthèse d'hydrocarbures, d'acétones, d'acides, d'alcools, d'éthers et de quinones dans la série aromatique* (Paris, 1885); Karl Elbs, *Die synthetischen Darstellungsmethoden der Kohlenstoff-Verbindungen* (Leipzig, 1889–91); Theodor Posner, *Lehrbuch der synthetischen Methoden* (ib., 1903); Lassar Cohn, *Arbeitsmethoden für organisch-chemische Laboratorien* (2 vols., Hamburg, 1906–07). See CARBON COMPOUNDS; CHEMISTRY (historical section).

SYNTHET'IC GEOMETRY. See GEOMETRY.

SYNTHETIC MINERALOGY. See MINERALOGY.

SYNTHETIC RUBBER. The efforts of chemists to synthesize rubber date from the discoveries of Bourchardt (1879) and Tilden (1882) that isoprene could be polymerized to form a substance that resembled rubber and that could be vulcanized. The hydrocarbon isoprene, or the closely related butardine, has been obtained by various complicated chemical processes from starch, phenol, turpentine, and petroleum. The making of artificial rubber, while undoubtedly a chemical reality, has not reached the commercial stage, although in Germany tires for motor vehicles have actually been made. A method of polymerization that is rapid, cheap, and efficient will probably put synthetic rubber on the market. See SYNTHESIS, CHEMICAL.

SYN'TONIN (from Gk. *σύντονος*, *syntonos*, stretched tight, from *συντείνειν*, *synteinein*, to stretch tight). A protein substance prepared by the action of dilute acids on the myosin of the muscles. The acid solution thus obtained is neutralized with alkali, and the precipitated syntonin is washed with a small quantity of water. Syntonin may be converted into a globulin probably identical with myosin, by dissolving in limewater, adding ammonium chloride, then neutralizing with acetic acid; from the solution thus obtained the globulin may be precipitated by adding the solution slowly to a large amount of distilled water. Syntonin is soluble in lime water and in dilute solutions of sodium carbonate, but not in acid sodium phosphate. It may be classed with the so-called metaproteins, and it is distinguished from other substances of the same class of proteins by its insolubility in acid sodium phosphate solution.

SYPHAX, sī'fāks (Lat., from Gk. *Σύφαξ*). A Numidian prince, who played a part in the Second Punic War, an enemy of Masinissa (q.v.).

SYPH'ILIS (from *Syphilus*, in the Latin poem entitled *Syphilus, sive Morbi Gallici Libri Tres*, by the Italian physician and poet Girolamo Fracastoro (1483–1553), a shepherd who was afflicted with the disease by Apollo as a punishment for offering homage to his King instead of to the god; of uncertain etymology, popularly explained as from Gk. *σῦς*, *sys*, hog + *φίλος*, *philos*, loving, or, less plausibly, from *σύν*, *syn*, with + *φίλος*, *philos*, loving), or LUES, or THE POX. A specific contagious disease peculiar to the human species, chronic in its course, and generally acquired during sexual congress. It is always due to contact with a syphilitic individual or with his secretions or discharges. Descriptions of syphilis are traced in the earliest writings, and it is asserted that indications of it are to be seen in the bones of prehistoric people, especially in South America, although Virchow maintained that these symptoms were not those of syphilis, but of arthritis deformans. (See SYNOVITIS.) In Chinese accounts scholars state that Hoan-Ti, who lived c.2637 B.C., mentions it, while in the earliest Indian records it is said to be found in the Ajwe-Veda of Suśrutas (400 A.D.). The Japanese historians described a disease several thousand years ago which is taken for syphilis. The Hebrews seem to have been familiar with it, and it is probable that many cases called leprosy were really syphilis. Hippocrates and his successors give a description of a disease which may be identical with syphilis, and Celsus mentions a disease which is somewhat similar to syphilis. Although it is probable that the malady existed in Europe as early as 1250 A.D., when Theodoric, a Dominican monk, wrote of the *malum mortuum* and recommended inunctions of mercury for its cure, its authentic and general recognition dates from a severe outbreak of the disease among the Spanish soldiers in the army of Charles VIII of France during the siege and following the occupation of Naples in 1495. It was known as the Neapolitan disease and as *morbus Gallicus*. Some scholars assert that this was the first appearance of syphilis in the Old World, it having been brought by Spanish sailors from America to Spain and thence to Italy. But this theory has lately been disproved by Sudhoff, whose researches and conclusions on the history of syphilis are now generally accepted as conclusive. The disease spread with frightful rapidity and virulence and during the following years was so widely disseminated as to be considered a form of plague. The armies of the various countries were nearly decimated, and no class of society escaped.

It was not at first recognized as a venereal disease. Its true nature appears to have been unsuspected at this time, as it was again a little previous to the time of John Hunter (q.v.), after whom was named the Hunterian or hard venereal sore. Hunter believed that there was but one venereal disease, that gonorrhœa, chancroid, and syphilitic chancre were merely variations of the same constitutional affection. Nearly half a century later (1831) Ricord established the identity of gonorrhœa, but failed to distinguish between chancroid and chancre. This was done by Bassereau in 1856. The severe epidemics of the fifteenth century have never been repeated, although syphilis has since prevailed with continually decreasing virulence. This is due in part to improved personal hygiene, better understanding of the disease, and rational treatment, but also doubtless to the fact that successive generations have transmitted a certain degree of immunity (q.v.) to their descendants. "It is believed that syphilis is a greater menace to the public health than any other single infectious disease, not even excepting tuberculosis," remarks Vedder. It is impossible to give adequate and correct statistical figures. The prevalence of syphilis and the impossibility of curbing the disease is not due to any misapprehension as to its importance, but to our present social and sanitary conditions, which prevent successful legislation and treatment.

Syphilis is caused by a specific microörganism, the *Spirochæta pallida*, discovered in 1905 by Schaudinn and Hoffmann. The diagnosis of syphilis received a great impetus from the investigations of Wassermann and his followers. By means of the Wassermann reaction, Noguchi's modification of it, and the luetin test, syphilis can be diagnosed with great precision in all its different phases. The treatment also has been advanced by Ehrlich's work and his discovery of salvarsan (q.v.) and other arsenical derivatives, such as atoxyl (q.v.), soamine, and arsacetin.

Wassermann's reaction, the serum test for syphilis, depends on certain well-known phenomena of immunity (q.v.), which may be briefly stated as follows. If the washed red corpuscles of a sheep (taken as the antigen) are added to the warmed serum of a rabbit which has been previously immunized with washed red corpuscles of the sheep (this constituting the amboceptor) and fresh guinea-pig serum (the complement), thus forming what is known as a hæmolytic series, hæmolysis follows. This reaction was applied by Wassermann to the diagnosis of syphilis. The technic may be briefly stated: to the syphilitic antigen, consisting of an extract of syphilitic organs, are added fresh guinea-pig serum (the complement), the suspected serum, warmed rabbit serum (the amboceptor), and the washed red corpuscles of the sheep. The mixture is then incubated. If no hæmolysis occurs (by reason of the complement having been absorbed in the hæmolytic series), the antigen and the serum being homologous, the reaction is called positive. Noguchi has modified this technic by using human instead of sheep's corpuscles in the hæmolytic series. The luetin reaction consists in the intradermal injection of a killed culture of the spirochæte, and is particularly serviceable in diagnosing latent or hereditary syphilis, whereas the serum tests are more useful in identifying active syphilis. A number of other tests have been devised, notably the iodine test of Landau, for a description of which the reader must be referred to textbooks on this subject.

Syphilis requires for its transmission contact of the specific poison existent in the secretions or discharges of a syphilitic patient with an abraded surface of skin or with a mucous membrane. The blood is also capable of transmitting syphilis. Although the disease is as a rule acquired through sexual intercourse, syphilis insontium, or syphilis of the innocent, is of frequent occurrence. Physicians may become inoculated by contact with syphilitic patients, and innocent patients, on the other hand, may be infected, though rarely, by surgical and dental instruments. The saliva of syphilitic individuals carries the specific virus, and in this way inoculation may occur by kissing and the use of pipes, spoons, cups, pencils, etc. Great care is necessary when one member of a family is affected to prevent transmission of the disease to others, since in the familiar intercourse of relations great danger exists.

The manifestations of syphilis may be divided into three stages or phases, to which some authorities have added a fourth, viz., that of parasyphilis; but it must be remembered that these stages do not follow each other with any degree of regularity as to time or intensity, and certain phenomena may be absent or so slight as to escape notice. The primary stage is that of the initial lesion, the Hunterian chancre, which appears as a rule within three weeks after infection. This consists, when fully developed, of an ulcer on an indurated base. After a period of quiescence, during which the primary sore heals—the so-called second incubation period, which lasts from four to eight weeks—there follows the secondary phase or stage of constitutional invasion. A rash, varying much in its characters, makes its appearance; small ulcers (mucous patches) appear on the mucous membranes, the lymphatic glands are enlarged, the throat is sore, there may be some fever, and there are the usual signs of an acute constitutional illness. This stage lasts for a variable period, depending on treatment and the violence of the invasion. Tertiary manifestations may not appear for years. The characteristic lesion of this stage is the gumma, which is essentially a soft elastic tumor composed of cells and fibrous tissue, with a tendency to ulcerate and break down. It may appear in any tissue of the body and in the breaking-down process may rapidly destroy considerable areas of tissue. The quaternary stage, or stage of parasyphilitic phenomena, appears late and is illustrated by such invasions of the cerebrospinal nervous system as tabes dorsalis and general paresis of the insane. In such diseases other factors besides syphilis enter into the pathology, and antisyphilitic treatment is successful only to a limited extent.

Congenital syphilis shows itself in many and curious ways. Children born of parents suffering from syphilis in the first or second stage may be infected with the disease. The infection may be derived from the father alone, the mother being healthy; or from the mother alone, the father being healthy; or from both father and mother. Or the mother may acquire syphilis after conception and convey it to the child in utero. A curious law, to which there seems to be no exception, is that, if a child inherits syphilis from its father, the mother being originally healthy, the infant may infect a wet nurse, but not its own mother, who is in some way protected against infection, although she may have shown no evidences of the disease. As a rule the effect of syphilis in the parents is to cut pregnancy short, with resulting miscarriages, premature or stillbirth. Children may be born alive, presenting lesions of any stage of the disease. In many cases the child is at birth apparently healthy, fat and plump, but in a few weeks develops a characteristic catarrh, commonly termed the snuffles, shows a rash, with ulcerations about the lips, genitals, and anus, and gradually wastes away until the face acquires a typical withered, shrunken, and aged appearance. Most of these children die in infancy.

The treatment and prophylaxis of syphilis is a matter of great importance, since there is no disease so widespread in its dissemination nor so potent in its influence upon the human species. Prevention depends on education in matters of sexual hygiene on the part of the public, elevation of the moral tone of the individual, and in segregation and inspection of prostitutes. The latter is practiced in many cities of the Old World, and attempts are constantly making towards the same end in the United States. Great ignorance prevails among the laity as to the nature, effects, and treatment of syphilis. The reliable remedies are still mercury and iodides; but these must be given with care and under close observation and should be combined with tonic remedies, according to the needs of the particular case. Lay medication is apt to be ineffectual, if not dangerous. Mercury may be given by inunction, fumigation, hypodermically, or by the mouth. Excessive doses of mercury are likely to produce a series of very unpleasant symptoms (see Mercury; Salivation), and its unwise use in the hands of the ancient practitioners has resulted in a popular distrust of the drug. When these drugs are given properly, there is every reasonable prospect of a permanent cure. The time of treatment should extend over at least two and one-half years after all visible signs of the disease have disappeared, and marriage should be prohibited during this interval. The general health must be watched, and exercise in the open air, full diet, and appropriate tonics administered. In the syphilis of infants mercury is best given by inunction. Children somewhat older may take mercury in the form of gray powder in small doses. The two other drugs that seem to exert almost a specific effect in children are cod-liver oil and the iodide of iron. Ehrlich's salvarsan, while not without danger in itself, has added immensely to the possibilities of rapid cure in desperate cases and may be used in conjunction with the ordinary mixed treatment, above described. In the parasyphilitic affections salvarsan or neosalvarsan may be injected into the spinal canal, this being done through the medium of salvarsanized serum, viz., serum drawn from a subject who has shortly before been immunized by a dose of salvarsan. This serum is supposed to contain antibodies against the disease. Many brilliant cures have been reported, but the value of the method is not fully established. See Hygiene, *Military Hygiene*. Consult: Fournier, *Syphilis and Marriage* (Eng. trans. by Morrow, New York, 1881); E. G. Ballenger, *Genito-urinary Diseases and Syphilis* (2d ed., Atlanta, 1913); F. H. Garrison, *An Introduction to the History of Medicine* (Philadelphia, 1914); Karl Sudhoff, *Aus der Frühgeschichte der Syphilis* (Leipzig, 1914); M. Nonne, *Syphilis und Nervensystem* (3d ed., Berlin, 1915).

SY'RA (Lat. *Syrus*, from Gk. *Σῦρος*). An island in the Ægean Sea, belonging to the Cyclades and situated nearly in the centre of the group, 10 miles southwest of Tinos (Map: Greece, F 6). Area 31 square miles. It is for the most part barren and rocky, and its natural products are insufficient to support its population. It was the site of Hermopolis (q.v.), the capital of the nomarchy of the Cyclades and one of the chief commercial ports of Greece. Its modern importance dates from the time of the Greek war of independence, when it became the point of congregation of Greek refugees. Pop., 1896, 26,856.

SYR'ACUSE (Lat. *Syracusæ*, from Gk. *Συράκουσαι*, *Surakousai*). Anciently the most famous and powerful city of Sicily, situated on the southeastern coast of the island, 33 miles south-southeast of Catania (Map: Italy, E 6). It was founded by Corinthian settlers under Archias, one of the Bacchiadæ, near the end of the eighth century B.C. The original colonists seem at first to have occupied only the little isle of Ortygia, which lies near the shore, but with the growth of the city the population soon passed over to the mainland. This settlement was on Achradina, at the eastern end of a high triangular plateau, which lies north of the island. North of the island lay the small harbor, while to the west was the great harbor, one of the best in Sicily. Ortygia was connected by bridges or a causeway with the mainland. The city consisted of Achradina, occupying the eastern end of the table-land and the adjacent coast, Tyche and Neapolis, to the west of Achradina, and of Epipolæ, still farther west, with the strong fort of Euryalus at the apex of the triangle. The colony rapidly rose to prosperity and was enabled to establish subcolonies of its own, Acræ (664 B.C.), Casmenæ (644 B.C.), and Camarina (599 B.C.). At first the government seems to have been in the hands of the descendants of the Dorian colonists, who were landowners employing a large body of serfs, seemingly Sicels. The commerce of the city brought, however, a large Demos of Greeks, who about 486 B.C. expelled the Gamori or ruling oligarchy and established a democracy. The Gamori were brought back in 485 by Gelon (q.v.), tyrant of Gela, who made himself master of Syracuse. He was a great ruler, and under him the city increased in size and wealth. He was succeeded by his brother Hiero I (q.v.) (478–467 B.C.), whose court became a literary centre. In 465 the democracy expelled his brother and successor Thrasybulus, and for 60 years a free and popular government was enjoyed under which Syracuse prospered greatly. The Sicels were reduced, and war was waged with neighboring states, till the island attracted Athenian intervention, only closed by the Peace of Hermocrates (424 B.C.). Renewed hostilities with Segesta (q.v.) led to the great struggle with Athens (415–413), in which Syracuse, aided by the Spartan Gylippus, annihilated the invading army and contributed not a little to the outcome of the Peloponnesian War. (See Alcibiades; Greece, *Ancient History*; Gylippus; Nicias.) But a new power appeared on the stage—the Carthaginian—whose conquests in Sicily towards the close of the fifth century threatened the existence of Syracuse. (See Carthage; Sicily, *History*.) The successful leadership of Dionysius the Elder (q.v.) enabled him to become tyrant of the city and make it the chief power of Magna Græcia and Sicily. He constructed docks and fortifications. His fierce and victorious war with Carthage (397 B.C.) raised the renown of Syracuse still higher. The reigns of Dionysius the Younger (q.v.) and of Dion (q.v.) were unsettled, but after the restoration of public liberty by Timoleon (343 B.C.) there was a brief season of tranquillity, during which the prosperity of the city rapidly revived. Under Agathocles (q.v.), however, the despotic form of government was again established (317 B.C.). This reign was marked by a war with Carthage, including an invasion of Africa, conducted with doubtful success. In 275 B.C. Hiero II (q.v.) was chosen general, and about 270 B.C. he assumed the title of King. He adopted the policy of alliance with Rome and preserved the independence of the state until his death in 216 B.C. His grandson Hieronymus joined the Carthaginians, and in consequence the city suffered a long siege, rendered famous by the devices of Archimedes, and was finally stormed and plundered in 212 B.C. by Marcellus.

Under the Romans Syracuse steadily declined, though it always continued to be the capital and first city of Sicily, and was made a colony by Augustus. Captured, pillaged, and burned by the Saracens (878), it sank into complete decay and is at present confined to its original limits, Ortygia, which, however, is no longer an island, but a peninsula. The population of Syracuse, which is the capital of a province of the same name, was 27,352 in 1912, according to Baedeker. The mainland contains the chief remains of antiquity, which include a fine rock-cut theatre, a Roman amphitheatre, the great altar of Hiero II, the remains of the ancient fortifications, and the great Latomiæ or quarries. The cathedrál on Ortygia has been built around an ancient Doric temple; the columns of the temple form part of the church. The museum contains remains of the pre-Hellenic population, found in graves and caves in the neighborhood. In the southern part of the town is the famous fountain of Arethusa.

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SYRACUSE. The fourth city in population of the State of New York, and the county seat of Onondaga County, 148 miles west of Albany and 149 miles east of Buffalo (Map: New York, D 4). It is situated at the mouth of Onondaga valley, 35 miles south of Lake Ontario, in an amphitheatre of hills. Area, 19 square miles.

Syracuse has superior facilities for transportation, steam railroads entering the city from ten directions, and canals from three. The Erie Canal pierces the heart of the city and gives water communication with Lake Erie and the Hudson River, and the Oswego Canal with Lake Ontario and the St. Lawrence. All steam railroad lines centring here are of two systems, the New York Central and Hudson River and the Lackawanna. Six interurban lines radiate from Syracuse. The street-railway system comprises 95½ miles of track, and reaches all sections of the city.

The chief residential streets are profusely shaded, presenting a parklike appearance. There are 38 public parks, ranging from small plots at street intersections to Burnet Park, on the hillside to the west, with more than 120 acres. Lincoln Park, a wooded height of 20 acres on the eastern border, commands a beautiful and extensive view of the city and its surroundings. The State Fair, under the auspices of the State Fair Commission, is permanently located in Syracuse.

The buildings of Syracuse University (q.v.) crown a commanding elevation and are among the most imposing edifices in the city. Other prominent public buildings are the city hall, the high school, costing $400,000, the Carnegie library, the county courthouse, the Federal Government building, the State Asylum for Feeble-Minded Children, the House of Providence Orphan Asylum, the County Orphan Asylum, the Old Ladies' Home, and the five hospitals. The Carnegie library contains 150,000 volumes, the Court of Appeals Law Library, belonging to the State, 35,096 volumes, and the University Library, 96,000 volumes. The city also maintains a Museum of Fine Arts. The Onondaga Historical Society occupies its own building.

Industrially, Syracuse is fifth among the cities of the State. Its establishments, according to the census of 1914, had $63,957,000 invested capital, and a production valued at $52,226,000. The city is noted for the number and diversity of its industrial establishments. In 1915 there were 760 plants, employing 25,000 persons. The chief articles manufactured are typewriters, automobiles and gears, candles, mince meat, china ware, clothing, agricultural implements, tool steel, furniture, cement, beer and ale, beds, caskets, carriages, wine presses, chemicals, drop forgings, elevators, fire escapes, incubators, mining machinery, safes, shoes, etc. The Onondaga Salt Springs are on the borders of Onondaga Lake. The manufacture of salt, from the brine pumped out of the springs, was formerly the main industry, but is now of minor importance. The Solvay Process Company's works, manufacturing soda ash and other products, and employing some 4000 men, are just outside the city limits on the west. With its many and varied manufactures, Syracuse has a large wholesale and export trade.

The government is vested in a mayor and common council, elected biennially. The comptroller and treasurer are chosen at the same time. The mayor appoints the heads of departments, including the city engineer, corporation counsel, and commissioners of public works, public safety, and charities. The schools are under the control of a board of education elected on a general ticket. In maintenance and operation the city spent, in 1914, $2,976,000, the principal items being: schools, $737,000, police department, $128,000, fire department, $225,000, and lighting, $128,000. The assessed valuation of the city's property, real and personal, in 1915 was $144,111,656. There are 100 miles of paved streets, principally of asphalt; 195 miles of sewers; and 234 miles of water mains. The water system is under municipal ownership and control. The water is obtained from Skaneateles Lake, 18 miles distant, and is conveyed by gravity to the city through 36-inch pipes. The plant cost $5,000,000.

Pop., 1850, 22,271; 1880, 51,792; 1900, 108,374; 1910, 137,249; 1915 (State census), 146,587.

The territory in which Syracuse is situated originally belonged to the Onondaga Indians. It was visited by the Jesuit missionary Father Isaac Jogues as early as 1642. By treaties in 1778 and 1795 the State bought a large tract containing the salt springs and formed from it the Onondaga Salt Springs Reservation, parts of which were subsequently sold to individuals. Syracuse proper was first settled about 1805, and was of little importance until after the completion of the Erie Canal, its population in 1820 being only 250. Until named Syracuse in 1819 it was known successively as South Salina, Bogardus' Corners, Cossitt's Corners, and Milan. It was incorporated as a village in 1825, and in 1847 absorbed Salina and was chartered as a city. It was prominent for its abolitionist sentiment preceding the Civil War, and was one of the chief stations on the Underground Railroad (q.v.). Here on Oct. 1, 1849, occurred the famous Jerry rescue, which did much to crystallize abolitionist sentiment in the North and arouse the animosity of the Southern planters. Consult Bruce, *Memorial History of Syracuse* (Syracuse, 1891).

SYRACUSE, SOPHRON OF. See SOPHRON OF SYRACUSE.

SYRACUSE UNIVERSITY. A coeducational institution for higher learning founded at Syracuse, New York, in 1870. Its college department is a continuation of Genesee College, which was conducted at Lima, New York, from 1851 to 1871. Its medical department is a successor of the Geneva Medical College (1835–72), which in part succeeded the Fairfield Medical College (1812–39). In 1915 the university comprised eight colleges: (1) the College of Liberal Arts, with classical and scientific courses leading to the degree of B.A. and B.S.; (2) the College of Fine Arts, with courses in architecture, belles-lettres, music, painting, art, and decorative design leading to the bachelor's degree in architecture, letters, music, and painting; (3) the College of Medicine, with a four years' course leading to the degree of M.D.; (4) the College of Law, with a three years' course leading to the degree of LL.B.; (5) the College of Applied Science, with courses in civil, electrical, and mechanical engineering leading to the corresponding engineering degrees; (6) the Teachers College, with fully equipped departments in pedagogy; (7) the College of Agriculture; (8) the New York School of Forestry. In the graduate schools the masters' and doctors' degrees are conferred. The university also maintains a school of oratory, a library school, a school of photography, and a summer school. In 1902 an observatory station of the United States Weather Bureau was established in connection with which lectures are given on meteorology and climatology. The university campus, containing about 100 acres, is situated on high ground and commands an extensive view of the surrounding country. Among the notable buildings on the campus are the Hall of Languages, occupied by several departments of the College of Liberal Arts, the Charles Demarest Holden Observatory, equipped with an 8-inch Alvan Clark telescope, the Administration Buildings, the John Crouse Memorial Hall, the Esther Baker Steel Hall of Physics, the Lyman Cornelius Smith College of Applied Sciences, the Carnegie Library, and the State Forestry Building. For athletic games there is a stadium which seats 20,000 spectators. The College of Medicine and the College of Law are situated in other parts of the city, but convenient to the main buildings of the university. The attendance in all departments, allowing for duplication, in 1914–15 was 4012. The faculty numbered about 300. The total resources are about $5,000,000. The general library contains 100,000 volumes, including in this the historical library of Leopold von Ranke. The president in 1916 was James R. Day, S.T.D., LL.D.

SYR-DARYA, sĕr-dăr′yȧ, or **SIR-DARIA** (ancient *Jaxartes*). A large river of Russian Turkestan, central Asia (Map: Asia, L 3). It rises on the north slope of the Tian Shan on the boundary of Chinese Turkestan, and flows in a general northwesterly direction until it enters the northeastern part of the Aral Sea after a course of over 1700 miles. Its upper course, known as the Narin, descends through a series of romantic gorges as a tumultuous mountain torrent, the fall being more than 3000 feet in less than 50 miles. It receives here numerous tributaries, but after making a long detour to the southwest around the highlands north of Ferghana, it enters upon the great arid lowland steppes, in which it receives no more affluents, but decreases in volume by evaporation and by the use of large quantities for irrigation. Its course becomes here very sluggish. In the rainy season it overflows the surrounding country, and its low banks are in some places lined with extensive marshes. The discharge into the Aral Sea is less than half of the volume of the river in its middle course. The delta is marshy and shifting, and the depth on the bar is generally not more than three feet. From its lower middle course the river sends an arm across the desert to the southeastern end of the Aral Sea. This channel is now nearly dry, but probably indicates the former bed of the main river. The river is practically unnavigable in its lower course.

SYR-DARYA, or **SIR-DARIA.** A territory in northwest Russian Turkestan. Area, about 194,850 square miles (Map: Asia, H 4). The larger part consists of extensive sand wastes. The southeastern part belonging to the region of the Tian Shan Mountains rises in snow-covered peaks to an altitude of over 15,000 feet. The flat part of the territory is very scantily watered by the Syr-Darya and Amu-Darya (qq.v.). The lakes are mostly salty. The settlements are found largely at the foot of the mountains, where the streams are utilized for irrigation. Wheat, silk, and cotton are the principal products. The nomadic inhabitants have extensive herds of cattle and sheep, and utilize the wool for the manufacturing of woolen products, besides exporting large quantities of the raw material to Russia and other parts of Europe. Horse breeding is carried on by the Kirghiz. The Central Asiatic Railway is the principal means of transportation. Pop., 1913, 1,989,000, consisting principally of Kirghizes and Sarts, the Russian forming only about 4 per cent of the total. Capital, Tashkend (q.v.).

SYRIA. Traditionally, the region lying between the Euphrates River and the Syrian Desert on the east and the Mediterranean on the west, and between the Alma Dagh (the ancient Amanus) in the north and Egypt in the south. This region now forms a part of Asiatic Turkey (Map: Turkey in Asia, C 4). Mesopotamia, or at least a portion of it, is frequently designated as East Syria. Syria proper is now a vilayet of the Turkish Empire and is divided into six provinces—Jerusalem, Lebanon, Beirut, Aleppo, Syria, and Zor. It occupies approximately the area within the above boundaries. It, therefore, includes Palestine. Its area is 114,530 square miles.

Syria proper is traversed from north to south by a system of mountains connected with the Taurus in the north and in the south with Mount Sinai as well as with the important mountain chain of western Arabia. The loftiest section is the Lebanon district, comprising the range of the Lebanon proper, skirting the middle part of the Mediterranean coast attaining 10,050 feet in Dhahr el Kosdib, and the parallel Anti-Libanus reaching 9200 feet in Mount Hermon with the valley of Cœle-Syria, between them. Syria is in general a plateau of limestone, with the exception of the sandstone and granite hills of Edom. The plateau dips steeply to the Mediterranean. It is traversed north and south by a great rift valley, the displacement of the plateau level along lines of fracture, which, beginning at the Gulf of Akabah (of the Red Sea) in the south, extends under the name of Wadi el Araba to the Dead Sea, thence north through the region of the Jordan to its sources, and beyond this through the Lebanon region, becoming narrower but widening again farther north, and finally reaches the sea at Antioch. This depression is over 400 miles long, and generally averages about 12 miles in width. It divides Syria (except in the north and northeast) into two long comparatively narrow stretches of table-land—the eastern and western. For the full description of the western, adjacent to the Mediterranean, see Palestine. The eastern strip merges into the Syrian Desert, and is sandy and bare, its elevated levels being dominated by the basaltic Jebel Hauran (6000 feet) situated east of Lake Tiberias. The Nahr el Asi (ancient Orontes), the Litany (Leontes), and many short streams flow into the sea on the west. The Jordan is the main feeder of the Dead Sea, whose surface is 1292 feet below that of the ocean. The principal affluents of the Jordan are the Yarmuk and Jabbok. In the east are a number of streams that die in the sands of the desert. There are several lakes besides the Dead Sea, the best known being Lake Tiberias (Gennesaret). The climate is that of the Mediterranean basin. At Beirut the mean annual temperature is 68° F.; at Jerusalem, 62.6° F. The rainfall is scanty, occuring in winter; Beirut having the heaviest with a rapid decrease south and east. The springs are short, the summers long, dry, and hot. Snow falls in winter and there is often almost severe cold. The flora is that of the Mediterranean region, the olive being prominent. Forests of conifers clothe portions of the western slope of the Lebanon. But small remnants survive of the famous cedars of Lebanon. In the east and south, however, the plant growth partakes of the scanty desert species. In the extreme north the date palm thrives. Of the wild fauna the lion has nearly disappeared, hyenas exist in some mountainous regions, and jackals abound. Gazelles are still met with. There are several species of venomous serpents, including the cobra. Formerly a land rich and highly productive, Syria is in modern times of very inferior agricultural and industrial significance. Fruits, grain, and vegetables are grown. The principal ports are Beirut and Jaffa. The Syrian Railroad has afforded an impetus to trade since 1895. The population is probably about 3,000,000. It is mainly Semitic in race. Mohammedans predominate, and Arabic is generally spoken. Bedouins and Arabs roam in the south and east. The Turks are few. The Christian population is considerable, the Maronites of the Lebanon region alone numbering over 100,000. There are many Jews in Palestine, where they form agricultural communities. The Mohammedan sect of the Druses (in the Lebanon region and the Hauran) has been prominent through its fierce hatred of Maronites. The chief towns are Damascus, Aleppo, Beirut, and Jerusalem.

History. About 1500 B.C. the kings of Egypt brought the greater part of Syria under their dominion. Their advance was opposed by the Hittites (q.v.), who were long dominant in northern Syria, and who spread also into the southern part of the country. The non-Semitic inhabitants were gradually amalgamated with the Semites among whom they dwelt, their speech becoming Semitic. About 1000 B.C. the Phœnicians were at the height of their power and prosperity and the Hebrew Kingdom was firmly established. By this time the Hittites, whose state had become disintegrated into a number of principalities, had begun to feel the power of Assyria (q.v.). Under David and Solomon the Israelites extended their sway over a great part of Syria, subduing the southern Hittites, the Amorites, and other peoples, and conquering Damascus and other important cities. On the southern part of the coast the Philistine cities were united in a powerful confederacy. After the disruption of the Hebrew realm Damascus became the seat of a powerful independent Kingdom. This was destroyed in the second half of the eighth century B.C. by the Assyrians, who imposed their yoke upon the Philistine cities, and put an end to the Kingdom of Israel, while the Phœnician cities paid them tribute. About this time the last Hittite principalities were swallowed up by the same enemy. At the beginning of the sixth century B.C. Syria came under the rule of Babylon (q.v.), which was succeeded in B.C. 538 by that of Persia. In 333–332 B.C. Alexander of Macedon established his sway in Syria. At the close of the century upper Syria was appropriated by Seleucus, one of Alexander's generals, who founded Antioch as the seat of his Kingdom. The Ptolemies and the Seleucidæ (q.v.) contended for the possession of the rest of the country, which finally passed to the latter, whose realm, which embraced a large part of western Asia, came to be known as the Kingdom of Syria. Many Greek cities were founded by this dynasty. In 167–141 B.C. Palestine threw off the yoke of the Seleucidæ. In 64 B.C. Syria was made a Roman province and in the following year Judea was made tributary to the Romans.

In the third century A.D. the Kingdom of Palmyra, on the eastern borders of Syria, enjoyed a short-lived splendor. After the close of the fourth century Syria formed part of the Byzantine Empire, from which it was wrested in 634–636 by the Saracens. In 661 Damascus became the seat of the caliphs, but about a century later it was supplanted by Bagdad. In the second half of the eleventh century the Seljuks occupied the country. In 1099 the Crusaders took Jerusalem, which was made the capital of a Kingdom. At the same time was founded the Principality of Antioch. In the middle of the next century the Christian power in Syria was endangered by the assaults of Sultan Nureddin, whose seat was at Aleppo. In 1174–87 Saladin, Sultan of Egypt, wrested Syria from the successors of Nureddin and overthrew the Kingdom of Jerusalem. In the thirteenth century Khwaresmians and Mongols swept over Syria. In 1291 Acre, the last stronghold of the Christians on the Syrian coast, was taken by the Mameluke ruler of Egypt and Syria. In 1516 Syria was attacked and easily conquered by the Ottoman Turks. In 1831–33 Mehemet Ali (q.v.) of Egypt made himself master of the country, but was forced to relinquish it to the Sultan in 1840. In 1860 there were massacres of the Maronites by the Druses and a frightful slaughter of Christians at Damascus.

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SYRIAC APOCALYPSE. See BARUCH, BOOKS OF.

SYRIAC LANGUAGE AND LITERATURE. The Aramaic dialect of Edessa and western Mesopotamia (see ARAMAIC), in which many literary productions have been preserved. Its name is derived from the Greek Συρία, which is either an abbreviation of 'Ασσυρία, or a survival of the old designation Suri found in cuneiform inscriptions. Before the introduction of Christianity the natives of Mesopotamia called themselves Aramæans. Subsequently this term was used especially for the pagans, while the Christians were designed by Greeks and Persians as Syrians and seem to some extent to have adopted the name themselves. The Syriac language shows in its earliest documents a remarkably fixed type, and must therefore have been long spoken in Mesopotamia. Characteristic of this dialect are the *n* of the preformative in the imperfect of the verb and the loss of the determinative force of the emphatic ending *a* in the noun.

There was probably an extensive pagan literature both in Edessa and in Harran; but the story of Achikar (q.v.); an account of a water famine in 201 A.D. preserved in the Chronicle of Edessa; and the letter of Mara son of Serapion of the second and third century, published in Cureton's *Spicilegium Syriacum*, seem to be the only extant specimens. The translation of the Old Testament was probably made by Jews. It may belong to the first century A.D., though it was subsequently revised in some books with the aid of the Greek version. Two recensions of the oldest translation of the New Testament have been preserved in part in a Sinaitic manuscript of the Gospels and a Nitrian manuscript published by Cureton, containing fragments of the Gospels. This latter version may have been made in the latter half of the second century. A compilation of the four Gospels, called the *Diatessaron*, was made by Tatian (q.v.), or translated by him from a Greek work of the same kind, about 180. This diatessaron is lost and is known chiefly through Ephraem Syrus (q.v.); the Arabic translation of this work published by Ciasca seems to belong to the eleventh century, and has manifestly been made conformable to the standard text. Having been in use for a long time in the Mesopotamian churches, the diatessaron was supplanted by the Syriac Vulgate, or Peshita (see BIBLE, *Versions*), apparently in the fifth century, through the efforts of Bishop Rabbulas (died 435). 2 Pet., 2 and 3 John, Jude, and the Apocalypse, which were not found in the old Syriac Bible, were later supplied from the versions of Philoxenus (508) and Thomas of Heraclea (616). In addition to the canonical books, Ecclesiasticus (q.v.) was also translated from the Hebrew and the other deuterocanonical books (q.v.) probably from the Greek, while 4 Maccabees and a part of Josephus' Jewish War called 5 Maccabees, as well as several other apocryphal books, including the apocalypses of Baruch and Ezra (qq.v.), were also translated from the Greek. Translations of the Psalms of Solomon (q.v.) and the Odes of Solomon (q.v.) were discovered in 1909. A translation of the Greek text adopted by Origen called the Syro-Hexaplaric version was made by Paul of Tella in 617; and a revision of the New Testament was made by Jacob of Edessa (q.v.) at the end of the seventh century.

As early as any of the New Testament translations are the works of Bardesanes, the Gnostic (q.v.), who died in 222 and was a poet, philosopher, astronomer, and historian. His *Dialogue on Destiny* is extant; his 150 hymns are lost. A number of Gnostic hymns have, however, been preserved in the *Acts of Thomas*, written in the third century, among the Hymns of the Soul. In the fourth century Aphraates (q.v.) wrote his homilies, and the famous Ephraem (died 373) his commentaries on the Bible and on Tatian's *Diatessaron*, his exegetical discourses, and his hymns. Among the disciples of Ephraem were such writers as Aba, Zenobius, Balai, and Cyrillona. The most flourishing period of Syriac literature extended from c.400 to the Arabic conquest. In the course of the fifth century the great schism occurred which divided the Mesopotamian church between Nestorians and Monophysites (qq.v.) and severed both from the Catholic church. An eminent poet of this century was Isaac of Antioch (q.v.); and Narses of Maalletha also deserves, to be mentioned. Much of the early Nestorian literature is lost; but some works of Hamana (died 607), Babai (died 610), and Elias of Merv remain. Among the Monophysites, Aksenaya, or Philoxenus of Mabug, Jacob of Serug (died 521), Jacob Baradæus, after whom the party was called Jacobites, and Jacob of Edessa (died 708) were perhaps the most influential writers. In addition to the strictly theological works, there grew up an historical literature, including the *Chronicle of Edessa*, the very excellent chronicle of Dionysius of Tell Mahre, many histories dealing exclusively with the Church, such as that of John of Ephesus (sixth century), and the translation and expansion of a work by Zacharias of Metylene, martyrologies and legends such as those of King Abgar and the Apostle Addai. Not only theological works, such as the *Clementine Recognitions*, the Apology of Aristides, the ecclesiastical history of Eusebius, and the commentaries of Theodore of Mopsuestia, were translated from the Greek, but also secular works like those of Homer, Æsop, Aristotle, Galen, and Hippocrates. Mana, Moses, Probus, Sergius, and Jacob of Edessa were especially active as translators, and Severus Sebocht of Nisibis wrote on astronomy and geography. After the Moslem conquest the Arabic language gradually gained on the vernacular. But Syriac still continued to be spoken in many localities and to be cultivated as a learned language. The use of two languages led to philological studies, and many works on grammar and lexicography were written. Among these may be mentioned the grammar of Elias of Tirhan and the lexicons composed by Bar Ali Honain (died 873) and Bar Bahlul (963). Many books were translated from the Arabic in the tenth century, such as the *Kalilah wa Dimnah*, *Sindbad*, and Pseudo-Callisthenes' life of Alexander. Classical Syriac was written with great elegance by the Sabian Thabit ben Korrah (died 901) and his sons. (See SABIANS.) With the decline of the caliphate, the Syriac gained a more vigorous life, and numerous theological writers used it. Theodor bar Choni (tenth century) wrote with great freedom from prejudice on other religions than Christianity. Dionysius bar Salibi (twelfth century) is of interest for the history of the Crusades; and Michael of Melitene wrote a history of the world. The most important of these later writers are Abulfaraj Gregory, called Bar Ebhraya or Bar-Hebræus (1226–86), who wrote a grammar, a commentary on the Bible, a history of the world, a commentary on Galen, translations from the Greek, essays on ethics and religion, astronomy, and other physical sciences (see BAR-HEBRÆUS); and Abhdisho (died 1318), a learned Nestorian who wrote the history of Syriac literature and other works. After the fourteenth century there were no noted writers.

The system of writing used by the Edessene Christians before the fifth century was a modification of the Aramaic script then in use in Syria, resembling most the Palmyrene. From the tenth century this writing was known as Estrangelo, or the writing of the gospel. The Nestorians continued to use it, while the Jacobites adopted for distinction a cursive form. At first vowels were not indicated at all. Subsequently vowel letters were used. But in the seventh century the Nestorians began to employ vowel points, and about 700 the Jacobites adopted some of the Greek vowels, which they wrote above or below the consonants to show the proper pronunciation.

The modern Syriac spoken with dialectical differences by the Nestorians in the West, those of Lake Urumiah, in the Kurdish mountains, and on the plain of Mosul, and by the Jacobites of Tur Abdin, exhibits, in addition to numerous Turkish, Kurdish, and Arabic loan words, certain peculiarities rendering it probable that it is a descendant of the Aramaic, once spoken in Assyria, rather than of the classical Edessene. In the dialect of Urumiah a considerable literature has been developed by American missionaries.

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SYRIAC VERSIONS. See BIBLE.

SYR'IAN PROTESTANT COLLEGE. An institution of learning at Beirut, Syria, founded in 1863 and incorporated under the laws of New York in 1864 by the Trustees of the Syrian Protestant College. The college was opened in 1866; in 1867 the school of medicine was organized; in 1900 a school of commerce was opened; in 1905 a nurses' training school; in 1909 the teachers' training course; and in 1910 the school of dentistry was added. There were in 1916 eight departments including in addition to the above the preparatory department, the school of pharmacy, and the school of biblical archæology and philology. The college occupies a site of 40 acres overlooking the Mediterranean and comprises 26 buildings. English is the language of instruction, having begun to replace Arabic in 1880. In 1913–14 the institution had an enrollment of 961 students, of whom 545 were in departments above the preparatory. There is a graduate body since the foundation of the college of 2306 members. The total faculty includes about 70 members. The president is Rev. Howard S. Bliss.

SYRIAN RITE. See LITURGY.

SYRIN'GA (Neo-Lat., from Gk. *σῦριγξ*, *syrinx*, pipe, tube; name first given to the mock-orange because its stems, after removal of the pith, were used as pipes). A genus of plants of the family Oleaceæ. The English common name is lilac (q.v.). Syringa is also a name very commonly applied to the mock orange, or *Philadelphus* (q.v.).

SYRIN'GOMYE'LIA (Neo-Lat., from Gk. *σῦριγξ*, *syrinx*, a pipe + *μυελός*, *myelos*, marrow). A disease of the spinal cord characterized by the formation of cavities and the growth of new tissue resembling glioma in its central parts. Its cause is not accurately known, though it may depend upon anomalous embryonic development, and it apparently follows infectious diseases as well as wounds upon the hands. It is not caused by alcohol or syphilis, nor is it hereditary. It often appears in women after childbirth. The disease is comparatively rare and appears between the eleventh and the thirtieth year; it is more frequent in males than in females, in the proportion of 2.2 to 1. The symptoms are pains in neck and arms with reduced sensation in the hands, atrophy of muscles in hands, arms, and shoulders, with twitchings, followed by wasting in muscles of back, thighs, and legs. The hands become clawed, the feet deformed, and the spine is curved, in extreme cases. Loss of sensation to temperature and pain, while not to touch, occurs, and is considered pathognomonic. Eruptions and ulcerations appear on hands and face, and other changes occur. The disease lasts from five to 20 years, and the prognosis for checking it is not good. It is incurable. Rest and general tonic treatment, hydrotherapy, and massage, as well as silver and arsenic, are measures tried. Consult Church and Peterson, *Nervous and Mental Diseases* (Philadelphia, 1914).

SYR′INGOP′ORA (Neo-Lat. nom. pl., from Gk. *σῦριγξ*, *syrinx*, pipe, tube + *πόρος*, *poros*, passage, pore). A genus of fossil tabulate corals in which the coral mass consists of a bundle of slender cylindrical tubes that rise from a common base and that are connected at intervals by slender hollow horizontal processes or plates. The genus ranges through the Upper Silurian, Devonian, and Lower Carboniferous formations.

SYR′INX (Neo-Lat., from Gk. *σῦριγξ*, pipe, tube). A simple instrument of reeds, probably the most ancient of musical instruments. It is thought identical with the Hebrew Ugab, mentioned in the Bible. The Greeks supposed it to have been made by the god Pan out of reeds, and hence its secondary name Pandean pipes. It was formed of seven, eight, or nine short hollow reeds cut in graduated lengths, so as to produce a musical scale, and then fixed together by wax. The lower ends were closed and the upper ones open and on a level, so that the lips could easily pass over the pipes.

SYRINX. An organ peculiar to birds, concerned in the production of voice. It is usually composed of several modified rings of the lower trachea or upper bronchial tubes, the inner half of which are covered by a thin medial fold of membranous tissue. Special muscles control the tension of this membrane, and by thus varying the size of the aperture through which the air leaves the lungs, varying tones are made and controlled. See BIRD, and consult the bibliography there given.

SYRLIN, zĕr′lēn, JÖRG, the Elder (c.1425–91). A famous German wood carver and sculptor, active at Ulm from about 1458, one of the most remarkable masters of his time. The three-seated stool of 1468 at the entrance of the choir in the cathedral, and his chief production, the stately double row of choir stalls (1469–74) there, the first of their kind in richness of detail and skillful workmanship, exhibit a plastic beauty and freedom of form unequaled by any contemporary effort. His earliest known work is a singing desk (1458) in the Ulm Museum, and as an isolated production in stone is to be mentioned the fountain in the market square, known as the "Fischkasten" (1482).

His son and pupil, JÖRG the Younger, carried on his father's workshop, but he lacked the unity and repose of the elder Syrlin. He carved the choir stalls (1493) and the celebrants' stool (1496), in the church at Blaubeuren, also a three-seated stool (1505) in the Neithardt Chapel of Ulm Cathedral, and in the latter the sounding board of the pulpit (1510). Consult the monograph by Grill (Strassburg, 1910), and Baum, *Die Ulmer Plastik* (Stuttgart, 1911).

SY′RO-CHALDÆ′ANS, or **SY′RO-O′RIEN′-TALS.** See CHALDÆAN RITE.

SYROKOM′LA, WLADYSLAW. Pseudonym of LUDWIK KONDRATOWICZ (q.v.).

SYRPHUS (sĕr′fŭs) **FLY** (Neo-Lat., from Gk. *σύρφος*, *syrphos*, *σέρφος*, *serphos*, gnat). A fly of the family Syrphidæ, many species of which are of much economic importance. More than 300 species occur in the United States. They are stout-bodied flies and vary greatly in color. Many species closely resemble bees and wasps. Nearly all of them are flower flies and pollen carriers. Many syrphus flies in the larval state feed upon plant lice and other soft-bodied insects. Others live in decaying wood or in manure or soft mud, in the sap of trees or in the stems of plants, or in fungi, or as guests of ants and bumblebees. The rat-tailed maggot (q.v.) is an example of the forms found in soft mud or in manure. Those which live in ants' nests belong to the genus *Microdon* and are among the strangest insect larvæ known. Those which live in the nests of bumblebees belong to the genus *Volucella*, and the adult flies resemble bumblebees.

SYR′TIS MA′JOR and **SYR′TIS MI′NOR.** The ancient names of two gulfs on the north coast of Africa. See SIDRA and GABES.

SYRUP. See SUGAR, MANUFACTURE OF.

SYSTOLE, sĭs′tô-lē. See HEART.

SYS′TYLE. An arrangement of classic columns in which the intercolumniation is equal to only twice the diameter of the column. See COLUMN; INTERCOLUMNIATION.

SYZRAN, sĭz-rän′y′. A river port in the Government of Simbrisk, Russia, on the River Syzran, near the right bank of the Volga (Map: Russia, G 4). It lies in a low district, submerged during the annual rise of the Volga. The town is known as a grain exporting centre. Pop., 1911, 46,234.

SZABADKA, sŏ′bŏt-kŏ. See THERESIOPEL.

SZARVAS, sŏr′vŏsh. A town of Hungary, in the County of Békés, 85 miles southeast of Budapest, on the left bank of the Körös (Map: Hungary, G 3). Pop., 1900, 25,773; 1910, 28,543.

SZÁSZ, säs, KÁROLY (1829–1905). An Hungarian poet and translator, born in Nagy-Enyed, Transylvania. During the revolution of 1848–49 he fought in the Honvéd army, then studied theology, and was engaged in teaching and pastoral work until 1865, when he was appointed councilor in the Ministry of Public Worship. Two years later he was appointed inspector of schools, and in 1876 again ministerial councilor. In 1884 he became reformed bishop at Budapest. He was elected to the Hungarian Academy in 1858. Besides numerous lyrics he wrote the epic poems *Almos* and *Salamon*, several dramas (*Zrinyi*, *Emperor Joseph*, *Herod*, *Friar George*), and the tragedy *The Death of Attila* (1888), but his reputation rests mainly on his masterly translations of the poets, Dante (*Divina Commedia*), Shakespeare, Moore, Tennyson, and Molière. He is also noted for the translations embodied in *A világirodalom nagy eposzai* (The Great Epics of the World's Literature, 2 vols., 1882).

SZATMÁR-NÉMETI, sŏt′mär-nā′mĕ-tê. A town in the County of Szatmár, Hungary, 63 miles northeast of Debreczin, on the right bank of the Szamos (Map: Hungary, H 3). It contains a beautiful cathedral. Szatmár-Németi was founded by the Germans in the eleventh century. Pop., 1900, 26,881; 1910, 34,892, chiefly Magyars.

SZÉCHÉNYI, sā′chĕn-yê, ISTVÁN (STEPHEN), COUNT (1792–1860). An Hungarian statesman, born in Vienna. As a youth he served in the Austrian army in the wars with Napoleon, and afterward traveled. In 1825 he took his seat in the Upper House of the Hungarian Parliament. As a leader of the National party he endowed the Hungarian Academy of Science, a conservatory of music, and a theatre. To his exertions were due the erection of the great suspension bridge between Pest and Buda, the improvement of navigation at the Iron Gate, the regulation of the Theiss, and the introduction of steamboats on the Danube. In 1847–48 he opposed the extreme measures of Kossuth, but later fell in with the popular movement and became a member of the ministry under Batthyányi and Kossuth in 1848. Becoming insane soon after, he was taken to the asylum at Döbling, near Vienna, where, though he partly recovered, he spent his remaining years. In March, 1860, his papers were searched by the police, and in a fit of excitement he shot himself. Consult Lónyay, *Graf Stephan Széchényi und seine hinterlassenen Schriften* (Pest, 1875).

His son Béla became known for wide travels and explorations in the East Indies, Japan, China, Java, Borneo, western Mongolia, and the frontiers of Tibet. In 1893 he published in German an account of his experiences.

SZE-CHUEN, or **SZE-CHUAN**, sĕ'chwän' (Chin., Four Rivers). The largest of the eighteen provinces of China (Map: China, H 6). Area, 218,480 square miles. The western part of Sze-chuen is a wild inhospitable region of high mountain ranges, with limited agricultural resources, and rivers too impetuous for junk navigation, inhabited chiefly by non-Chinese tribes—Man-tse, Si-fan, and Lolos (q.v.). The eastern portion east of the Min River including the plain of Cheng-tu, 2000 square miles in area and 1800 feet above sea level, is a rich fertile country of innumerable small valleys. The province is well watered by the Yang-tse and its numerous tributaries—the Yalung, the Min, the T'o, and the Kia-ling from the north, and the Ta-kwan, the Nan-kwang, the Yung-ning, the Chih-shui, the K'i-kiang, and the Kung-t'an from the south. Nearly all of these are obstructed in parts by rapids, but they nevertheless form most valuable avenues of communication in an otherwise difficult country. The climate is not extreme, although it is continental in character and changes are sudden. The rainy season begins in May and is at its height in July.

Sze-chuen is rich in minerals, especially in coal and iron. Coal is widely distributed, but the seams are thin and the quality does not compare with the coal of Kansu, Shansi, Honan, or even Hunan. Copper, silver, gold, and lead occur in small quantities. Notwithstanding the mountainous character of the country, agriculture has been brought to a high state of perfection; the province produces everything needed for home consumption except cotton and wool. The hillsides in many places have been terraced. Wheat is a winter crop. Rice, the staple article of diet, is extensively grown. Other crops are barley, maize, millet, buckwheat, pulse, potatoes, tobacco of fine quality, tea, sugar, indigo, and sesamum, rape, and other oil-producing plants. Hemp is the only textile plant grown, except that used in the manufacture of grass cloth.

Other important products are silk, white wax, vegetable tallow, tungoil, rhubarb, medicines, musk, and hides. Wool is imported from Shensi, Tibet, Koko Nor, and other regions. Cotton, both raw and manufactured, comes chiefly from Hupeh. Cotton spinning and weaving are important home industries, and the cloth is exported to Tibet and Yunnan, along with tea and silk. Iron manufacture from the ores of the province is an important industry. Enormous quantities of salt are obtained from brine springs from 500 to 2000 or more feet in depth, the brine being evaporated by natural gas or coal. It is a government monopoly, and brings in a large revenue. Many people are also employed in paper making and the production of fans, umbrellas, crape, gauze, silk embroideries, etc.

Sze-chuen can be entered from the east by only two important routes: either overland through Shansi and Shensi, along difficult mountain paths infested by robbers, or up the Yang-tse by steam to Ichang (q.v.), and thence by native, specially constructed junks, hauled slowly and at great risk up rapids and through deep gorges. Within the province itself there are many pack roads. Capital, Cheng-tu (q.v.), where resides the Governor-General, who also has charge of East Tibet (q.v.). The principal port opened to foreign trade is Chungking (q.v.). The population is estimated at about 54,500,000. Consult Baber, *Travels and Researches in Western China* (London, 1882); Hosie, *Three Years in Western China* (New York, 1890); and Bishop, *The Yang-tse Valley and Beyond* (ib., 1901).

SZEGEDIN, sĕg'ĕd-ĕn (Hung. *Szeged*). A royal free city of Hungary, next in size to Budapest, in the County of Csongrád, on the right bank of the Theiss a little below the confluence of the Maros, 118 miles by rail southeast of Budapest (Map: Hungary, F 3). The town has been largely and handsomely rebuilt since the terrible inundation of 1879, when 2000 persons lost their lives. A high dike has been constructed to protect the city from another such disaster. The modern streets are wide and there are several attractive squares. Szegedin has a fine rococo town hall, a Gothic cathedral, a handsome theatre, and other stately edifices. The Franciscan monastery contains an excellent library (89,000 volumes) and a museum of antiquities. There are also a Minorite and a Piarist monastery. The principal manufactures are paper, salt, cloth, the famous Szegedin soap, and the red pepper usually called paprika. As the commercial centre of the great Hungarian Alföld it has a brisk trade in grain, wool, tobacco, lumber, etc., both by rail and river, the Theiss being lined with quays. Boat building is extensively carried on. New Szegedin lies on the opposite bank. Szegedin was fortified by the Turks, who held it from 1526 for 160 years. Pop., 1900, 102,991; 1910, 118,328, mostly Roman Catholic Magyars.

SZÉKELY, sā'kĕ-lĕ. See Dozsa.

SZEKLERS, sĕk'lĕrz. See Transylvania.

SZÉLL, sāl, Koloman de (1843–1915). An Hungarian statesman, born in Rátót, and educated at Budapest and Vienna. Entering local politics in 1867 and Parliament the next year, he so distinguished himself by his financial interpellations that in 1875 he was offered the portfolio of finance by Wenckheim. He retained it until 1878, when he retired because of his disapproval of the Bosnian occupation, but kept his seat in Parliament. He then became president of the Hungarian Bank in Budapest, refusing every inducement to reënter the cabinet until the fall of Bánffy in 1899, when he rose to the head of the government as Minister of the Interior and President of the Council. He retired in June, 1903.

SZE-MA KWANG, sŭ'mä kwäng', or **SSŬ-MA KUANG** (1019–86). A distinguished Chinese statesman and historian, born in Hia, a district of Honan. At 19 he entered the public service, rose rapidly, became president of the Hanlin-Yüan (q.v.) and a Minister of State. He is specially noted for the persistency and the vigor of his opposition to Wang An-shih (q.v.), "the innovator." Failing to induce the Emperor to dismiss Wang and repeal his reform, Sze-ma retired to private life, and devoted himself to literature and especially to the preparation of his *History of China* (403 B.C. to 960 A.D.), in 294 books, called the *Comprehensive Mirror for the Aid of those who Govern.* In 1085, on the death of the Emperor, he was taken into favor by the Empress Regent, was reinstated in office, and at once set about the repeal of the reforms of Wang, but he died in the following year. Besides the *Comprehensive Mirror* he was the author of the *Ki-ku-lu* (Investigations into Antiquity), in 20 books, which extends to 1067 A.D., an etymological dictionary, and many miscellaneous essays. Consult Rémusat, *Nouveaux mélanges asiatiques* (2 vols., Paris, 1829), and H. A. Giles, *History of Chinese Literature* (New York, 1901).

SZEMAO, sŭ'mou'. A town in the southwestern part of the Province of Yunnan, China, situated 185 miles southwest by west of Yunnan-fu. The trade of Szemao is almost entirely with Burma and Tibet. The town was opened to foreign residence and trade in 1897. Pop., 9000.

SZE-MA TS'IEN, sŭ'mä tsyĕn', or **SZŬ-MA CH'IEN** (c.145–c.85 B.C.). The first great historian of China. He was born in Lungmun, in Honan, made good progress in learning while still a child, and at 20 began a great tour of the Empire. On his return he entered the public service, and was commissioned to inspect and report upon the regions now known as Sze-chuen and Yunnan, then recently conquered. On the death of his father in 110 B.C. he succeeded him as historiographer, and entered upon the task of completing the great historical work which had been begun by his father. This he accomplished 91 B.C., but the work did not appear until some years after his death. It is entitled *Shih Ki* (Historical Records), and in 130 books gives the history of the country from 2697 B.C. to 104 B.C. For specimens of his style, consult H. A. Giles, *History of Chinese Literature* (New York, 1901), and Friedrich Hirth, *Ancient History of China* (ib., 1911).

SZENTES, sĕn'tĕsh. A market town of the County of Csongrád, Hungary, on a tributary of the Theiss, 28 miles north by east of Szegedin (Map: Hungary, G 3). The town formerly suffered from inundations, but is now protected by a number of large dikes. Agriculture and fishing are the principal pursuits, and wine is exported. Pop., 1900, 31,308; 1910, 31,593, mostly Lutheran Magyars.

SZEWCZENKO, TARAS (1814–61). See SHEVTCHENKO, TARAS GRIGORYEVITCH.

SZIGLIGETI, sē'glê-gä'tĕ, EDUARD (1814–78). An Hungarian dramatist, whose real name was Joseph Szathmáry. Born at Grosswardein, he studied engineering, but in 1834 went on the stage at Buda and in 1837 became secretary and stage manager of the newly erected National Theatre at Pest. Of his numerous dramas several were crowned with prizes by the Hungarian Academy, among them *Rózsa*, *Vándor szinéssek* (Itinerant Actors), *Pál Béldi*, *Laczfi Imre*, and *Béla IV*, but the greatest success attended his popular plays drawn from national life, many of which found their way also to the German stage, notably *The Deserter*, *Two Pistols*, *The Csikós*, *The Foundling*, and others. Besides his excellent *A dráma és válfajai* (The Drama and its Species, 1874), he published biographies of Hungarian actors (1878). He was elected a member of the Hungarian Academy (1840) and of the Kisfaludy Society (1845), and in 1873 director of the National Theatre. Consult Pál Gyulai, *Memorial Addresses* (Budapest, 1879 and 1890), and P. Rakodczay, *Eduard Szigligeti's Life and Works* (Pressburg, 1901). Both of these works are written in Hungarian.

SZILÁGYI, sē'läd-yê, SÁNDOR (1827–99). An Hungarian historian, born at Klausenburg, and educated there and at Maros-Vásárhely. From 1853 to 1867 he was connected with the reformed college of Nagy-Körös, after which he was appointed secretary in the Ministry of Public Instruction, and in 1879 became librarian of the university at Budapest. He founded the Hungarian Historical Society, of which he was secretary until his death, and of whose organ, *Századok* (The Centuries), he was editor. He was the moving spirit in the revival of historical interest which took place in Hungary after 1849. Among his works are the *Monumenta Comitialia Regni Transylvaniæ* (21 vols., 1875–98), a collection of papers from Hungaro-Turkish sources in nine volumes, and a national history, 10 vols. (1894–98). His best-known monographs are: *Gabr. Báthory* (1867); *Siegmund Rákóczi* (1886); *Georg Rákóczi II* (1891); *Georg Rákóczi I* (1893). Consult Arpád Károlyi, *Memorial Address* (Budapest, 1900).

SZOLNOK, sôl'nôk. A town of Hungary, the capital of the County of Jazygia—Great Cumania—Szolnok, 57 miles southeast of Budapest, on the right bank of the Theiss, at the mouth of the Zagyva (Map: Hungary, G 3). On March 5, 1849, the Austrian General Karger was defeated here by the Hungarians. Pop., 1900, 25,379; 1910, 28,930, mostly Roman Catholic Magyars.

SZUJSKI, shwĭs'kĭ, JÓZEF (1835–83). A Polish historian and Romantic dramatist, born at Tarnov, Galicia. He founded with Tarnowski the *Przeglad Polski* in 1867, was appointed professor of Polish history at the University of Cracow in 1869, and later also secretary general of the Cracow Academy. In 1881 he was called to a seat in the Austrian House of Lords. He published many mediæval documents and chronicles bearing upon Polish history and in his *Dzieje Polski* (1862–66; new ed., 1896) presented a history of Poland in the manner of Guizot. In German he wrote *Die Polen und Ruthenen in Galizien* (1882). Besides poems and tales he produced a number of historical dramas, such as *Halszka z Ostroga* (1858), *Jerzy Lubomirski* (1863), *Maryna Mniszchowna* (1876), *Jadviga*, *Kopernikus*, *Wallace*, and others.

T

T The twentieth letter of the English alphabet. Its Semitic original, *tau*, the last letter of the Phœnician alphabet, meant "cross" and was so called on account of the early shape of the character. See Alphabet, especially Plate containing characters.

As a phonetic character *t* is the voiceless alveolar explosive. To form this sound the tongue tip is brought into contact with the gums of the upper front teeth and the breath is made to escape explosively. Its corresponding voiced explosive is *d*. These two sounds are most frequently called dentals, or teeth sounds, though the teeth have in reality no part in their production. Other terms are lingual, front lingual, tongue tip, etc.

English *t* represents in general an original Indo-Germanic *d*, as Skt. *dam*, to tame, Gk. *δαμάω*, Lat. *domare*, Eng. *tame*. It may also represent an original Indo-Germanic *t*, as in Skt. *stigh*, to step, Gk. *στείχω*, AS. *stigan*, Eng. *stile*. An excrescent *t* occurs especially between *s* and *r*, as a glide sound between the median and lateral positions of the tongue, as in Eng. *stream*, compared with Skt. *sravas*. An inorganic *t* has also been developed in some modern English words after a final *s*, as *amidst* from *amiddes*, *amongst* from *amonges*, and *whilst* from *whiles*. As in French, *t* shows a tendency to become palatalized before palatal vowels, and in a great number of words, like *nation*, *partial*, *factious*, etc., it has an *sh* sound.

The digraph *th* represents both the voiced and the voiceless spirant, as *then*, *thin*. It may be pronounced *t*, as *Thames*, *thyme*, as may also the *-ed* of the preterite and perfect participle, as *dressed*. In many words *t* is silent, as in *chasten*, *moisten*, *christen*, *castle*, *gristle*, *hustle*.

As a mediæval numeral T = 160; T̄ = 160,000. In music *t* = tenor, tempo. Consult: Philippe Berger, *Histoire de l'écriture dans l'antiquité* (Paris, 1892); Maurice Prou, *Manuel de paléographie latine et française* (ib., 1910); Sir E. M. Thompson, *Introduction to Greek and Latin Palæography* (London, 1912); Passy, *Petite phonétique comparée des principales langues européennes* (2d ed., Leipzig, 1912); Van Hoesen, *Roman Cursive Writing* (Princeton, N. J., 1915). See Dentals; Letters; Paleography; Phonetics.

TAA. See Pagoda.

TAAFFE, tä′fe, Eduard, Count (1833–95). An Austrian statesman of Irish extraction, born at Prague. He entered the public service in 1857 and was appointed Governor of Salzburg in 1863. He was Minister of the Interior in 1867 and Minister of National Defense in 1868, becoming President of the Council after Prince Auersperg's retirement in September, 1868. He resigned in January, 1870, but three months later became again Minister of the Interior and remained in office until February, 1871, when he was made Governor of Tirol and Vorarlberg. In February, 1879, Taaffe was again appointed Minister of the Interior, and in August he formed a new cabinet, over which he presided until 1893. The distinguishing feature of his administration was the greater weight given to the Czechs and the Poles as well as to the clericals in public affairs and his vain effort to conciliate the divergent nationalities of the Empire. A radical electoral reform measure, which displeased all parties, compelled him to retire in November, 1893.

TAAL, täl. A town of Luzon, Philippines, in the Province of Batangas. It is on the Transipit River near the Gulf of Balayán and is connected by a bridge with Lemeri on the opposite bank. It is the principal seaport of the province, with a large trade in coffee, sugar, and cotton goods in addition to the local industries of agriculture, fishing, and stock raising. The old town of Taal was situated on the bank of the lake of the same name near the volcano Taal and was destroyed in 1754, while it suffered severely in the eruption of Jan. 30, 1911. Pop., 1903, 17,525, a considerable number of whom are of Chinese origin.

TAAL, or Bombón. A volcano in central Luzon, Philippines (Map: Philippine Islands, C 3). It forms a small island in the middle of Lake Taal, which lies 10 miles southwest of the Bay Lagoon. Its height is only 1050 feet, but it has a crater of 7650 feet in diameter. A number of eruptions have been recorded since the discovery of the islands, the most destructive occurring in 1873 and Jan. 30, 1911.

TABAGO, tȧ-bä′gō. An island of the West Indies. See Tobago.

TABAN′IDÆ (Neo-Lat. nom. pl., from Lat. *tabanus*, gadfly). A numerous family of dipterous insects which live by sucking the blood of horses, cattle, and other animals and are popularly known as gadflies, horse flies, or deer flies. See Gadfly.

TAB′ARD, The. A famous inn of old London. It was on High Street, Southwark, near Kent Road, and must have been in existence as early as the fourteenth century, for Chaucer starts his pilgrims from it on their journey to the shrine of Thomas à Becket. Its sign was a tabard (sleeveless jacket). At the end of the sixteenth century it was in high repute. In the seventeenth century it was damaged by the Great Fire, and in the process of restoration the sign was changed to a Talbot. Its site is now occupied by the freight depot of the Midland Railway.

TABARI, tȧ-bä′rē (Ar. *Abū Ja 'far Muhammad ibn Jarīr al-Tabarī*) (838–923). Author of the first universal history in Arabic. A Persian, born in Tabaristan, he studied at Bagdad and in Syria and Egypt. His great historical work is the *Annals*, a history of the world from the creation to 302 A.H. (914 A.D.). This was edited by De Goeje (15 vols., Leyden, 1879–1901). Nöldeke's *Geschichte der Perser und Araber zur Zeit der Sāssaniden* (Leyden, 1879) is a translation of portions of the *Annals*. Tabari's extensive commentary on the Koran stands superior to all other commentaries (ed. by Kern, 31 vols., Cairo, 1902–03). Consult Brockelmann, *Geschichte der arabischen Litteratur* (2 vols., Weimar, 1898–1902), and Haussleiter, *Register zum Qoran-Kommentar des Tabari* (Strassburg, 1912).

TABASCO, tȧ-BÄS′kō. A maritime state of Mexico (Map: Mexico, M 8). Area 10,372 square miles. Tabasco has no railways nor good roads; its principal rivers, the Usumacinta and the Grijalva, with their tributaries furnish means of transportation. The climate is hot and unhealthful and the rainfall very abundant. Agriculture is the leading industry, and the fertile soil produces sugar, cacao, rice, rubber, coffee, corn, and fruits. Stock raising is of secondary importance. Pop., 1910, 187,574. Capital, San Juan Bautista.

TABASHEER, or TABASHIR, tăb′ȧ-shēr′ (Hind. *tabāshīr*, Skt. *tavaksīra*, *tvaksīra*, bamboo manna). A substance sometimes found in the cavities or tubular parts of the stems of bamboos. Its formation is believed to be due to disease or injury to the plant. The substance, which has been found to be almost pure silica, is white, opaque, or translucent, and breaks into irregular pieces resembling dry starch. It was formerly in high repute among the Hindus as a tonic. Tabasheer is remarkable as having the lowest refracting power of any known substance.

TABB, JOHN BANISTER (1845–1909). An American poet, born in Virginia. He was a Roman Catholic priest and instructor in English literature at St. Charles College, Ellicott City, Md. The verse of Father Tabb, small in amount but often of good quality, comprises: *Poems* (1883); *An Octave to Mary* (1893); *Lyrics* (1897); *Poems Grave and Gay* (1899); *Two Lyrics* (1900); *Quips and Quiddits* (1907); *Later Poems* (1910).

TABERNACLE, tăb′ẽr-nȧ-k'l (Lat. *tabernaculum*, dim. of *taberna*, hut, booth; connected with *tabula*, plank, board). Primarily a tent, booth, or shelter, and hence also (1) a shrine or portable receptacle, (2) a fixed receptacle for a statue, (3) a portable tent or sanctuary, (4) a large building for worship or religious gatherings. In Roman Catholic ecclesiology the term is applied to the shrine or receptacle in which the consecrated elements of the Eucharist are kept; usually a richly adorned shrine above the altar, often of marble or metal, inclosing a wooden receptacle. A red lamp is kept always lighted before it. In architecture the tabernacle is a tall narrow niche for a statue, with a richly adorned projecting canopy above it and a carved corbel at its foot, on which the statue stands. It is a common feature on Gothic exteriors. In sense (4) a tabernacle is a large hall for religious worship or for revival gatherings, of either permanent or temporary construction. In this sense it is used especially by the nonliturgical denominations.

In biblical usage the tabernacle denotes the portable sanctuary which, according to the traditional view, was carried about by the Israelites in the wilderness. The command to build this structure is found in Ex. xxv. 10–xxvii. 19, and the account of its construction (in almost identical terms) in Ex. xxxvi. 8–xxxviii. 31. While it is called a tent, it was in reality a house, having upright walls of thick boards on three sides and a curtain on the fourth. The wooden framework had four coverings—one of linen, one of black goats' hair, one of rams' skins dyed red, and one of the skins of wethers. In front the curtain was fastened to pillars of acacia wood, with copper bases and capitals covered with gold. This structure was divided into two parts, separated by an inner curtain, supported by four pillars with bases of silver and wholly overlaid with gold. The outer and larger apartment was the Holy Place, accessible to priests only; the inner, the Holy of Holies, was entered only once a year by the high priest. Around the sanctuary was a court inclosed by curtains supported by 60 pillars of wood with bases of bronze and capitals overlaid with silver. In the Holy of Holies stood the Ark of the Covenant; in the Holy Place the table of shewbread, the golden candlestick, and the altar of incense; in the court stood the brazen altar of burnt offering and around it were ash pans, shovels, bowls, forks, and firepans of brass, while in the middle was the great brazen laver. The tabernacle is decribed as being of extraordinary splendor and of costliest materials. It stood in the centre of the camp and was carried by a large retinue of men when the camp moved. Many modern scholars regard the description as wholly imaginary and devoid of historical value. It is considered by them as having been drawn on the basis of Solomon's temple and projected into the Mosaic period. This, they maintain, is indicated not only by the impossibility of such a house being constructed and carried about in the wilderness, but also by the fact that the earlier records know nothing of a tabernacle of this kind, while some passages seem to have preserved the picture of a much simpler tent where Yahwe revealed Himself to Moses (Ex. xxxiii. 7 et seq.; Num. xi. 25, xii. 5, xiv. 10). This "tent of meeting" (*'ōhel mōēd*) stood outside the camp and was only a small tent with a single custodian, and Yahwe revealed Himself there in a cloud at the door. It is not impossible that the memory of such a portable shrine, common to many nations, carried about while they were still nomads, survived among some of the tribes that afterward formed the people of Israel. When David brought the ark to Jerusalem, he made a new tent for it (2 Sam. vi. 17) and placed it at Gihon, the modern Ain Sitti Maryam (1 Kings i. 38). Within the tent there were a horn of oil for the anointing of kings (1 Kings i. 39) and an altar with horns (ib. i. 51; ii. 28). David's plan to build a house was frustrated by Nathan on the ground that Yahwe had never dwelt in a house, but always lived in a tent as He walked about (2 Sam. vii. 6). It is possible that the destruction of Shiloh was looked upon in some circles as the punishment for causing Yahwe to dwell in a house. Sellin and Gressmann think that, while the story of the tabernacle has obviously been embellished, there is a nucleus of historic fact in it, and that the tent of the nomadic period may already have contained Urim and Thummim, ephod, teraphim, the magic staff of Moses, the brazen serpent, the blossoming staff of Aaron, the jug with manna, and possibly also an altar. Popper has shown that the account of the construction, repeating almost verbatim the command, is a very late expansion of the text.

Bibliography. J. Popper, *Der biblische Bericht über die Stiftshütte* (Leipzig, 1862); J. W. Colenso, *The Pentateuch and the Book of Joshua Critically Examined* (London, 1862–79); A. Kuenen, *De Godsdienst van Israël* (Haarlem, 1869); J. Wellhausen, *Prolegomena zur Geschichte Israels* (4th ed., Berlin, 1895); Carpenter and Battersby, *The Hexateuch* (London, 1900); I. Benzinger, "Tabernacle," in *Encyclopædia Biblica* (ib., 1903); A. R. S. Kennedy, "Tabernacle," in James Hastings (ed.), *Dictionary of the Bible* (new ed., New York, 1909); E. Sellin, "Das Zeit Jahwes," in *Alttestamentliche Studien Rudolph Kittel dargebracht* (Leipzig, 1913); Hugo Gressmann, *Mose und seine Zeit* (ib., 1913).

TABERNACLES, Feast of (Heb. *Ḥag hasukkōth*). The name given in the Old Testament to a festival which marked the close of the harvest of fruit, oil, and wine in Palestine. As a harvest festival it is also known as the Feast of Ingathering (Ex. xxiii. 16; xxxiv. 22) and can be traced back to the Canaanites. The festival was marked by general jubilation and by a visit to some sanctuary, accompanied by sacrifices for the purpose of testifying gratitude to the giver of fertility. Among the popular customs observed by the Canaanites was the erection of booths in the vineyards, in which the people dwelt during the vintage. Hence the name Festival of Booths (or Tabernacles) in the four passages besides those already mentioned in which the ritual is set forth (Deut. xvi. 13–15, xxxi. 10–13; Lev. xxiii. 34–36, 39–44; Num. xxix. 12–40). This Canaanitish agricultural festival was adopted by the Hebrews and was given an historical aspect by interpreting the custom of dwelling in booths as a reminiscence of the nomadic stage in the life of the people and more particularly of the traditional 40 years' sojourn in the wilderness when the tent formed the only habitation. It is possible that the compromise between a Canaanitish harvest festival and a nomadic festival was facilitated by the fact that *sukkoth* may signify tents of hides or cloth as well as booths made of branches of trees. The pristine importance of the festival may be gathered from the fact that it was called "the festival" par excellence and that originally it was the single occasion in the year on which a pilgrimage to a sanctuary was prescribed. Hence, as Volz has pointed out, it was originally Yahwe's New Year's festival. As finally shaped in the Hebrew ritual, it extended over the seven days from the fifteenth to the twenty-second day of Tishri (the seventh month), and in addition the eighth day was observed as a "solemn assembly," which in Rabbinical Judaism developed into the festival of Rejoicing of the Law. Booths were erected on the roofs of houses or in the courts and streets, made of olive, pine, myrtle, and palm branches. (Cf. Neh. viii. 15.) The sacrifices prescribed for this feast were more numerous than for any other, sin offerings (one kid daily) and burnt offerings (two rams and 14 lambs daily) being prescribed, besides 70 bullocks during the seven days (13 on the first day, 12 on the second, and so on in a diminishing scale). Besides these distinctly biblical enactments we find in the days of the second temple daily processions around the temple altar, the priestly procession to Siloam to fetch water and its libation in connection with the morning sacrifice (cf. John vii. 37), the singing of the Hallel psalms (Ps. cxiii–cxviii), the lighting of the four great golden candelabra in the Court of the Women (John viii. 12), and the carrying of palm branches entwined with myrtle and willow together with a specimen of the ethrog (or citron) fruit by the worshipers into the synagogues. The erection of booths and the waving of the palm branches with the ethrog are customs still observed in orthodox Jewish communities. Consult: I. Benzinger, *Hebräische Archäologie* (2d ed., Tübingen, 1907); P. Volz, *Das neujahrsfest Jahwes* (Leipzig, 1912); E. Sellin, "Das Zeit Jahwes," in *Alttestamentliche Studien Kittel dargebracht* (ib., 1913).

TABES DORSALIS, tā′bēz dôr-sā′lĭs. See Locomotor Ataxia.

TABES MESENTERICA, mĕs′ĕn-tĕr′ĭ-kȧ. See Mesentery and its Diseases.

TAB′LATURE (Fr. *tablature*, from Lat. *tabula*, plank, table, tablet). A method of musical notation used in the fifteenth and sixteenth centuries. At first it was chiefly employed for the lutes and viols. The lines and spaces of the staff did not represent the pitch of the notes, but the frets of the instrument. Either the lines or the spaces were used, but not both. These lines or spaces varied according to the number of the strings of each instrument. The French and English tablatures denoted the tones by letters, the Italian by numerals. But the German or organ tablatures employed a regular staff and musical notation for the melody or highest part, while the tones completing the harmony were written by letters vertically below each note of the melody. All tablatures had three points in common: (1) all letters or figures belonging to the same chord were written vertically one above the other; (2) all employed lines for the division of the separate bars or measures; (3) all made use of a uniform system to denote the time value of notes and rests. These signs were written either above or below the numbers or letters. Rests were denoted by a horizontal line placed below the note sign.

TABLELAND. See Plateau.

TABLE MOUNTAIN, or **TAFELBERG,** tä′fel-bĕrG. A mountain of Cape of Good Hope Province overlooking Cape Town and Table Bay (Map: Cape of Good Hope, D 10). It is 3550 feet high and is named for its level top of a mile in length. It is often covered with a white cloud, which is called the Tablecloth.

TABLES. See Furniture.

TABLES, Fencing the. See Fencing the Tables.

TABLES, Lunar. Tabular lists of numerical data based on the elements (q.v.) of the moon's orbit and used for calculating the moon's position on the sky. See Nautical Almanac.

TABLET OF ABYDOS. See Abydos.

TABLETS, Wax. See Paleography, *Materials.*

TABLEWARE, Silverplated. An imitation of solid silver plate (see Plate) produced by using a body of cheaper metal. The earliest form was Sheffield plate, named from the English city where the process now abandoned was developed. Birmingham also became an important centre of the industry. In 1742 Thomas Bolsover of Sheffield, while repairing a knife, accidentally overheated it, so that the silver melted and spread in a thin coating over the copper. The fact that this coating stuck fast when cooled impressed him, and thus was invented a method of coating small copper objects with silver by the application of heat. Later Joseph Hancock improved the process so that large objects could be produced. Starting with a bar of copper or copper alloy between thin bars of silver, he heated them to fusion and then rolled them and rerolled them into a large flat sheet of silver-plated copper that could easily be shaped into all kinds of tableware, which were still further embellished by soldering on handles, knobs, and other ornaments of cast or stamped silver. Of course, where a cut edge of this plate was exposed, the copper showed, but in 1784 George Cadman overcame this defect by soldering on an ornamental molding of solid silver. The electroplated imitations of Sheffield plate do not have such a molding. Genuine old pieces of Sheffield plate are much prized for the warmth of color and the excellence of the texture, which are far superior to those of electroplated objects. (See Electroplating.) Worn pieces of Sheffield plate are often repaired by electroplating, but when so repaired are valueless from the standpoint of museum or collector. In 1840 John Wright, a surgeon of Birmingham, discovered the electroplating value of a solution of cyanide of silver in cyanide of potassium, and the new and cheaper process soon crowded out the old one. Wright's patent was purchased by the Elkingtons of Birmingham, who the next year erected large factories and inaugurated the development of the immense electroplating industry. Consult H. N. Veitch, *Sheffield Plate* (London, 1908).

TABLEY, Baron de. See Warren, J. B. L.

TABOO′ (adaptation of Tongan, *tabu,* Polynesian *tapu,* forbidden, probably from *ta,* mark, and *pu,* an intensive adverb; Fiji *tambu;* Hawaiian *kapu*). An object or act religiously interdicted, and the religious system based upon such interdiction. Under various names the practice of taboo is found all over the earth, but it has nowhere else been so systematized as in Polynesia. Primarily taboo is something forbidden because the tabooed object is regarded as potent to injure, owing to its mana or mysterious (spiritual) power, which may be either holy, as a priest's possession, or unclean, as a corpse. There is at first no moral significance in taboo, and often the interdict is due merely to fear of evil spirits. Thus, in New Zealand there are a mana taboo and an atua taboo, the latter arising from a belief in spirits. Taboo also reverts frequently to another phase of primitive philosophy, which sees retained in blood, nails, hair, etc., though separated from the body, the spiritual power of the individual. But at times taboo is merely the expression of conservatism which may be religious or social. An instance is the taboo of iron in religious ceremonies. Thus, both the ancient Romans and the modern Pawnee Indians put a taboo on iron, since the gods dislike innovations. Even without the fear of divinities the same religious conservatism prevents the Australians from using stone implements in circumcision, for which they employ the still more antique burnt-wood knife. But there is also a social conservatism resulting in taboo. Foreigners and new things generally are dangerous and are regularly tabooed by many tribes (as in Africa), though the taboo is easily removed except in the case of chiefs. In such cases the foreign person, thing, or act is tabooed because of the dreaded mana. But, on the other hand, there are taboos which are simply in the interest of old practices. Thus, the Hindu laws give the bed hours of kings, and it needs only the right environment of superstition and antiquity to make such laws seem to be the effect of taboo, as in Egypt, though this is not the case in India.

Taboo may be permanent or temporary, private or public. Especially stringent are all royal and priestly taboos, because kings and priests control the weal of the people and must be guarded against danger in food and the like. In some cases a king becomes a mere slave bound by the rules thus laid upon him. In others he makes taboos for his own interest. The people too must guard themselves from the mysterious divine mana of the king, and it is this latter aspect of taboo which king and priest alike find it for their interest to maintain.

What is not taboo is *noa* (common), and in this antithesis lies the germ of the conception of personal property. Thus, taboo became in many cases merely an assertion of proprietary rights, as may be seen from the fact that a lesser chief's taboo was disregarded in New Zealand by a stronger chief, but the latter's taboo was feared and respected by the former. Isolation was the object of taboo, and this was the first stage to ownership. Food taboos are often totemistic or hygienic, and the taboo of knots, which is very common, is a temporary taboo imposed because of the belief in mimetic magic. But it is not necessary that the imitative act be due to a wish to injure. Thus, in Africa, Greece, and elsewhere there is a taboo on knots, locks, crossed arms and legs—in short on all that suggests an impediment. Another common taboo is the *hlonipa* (name taboo) of the Kafirs, with the taboo of woman language found among the same tribes (as also among the Semites and the Caribs), certain names and words being tabooed, e.g., the names of fearful beasts in India, of kings in Africa, and of the dead in Australia and elsewhere, as well as words used only by women. Sex taboo is very common. Thus, the belief that a woman's blood is fatal to a man leads at stated periods to a temporary taboo of women even among civilized Hindus, and in many countries men may not eat with women. Other common examples of taboo are as follows: to be ill or to touch a corpse or grave, a king or a priest, or anything divine (such as royal blood) renders one taboo. A priest's or a king's clothes are so filled with mana that it would kill any one else to wear them, and to enter a chief's house or even in some cases to look at him would be destructive. A priest's house is taboo even to himself, so far as eating in it goes. The taboo of part of one's self is often recognized. Thus, when a person is under taboo he may not touch his own head and has to be fed by another or eat with chopsticks. Such a person may not touch a drinking vessel lest he render it also taboo and dangerous; for whatever comes in contact with a tabooed object becomes itself tabooed. The private or public taboo of places for certain practical reasons is also noteworthy. A river is tabooed by a king until the fishing season is over, a wood till the game is caught, a field till the harvest is gathered. A public taboo is where, as in New Zealand, a whole community is made taboo while getting in their crops. This renders it impossible for any member of the tribe to do anything else till the taboo is removed and prevents any stranger from approaching the tabooed ground. The removal of a public taboo is made by a priest, who repeats a spell and performs certain rites over the tabooed people. If a chief wants anything for himself, he taboos it by calling it part of himself. Women, if of high rank, may taboo an object as effectively as do chiefs of the tribe.

Taboo has been explained either as a priestly trick or as a religious observance, required by the chief for political reasons. But neither explanation will suffice for most cases, while again some taboos are not religious at all. Others explain taboo as due to a categorical imperative and deduce from it all moral laws as well as most of the practices of civilized communities, such as caste, the wearing of ornaments, the carrying of umbrellas, the washing of newborn babes, etc. On the other hand oaths, the punishment of murderers and thieves, and marriage restrictions may be developed out of a taboo system, which recognizes no moral sin, only the danger of breaking taboo. But in that case we have to do not with a categorical imperative, but with a belief in a mysterious spiritual potency and the fear of its effect. An extension of this belief results in its becoming purely formal. Taboo itself, then, may be divided into purely religious and formal taboo; while, if everything forbidden is to be called taboo, there must be added a mass of detailed regulations arising from different sources, some of them having no connection with what is strictly called taboo; and it is evident that for such a combination of effects there can be no one explanation. Consult: Taylor, *Te Ika A Maui, or New Zealand and its Inhabitants* (2d ed., London, 1870); Gennep, *Tabou et totémisme à Madagascar* (Paris, 1904); W. G. Sumner, *Folkways* (Boston, 1907); W. Smith, *Lectures on the Religion of the Semites* (new ed., New York, 1907); J. G. Frazer, *The Golden Bough: A Study in Magic and Religion* (3d ed., London, 1907–13); id., *Taboo and the Perils of the Soul* (ib., 1911).

TA′BOR. The most conspicuous and famous mountain in Galilee (Map: Palestine, C 2). Its summit is 1843 feet above sea level. As a typical mountain of the Holy Land it impressed itself upon the language of poetry. It seems to have been the natural site for a sanctuary, and upon it from early times lay a town of the same name. Here Barak assembled his forces to attack Sisera (Judg. iv); twice the Jews held it, though unsuccessfully, against the Romans (53 B.C.; 67 A.D.). It is the traditional scene of the Transfiguration of Christ, although most unreasonably, and so it became the site of churches and monasteries and was an object of pious pilgrimage. Consult: V. Guérin, *Description géographique, historique, et archéologique de la Palestine*, vol. ii (Paris, 1874); *The Palestine Exploration Fund Memoirs*, vol. i (London, 1881); L. B. Paton, *Descriptive Geography of Palestine* (New York, 1911); I. Benzinger, in Baedeker, *Palestine and Syria* (5th ed., Leipzig, 1912).

TABOR (OF. *tabour*, Fr. *tambour*, Sp. *tambor*, from Ar. *tambūr*, sort of lute with a long neck and six brass strings, drum). A small drum, played with one stick, generally in combination with a galoubet or three-holed fife.

TABOR COLLEGE. An institution for higher education founded at Tabor, Iowa, as an academy in 1857 and incorporated as a college in 1866. The founders were Congregationalists, whose desire was to establish a Christian college for young men and women who might be trained for lives of service. There are three departments—the college, the academy, and the conservatory of music. The college subjects are arranged in courses leading to the degree of A.B. The academy prepares for college instruction, and the conservatory offers musical training. The dean and acting president in 1915 was Nelson W. Wehrhan, Ph.B., B.D.

TA′BORITES. The more radical party of the Hussites in Bohemia. They derived their name from their fortress of Tabor, near the river Lužnič. They asserted the right of individual judgment, rejected ordinances of the Church not expressly appointed in the Bible, accepted only the sacraments of baptism and the Lord's Supper, and had democratic tendencies. Their leaders were John Ziska (q.v.), Nicholas of Pistna (Husinec), Procopius the Great, and Procopius the Lesser. (See PROCOPIUS, ANDREW.) At first, in the face of common danger, all parties of the Hussites held together and inflicted repeated defeats upon the Imperial troops. After the Calixtines (q.v.) had made terms with Sigismund and the Church (1433) the Taborites continued the war, but were overthrown at Böhmischbrod, May 30, 1434. The remnant of them was absorbed in the Bohemian Brethren (q.v.). See HUSSITES.

TABRIZ, tȧ-brēz′, TAVRIS, or TEBRIS. The second largest town of Persia, capital of the Province of Azerbaijan, situated in a wide valley, on the Aji, a tributary of Lake Urumiah, 35 miles east of the lake, over 4000 feet above the sea (Map: Persia, B 3). Owing to the many earthquakes, large sections of the town are in ruins. The place is healthful, although the weather is cold a third of the year. In spite of the altitude the bare rocks rising on the northeast and east and the peak of Sahand standing on the south give Tabriz the appearance of being shut in by mountains. The squalor of the native huts and the poor sanitary precautions are counteracted by the abundance of water and the numerous refreshing orchards and gardens. Few buildings or ruins are of special note. There are about 100 public baths, numerous caravansaries, five Christian (Armenian) churches, and over 300 mosques. Among these the Blue Mosque (Masjid i Kebud), incrusted within and without with blue faïence tiles, is especially worthy of mention. Before the Caucasus Railroad and the Caspian Sea became important mediums of transportation, and the Russian trade was diverted to

Astara and Resht, Tabriz was the emporium of Western trade. More than half the trade is with Russia. The imports are largely cotton and woolen tissues, sugar, and tea. The exports are chiefly carpets, dried fruit, hides, live animals, and raw cotton. The Russian carriage road from Julfa, on the frontier, to Tabriz (80 miles) was completed about the beginning of 1907. There are lead mines in the vicinity of Tabriz, and copper and cobalt are found in the Sahand. Pop., about 200,000.

Tabriz is said to have been founded by the wife of Harun al Rashid in 791, but is mentioned before that date. In 858, 1041 or 1042, 1721, and 1780 it was devastated by earthquakes. In that of 1721, 80,000 persons are said to have lost their lives. It was held in turn by the Arabs, Seljuks, Mongols, and Turkomans, from whom it was taken by the Persians. It was several times in the possession of the Turks and was finally taken from them by Nadir Shah in 1730. Tabriz was captured by the Turks and then by the Russians in the European War which began in 1914. (See War in Europe.) Tabriz is essentially a Turkish city, and Turkish is the prevalent language.

TABU. See Taboo.

TAB'ULA BANTI'NA. The chief source of knowledge of the Oscan tongue—a bronze tablet in the Naples Museum, containing on one side an Oscan inscription (38 lines) referring to affairs of Bantia and on the other a portion of a law in Latin (32 lines). It was found near Bantia in 1793. See Italic Languages, *Oscan.*

TAB'ULA CEBE'TIS. See Cebes.

TABULÆ EU'GUBI'NÆ. See Eugubine Tables; Italic Languages.

TAB'ULÆ HERAC'LEEN'SIS. See Heraclea, 1.

TABULA ILI'ACA (Lat., Ilian Tablet). A small relief in soft marble found near the ancient Bovillæ in 1683 and now in the Capitoline Museum at Rome. The slab, 10 by 11½ inches, is covered with scenes in low relief from the Trojan War, taken from the *Iliad* and the poems of the Trojan cycle (see Cyclic Poets), with explanatory Greek inscriptions. Some think it was intended for school instruction, others that it was an ornamental panel of a bookcase. Consult: Jahn, *Griechische Bilderchroniken* (Bonn, 1873); A. Baumeister, *Denkmäler des klassichen Altertums* (Munich, 1889); Th. Schreiber, *Atlas of Classical Antiquities*, plates xcii *a*, xciii (Eng. ed., by W. C. F. Anderson, New York, 1895).

TAB'ULA'RIUM (Lat., from *tabula*, board, tablet, record). A large building on the slope of the Capitoline Hill facing the Roman Forum, built by Quintus Lutatius Catulus in 78 B.C. for the preservation of state records. It rested on massive substructures and consisted of a series of vaults with an upper corridor, lighted through a series of arches flanked by Doric half columns, some of which are still to be seen. Its extent corresponded with that of the present Palazzo del Senatore, which is built on the ancient walls. The structure is in good preservation. Consult Christian Hülsen, *The Roman Forum* (Eng. trans., by J. B. Carter, 2d ed., Rome, 1909), and S. B. Platner, *The Topography and Monuments of Ancient Rome* (2d ed., Boston, 1911).

TAB'ULAR STANDARD. A proposed standard of value which should obviate difficulties due to changes in the purchasing power of money. The proposal involves the preparation, by public authority, of a table of relative values of certain selected commodities after the fashion of an index number and the permissive use of this table as a legal standard in contracts involving deferred payments. A tabular standard has been briefly defined as an official index number. Its compilation would require a commission or other body with power and facilities to collect price statistics. Having decided what commodities should be employed as basis for the standard, the commission would then calculate a yearly or monthly index number according to some accepted method. (See Index Numbers.) The statistics would of course be public, and any one who chose could verify the calculation. The rise and fall of prices would either be expressed in percentages, or an arbitrary unit would be adopted whose changing values, expressed in money, would indicate the same thing.

The practical operation of the tabular standard is simple. When a person makes a loan of, say, $100 for one year, the contract entitles him to receive the same number of dollars (usually with interest) at the end of the specified time, but it does not insure that the $100 which he lent and the $100 he receives will have the same purchasing power. If prices have risen in the interval, his $100 will buy less; if prices have fallen, it will buy more. In so far as changed purchasing power is not compensated by a change in rates of interest, debtors are likely to be burdened by an appreciation, creditors by a depreciation, of the value of money. Suppose, however, the tabular standard to be employed, and that A sells a piece of property to B for $12,000, of which one-fourth is to be paid at once and one-fourth more at the end of each succeeding year. The $3000 cash is, of course, paid as such. But after a year the tabular standard might show the purchasing power of money to have fallen 10 per cent. Expressed in tabular units, if at the time of sale a unit was worth $10, it would now be worth $11.11, giving the proportion 10.00 : 11.11 : : $3000; $3333.33, which last figure is what B will have to pay. If at the end of the second year a unit of the tabular standard was worth $9, B would be called on for only $2700. Whether he pays more or less in money, the sum will always have a uniform value in terms of the commodities on which the standard is based.

That many advantages would be gained from the use of a tabular standard has generally been admitted. Two serious practical difficulties stand in the way of its introduction. First, the conservative attitude of business men towards any change of this sort; second, the difficulty of agreeing upon the precise mode of calculating the standard, and especially upon the precise commodities which should be selected as basis.

The first conception of a general index number or tabular standard, however, appears to date from 1798, when Sir George S. Evelyn read before the Royal Society a paper on "Endeavors to Ascertain a Standard of Weights and Measures." (*Philosophical Transactions*, vol. lxxxviii, pp. 175 et seq.) Evelyn's selection of articles is open to criticism, as was pointed out by Arthur Young in 1811. Joseph Lowe (*The Present State of England*, London, 1822), referring to both Young and Evelyn, proposes the actual introduction of a tabular standard and discusses the modes of calculating it. (New York ed., 1824, p. 287, and Appendix.) His is the first practical treatment of the subject in English. In Germany the principle of the tabular standard had been suggested about 1805, in application to rent payments. (Horton, *Silver and Gold*, 1877, pp. 39, 157.) G. P. Scrope, in a pamphlet of 1833 and in *Principles of Political Economy* (London, 1833, pp. 405, 424), again proposed the standard. G. R. Porter also treated the subject and gave a table in his well-known *Progress of the Nation* (London, 1838, 1847). The matter was finally brought to prominence by W. S. Jevons, in an essay of 1865, and more forcibly in his *Money and the Mechanism of Exchange* (1875, chap. xxv).

Consult the *Reports of the Committee of the British Association on Measuring Variations in the Value of the Monetary Standard* (*British Association Reports*, 1887, 1888, 1889, 1890; the most important material in English); *Report of the Monetary Commission of the Indianapolis Convention, 1898;* also Walker, *Money* (New York, 1878); Price, *Money and its Relation to Prices* (London, 1896).

TAB′ULA′TA (Lat. nom. pl., tabulate, floored, table-shaped). A suborder of fossil corals characterized by the development of distinct horizontal septa or tabulæ across the visceral chambers of the corallites. It includes such genera as *Favosites*, *Pleurodictyum*, *Michelinia*, *Aulopora*, *Syringopora*, and others which are important members of the Paleozoic faunas. See Cœlenterata; Coral; and articles on the genera.

TABULATING MACHINES. See Calculating Machines.

TACAHOUT, tä′kȧ-hōōt′ (native name). The small gall formed on the tamarisk tree, *Tamariscus indica*. Tacahout contains a large proportion of gallic acid.

TAC′AMAHAC′ (South American name), or Tacamahaca. A name applied to several varieties of oleoresins. One sort of tacamahac is yielded by the balsam poplar (*Populus balsamifera*) growing in the United States. Another variety is obtained from certain tropical American trees (*Elaphrium tomentosum* and *Elaphrium tacamahaca*). East Indian tacamahac is obtained from the *Calophyllum calaba*, *Calophyllum inophyllum*, and *Calophyllum tacamahaca*. These and certain other varieties are used in making varnishes and to some extent also in medicine. See Calophyllum.

TACANA, tȧ-kä′nȧ. A group of tribes, constituting a distinct linguistic stock, inhabiting the banks of the Upper Beni and Mamore rivers, northeastern Bolivia. They are remarkable for their light complexion, fine features, and independent expression. See Arauna. Consult D. G. Brinton, *Studies in South American Native Languages* (Philadelphia, 1892), and A. Groeteken, in *Anthropos*, vol. xi (Salzburg, 1907).

TAC′CA (Neo-Lat., from the Malay name). A genus of large perennial tuberous-rooted plants of the family Taccaceæ. The few species are found in maritime places and woods in the South Sea Islands, tropical Asia and Africa. Some of them (*Tacca pinnatifida*, etc.) are much cultivated for their starchy tubers, which are used as food, their acridity being removed by maceration with water. They yield tahiti arrowroot, used as a substitute for West Indian arrowroot. The leafstalks of various species are boiled in China and Cochin-China and used as food. Hats, brooms, and other articles are made from the leaves.

TACHÉ, tȧ′shȧ′, Alexandre Antonin (1823–94). A Canadian Catholic archbishop, born at Rivière du Loup, Lower Canada (Quebec), and educated at Quebec and Montreal. He joined the Order of Oblate Fathers, traveled great distances in the region of the Great Lakes and the northwest, became known for his mission work among the Indians, and founded several schools, colleges, and convents. In 1853 he became Bishop, and in 1871 Archbishop, of St. Boniface, Man., and he founded the Catholic theological college in that town. He wrote *Vingt années de missions dans le nord-ouest* (1866), and *Esquisse sur le nord-ouest de l'Amérique* (1869), which has been translated into English and is one of the most valuable works of reference on that region. Consult J. C. Dent, *Canadian Portrait Gallery* (Toronto, 1880).

TACHÉ, Sir Etienne Pascal (1795–1865). A Canadian statesman. He was born at St. Thomas, Quebec, and served in the militia during the War of 1812. He afterward studied medicine and practiced his profession until 1841, when he was elected to the Canada Legislative Assembly. He was successively Commissioner of Public Works, Deputy Adjutant General of Militia, and member of the Legislative Council in 1848; Receiver-General in the Lafontaine-Baldwin ministry (1849–51) and in the Hincks-Morin and MacNab-Morin ministries (1852–56); and was appointed Speaker of the Legislative Council, retaining the receiver-generalship. He became Premier in the Taché-Macdonald ministry in 1856, but the real head of the government was John A. Macdonald, the Conservative leader in the Lower House. Taché retired from the premiership in 1857, but later formed in 1864 the second Taché-Macdonald ministry, combining the offices of Premier and Receiver-General. At this time political life was at a deadlock and old party lines had been practically obliterated. For the course of events preceding the historic gathering in 1864 at the city of Quebec, where Confederation was discussed and resolved upon, see Canada, *History*. Of this conference Taché was elected chairman. In 1858 he was knighted. Consult J. C. Dent, *Canadian Portrait Gallery* (Toronto, 1880), and ib., *The Last Forty Years* (ib., 1881).

TACHI. See Yokuts.

TACHINA FLY, tȧ-kī′nȧ (Neo-Lat., from Gk. ταχύς, *tachys*, swift). A parasitic fly of the family Tachinidæ. These insects resemble in general the common house fly and as a rule are gray, sometimes striped. They are usually parasitic upon caterpillars, upon the backs of which the females lay their eggs. The maggots penetrate the body of the victim and feed upon its soft internal organs. Frequently, however, caterpillars cast their skins before the eggs hatch. Tachina flies are considered beneficial to man.

TACHYCARDIA, tăk′ĭ-kär′dĭ-ȧ. See Pulse.

TACHYGENESIS, tăk′ĭ-jĕn′ė-sĭs (Neo-Lat., from Gk. ταχύς, *tachys*, swift + γένεσις, *genesis*, origin, generation). A term proposed by Hyatt for rapid evolution, or evolution by leaps, i.e., without the vast series of intermediate forms postulated by Darwin. Hyatt defines tachygenesis as "the law of acceleration in the inheritance of characters." It has been found that characteristics are inherited in a series of species in a given stock at earlier and earlier stages in the ontogeny of each member of the series. These characteristics, as a rule, altogether disappear from the ontogeny, through lapse of heredity in the last members of a series, and thus the terminal forms become very distinct in development. Rapid evolution was also marked at the beginning of the evolution of any stock. In the dawn of geological history, as soon as divergent evolution set in, each type had a more or less free field, and its first steps in evolution were obviously not affected by natural selection. Afterward evolution became much slower. On the other hand, when the type began to decline there was a sensible quickening of evolution. Dall suggested the term "saltatorial evolution"; Galton, De Vries, and others, and especially the paleontologists, have all supposed that evolution has often been by leaps or spurts. Consult W. H. Dall, "On a Hypothesis of Saltatory Evolution," in *American Naturalist*, vol. xi (Boston, 1877), and A. V. Hyatt, "Cycle in the Life of the Individual (ontogeny) and in the Evolution of its Own Group (phylogeny)," in *Proceedings of the American Academy of Arts and Sciences*, vol. xxxii (ib., 1897).

TACITUS, tăs'ĭ-tŭs, MARCUS CLAUDIUS (c.200–276). Roman Emperor (275–276). He was born at Interamna (modern Terni), in Umbria, and was elected Emperor by the senate after the death of Aurelian and an interregnum of seven months (275). He began his brief reign of 200 days at the advanced age of 75 years. He instituted needful reforms and favored the restoration of the power of the senate. His victory over the Alani and the Goths, for which he took the title *Gothicus Maximus*, is recorded on his coins. He was murdered by the soldiers in Asia.

TACITUS, PUBLIUS CORNELIUS (c.55–c.117). A Roman historical writer. His training and career indicate that he belonged to a Roman family of good standing. He was prætor in the reign of Domitian and consul suffectus under Nerva. In 78 he married the daughter of Gnæus Julius Agricola (q.v.), a man prominent as a soldier and statesman. This event had great influence on his subsequent career. After his prætorship he was absent from Rome for at least four years until after 93, the year after the death of his father-in-law. The intimacy of Tacitus and Pliny the Younger is proved by references in the letters of the latter, and the two were associated in the successful prosecution of Marius Priscus, proconsul of Africa, charged with extortion. Tacitus' *Annals* were published in 116 or 117, so that we may believe that he lived to the reign of Hadrian. Apparently he looked forward to writing a history of the reign of Domitian and of that of Trajan, but he must have changed his plan, for he began his *Histories* with Galba and continued the work through the reign of Domitian. In the *Annals* he declares his purpose of writing the history of Augustus and in the *Histories* his design of narrating the reigns of Nerva and Trajan, but we have no indication that he ever carried out these contemplated tasks. He wrote, however, the history of the empire from the death of Augustus down to the beginning of his earlier work, i.e., through the reign of Nero.

The earliest extant work of Tacitus is the *Dialogus de Oratoribus*, published about 75, or somewhat later, but not later than the reign of Titus. The *Agricola* followed in the year 98. Even when engaged upon these books the historian was preparing for some greater work. It is possible that his *Germania*, or more fully *De Origine, Situ, Moribus, ac Populis Germaniæ*, represents some of the material accumulated in preparation for a more extensive history. The *Histories* belong to the reign of Trajan. The *Annals* are the last work of the historian. As we have references to the *Annals* in the *Histories*, the date must be later than 108, and, as there is apparently a reference in the second book to Trajan's conquest in the East (115–116), the publication may have been just prior to the reign of Hadrian. The *Dialogue on Oratory* belongs to the writer's early manhood, and gives evidence of the influence of Cicero and Quintilian, in so marked a degree that some scholars have attempted to assign it to Quintilian or to some other author not identified. The best opinion of the present day, however, is in favor of the genuineness of the work. Different as the work is on the surface from the *Annals*, it is yet possible to see in it the beginnings of the style so characteristic of Tacitus' latest work. The subject is an investigation into the causes of the decline of eloquence, and the discussion is carried on by two celebrated orators of the Flavian period who are respectively supporters of the old and of the new oratory. The *Agricola* is a gem, a most carefully prepared piece of biographical composition. The rhetorical power of the writer is plainly felt in the closing chapters, which are unexcelled in Latin literature. His *Germania* is a most important work because of its descriptions of political institutions and of the customs of various tribes. As the writer brings into vivid contrast the life of the Germans and that of the Romans, it has been thought by some that he was endeavoring to instruct his countrymen, either by pointing out their evil ways, or by startling them and warning them against the dangers threatening on their northern frontier. Tacitus shows an exact knowledge of those Germans near the Rhine, but is uncertain as to the interior and more remote tribes. The greatest work of Tacitus has not come down to us entire, for of the *Histories* there are extant only the first four books and a part of the fifth, so that we have merely the year 69 and a part of 70. Of the *Annals* there is extant only about one-half, and this does not give a continuous narrative. After the fifth chapter of the fifth book there is a lacuna which marks the loss of the events of 29–31. Tacitus probably ended this book with the death of Sejanus, so that the beginning of the sixth book is also lacking. The seventh to the tenth, the beginning of the eleventh, and the close of the sixteenth are also missing, and we thus lose all of the reign of Caligula, the first five years of Claudius, and the last two years of Nero.

In the *Annals* Rome and the Princeps form the centre about which are grouped the events of a history which is not that alone of Rome, but of the associated provinces. The Medicean manuscript designates the work *Ab Excessu Divi Augusti*, and this is no doubt the original title. In the *Histories* Tacitus writes as a contemporary, and therefore with a surer touch, and he gives full play to his dramatic powers in his description of what is quite familiar to him. The *Annals* represent the culminating task of his lifetime and are the work of the period of his full development as a writer.

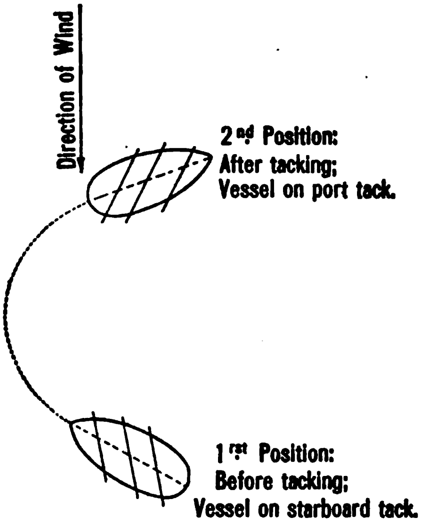
The great power of Tacitus as an historian is due to his skill in discerning the motives which lead men to act, his deep psychological insight. He studies men, not things, and hence he is skilled in character painting. A marked feature of the Tacitean spirit is the tendency to impute a base or unworthy motive to all the actions of those men whom he describes. This is particularly true of his treatment of Tiberius. Certain it is that Tacitus writes of Roman society as a pessimist, and we may obtain a juster view by turning to the more attractive picture presented by his friend and contemporary Pliny the Younger.

There are three distinguishing features of Tacitus' style—conciseness, variety, and poetical coloring. There is not a superfluous word, and his condensation sometimes causes obscurity. We may say that his conciseness corresponds to his thought, for there is nothing artificial in it, and the style is characteristic of the writer. Here he was influenced by study of Sallust (q.v.) and Thucydides (q.v.). Tacitus' fondness for variety is found in his word positions, and in his variation in forms and constructions. The poetical coloring came from his study of the Augustan poets, particularly Vergil. Many words and expressions may be traced to Vergil, particularly in the minor writings and the *Histories*.

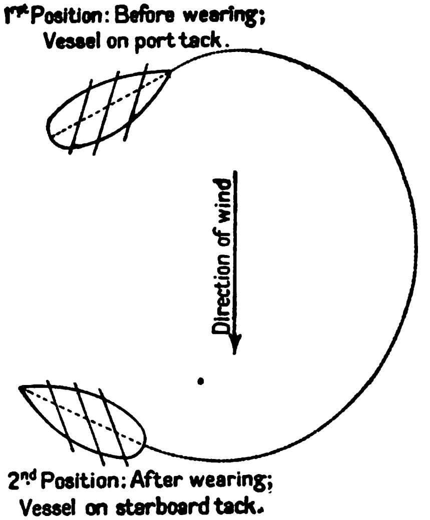
Important manuscripts of Tacitus are the Codex Mediceus (I), dating from the ninth century and containing a part of the *Annals;* and the Codex Mediceus (II) of the eleventh or twelfth centuries, containing what remains of the other books of the *Annals* and the *Histories*. The *Germania* and *Dialogus* are obtained from a manuscript in the Vatican based on an earlier one of the ninth century and again from a manuscript at Leyden, dating from the fifteenth century. The *Agricola* is found in two transcriptions of the fifteenth century, now in the Vatican. The *editio princeps* is by Puteolanus of Milan, about 1476. The best text is that of C. Halm in the "Teubner Series" (Leipzig, 1886). Important editions are the *Annals*, with English notes by H. Furneaux (Oxford, 1891–92; vol. i, 2d ed., 1896); Allen, *The Annals of Tacitus*, i–vi (Boston, 1890); Codley, *The Histories* (New York, 1891); Spooner (London, 1891); Frost, *Agricola* and *Germania* (ib., 1861); Hopkins, *Agricola* and *Germania* (Boston, 1893); Furneaux, *The Agricola* (Oxford, 1896); Gudeman, *Agricola* and *Germania* (Boston, 1900); id., *Dialogus* (ib., 1894; 2d ed., in Ger., Leipzig, 1915); Peterson, *Dialogus* (Oxford, 1893); Furneau, *The Germania* (Oxford, 1894). Consult also: A. Draeger, *Ueber Syntax und Stil des Tacitus* (3d ed., Leipzig, 1882); Gaston Boissier, *Tacitus and Other Roman Studies* (New York, 1906). The lexicons for Tacitus are Boetticher's (1832) and the great work of Gerber and Greef (completed 1903). An excellent English translation is that by Church and Brodribb (London, 1876–77); a translation of the *Dialogus*, *Agricola*, and *Germania* by W. Peterson and M. Hutton forms one of the volumes of the Loeb Classical Library (New York, 1914). Consult the introductions to the editions of the *Dialogus* by Peterson and Gudeman; Martin Schanz, *Geschichte der römischen Litteratur*, vol. ii, part ii (3d ed., Munich, 1913); W. S. Teuffel, *Geschichte der römischen Literatur*, vol. iii (6th ed., Leipzig, 1913); M. S. Dimsdale, *A History of Latin Literature* (New York, 1915).

TACK. See NAIL.

TACKING (from *tack*, from OF. *taque, tache*, dialectic Fr. *tache*, nail, tack; so called because of the part of the sail to which the rope is attached) AND **WEARING** (from wear, AS. *werian*, Goth. *wasjan*, OHG. *werjan*, to clothe; connected with Lat. *vestis*, Gk. *ἐσθής*, *esthēs*, clothing, Skt. *vas*, to put on clothing). A vessel is said to be on the starboard tack when she is sailing with the wind on her starboard side, and on the port tack when the wind is on her port side. She is close-hauled on either tack when she is sailing as near to the wind as the set of her sails permits. The operation of changing from one tack to the other is called tacking if the vessel comes up head to wind and then falls off on the other tack, and wearing or gybing if she falls off—bringing the wind astern—and then comes up to the wind on the new tack.



TACKING.


1st Position: Before wearing;
Vessel on port tack.
Direction of wind
2nd Position: After wearing;
Vessel on starboard tack.

WEARING.

It is evident from the sketches that in tacking there is a gain to windward, if the vessel is a weatherly one and well managed; while in wearing there is a loss, because part of the time the ship is running away from the wind. Therefore tacking is always preferred when practicable. While all properly built vessels will tack under ordinary conditions of sea and wind, there are times when the sea is very rough and the wind so strong that little sail can be carried; or the wind may be too light to give sufficient headway for tacking; or the vessel may be improperly sparred or ballasted. In these cases wearing is necessarily resorted to. In vessels carrying fore-and-aft sails only, the operation of tacking requires little labor, but in square-rigged ships the yards must be swung and the sails adjusted on the new tack. Wearing is called gybing when the vessel is fore-and-aft rigged and carries a boom mainsail which is not taken in or lowered during the operation. It is evident that when the wind, in wearing, passes from one side to the other of such a sail it will give a thrust of considerable violence, and this thrust must be carefully watched in small vessels—and in large ones if the wind is strong—or it may cause them to capsize.

Tacking is frequently called going about. While the operation is in progress a vessel is in stays; if she fails to tack and falls back on the same tack as before, she is said to miss stays. A lively, fast-moving vessel, particularly if deeply loaded, will, before losing way, shoot some distance directly up into the wind after it is out of her sails. Advantage is frequently taken of this fact to avoid some slight obstruction, when tacking is undesirable or otherwise unnecessary, and the operation is called making a half board. To make a good board is to lose nothing to leeward; to make short boards is to tack frequently; to make sternboard is to go astern.

TACKING OF MORTGAGES. The act, permitted by a doctrine in English equity practice, of one who takes a mortgage or lien on real property subsequent to a second or later mortgage and purchases the first mortgage and merges or tacks his security in it. The effect of this is to compel the intermediate incumbrancers to redeem the first mortgage, including the one thus merged with it, before they can enforce their liens. The application of the doctrine in the United States is restricted to cases where the subsequent mortgagee buys in the first mortgage without actual or constructive knowledge of the existence of the intervening lien. Consult authorities referred to under REAL PROPERTY.

TACKLE (MDutch, Dutch, LG. *takel;* possibly connected with Icel. *taka*, AS. *tacan*, to take, Lat. *tangere*, to touch). A combination of blocks and ropes designed to increase the capacity of the available power to move heavy weights or decrease the time required to move an object with a power capable of moving only at a certain speed. The block consists of a shell or frame containing one or more sheaves or pulleys and a strap to attach the block to the weight or support. It is evident that in all cases one block of a tackle, or one end of the rope—if there is a single movable block—must be fixed. This being the case, in simple purchases and neglecting friction we have $P = \frac{W}{N}$, in which P is the power, W the weight, and N the number of parts of rope at the movable block. The amount of power lost by friction depends upon many things, such as the character of the rope, its size with reference to the diameter of the pulley and the weight to be raised, the condition of the atmosphere, the bearings of the pulleys, etc. But in ordinary tackles, with the usual type of pulleys, rope, etc., the loss by friction is estimated at about one-sixth the gain effected by each pulley or sheave. The different classes of tackles, or purchases as they are frequently called, are shown in the accompanying figures. See BLOCK; PULLEY.

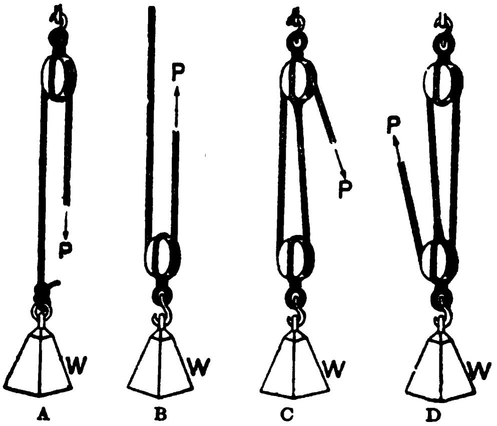


FIG. 1.
A, single whip; *B*, runner; *C* and *D*, gun tackles.

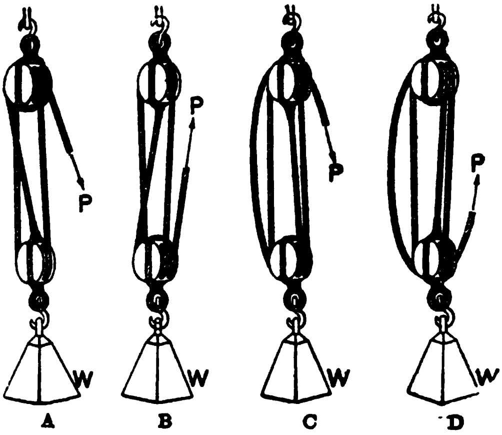


FIG. 2.
A and *B*, luff or watch tackle; *C* and *D*, twofold purchases.

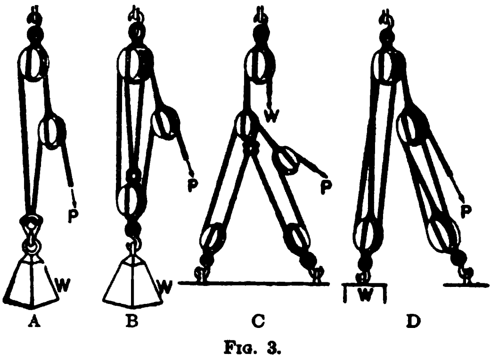


FIG. 3.
A, single Spanish burton; *B*, double Spanish burton: *C*, Bell's purchase; *D*, luff upon luff.

TACLOBAN, tăk-lō′băn. Capital of the Province of Leyte (q.v.), Philippine Islands (Map: Philippine Islands, E 5). The town, which is on the east coast, is well built and has an important trade. The port is well protected and has four different wharves. Pop., 1903, 11,948.

TACNA, tăk′nȧ. The northernmost province of Chile (Map: Bolivia, C 7). Area, 9248 square miles. Its level and arid interior is inclosed by the slopes of the Andes on the east and the coast range on the west. The rainfall is scanty and, excepting river valleys, the interior is an arid desert. The climate is unhealthful and earthquakes not infrequent. There are deposits of nitrate, silver, and copper, which are mined to a limited extent. Pop., 1912, 44,291; concentrated chiefly in the capital, Tacna (q.v.), and the port Arica (q.v.). The province formerly belonged to Peru and was ceded to Chile for ten years in 1884. At the expiration of that period, according to the provisions of the treaty, the ownership of the province was to have been determined by a plebiscite of the inhabitants. At the end of the 10 years disagreement as to the manner of taking the plebiscite prevented a settlement of the question, and all efforts towards adjustment have ended in failure.

TACNA. The capital of the Province of Tacna, Chile, in the northwestern part of the province, about 40 miles by rail from Arica (Map: Bolivia, C 7). It was formerly a place of considerable commercial importance with notable municipal and industrial establishments, but the construction of railway lines in the Province of Antofagasta diverted the trade southward. Pop., 1907, about 15,000. During the Chilean-Peruvian War a battle took place near Tacna on May 26, 1880, in which the Chileans defeated the allied Peruvian and Bolivian forces.

TACO′MA. The county seat of Pierce Co., Wash., at the head of Commencement Bay, Puget Sound, 28 miles south of Seattle (Map: Washington, C 3). It is the terminus and western headquarters of the Northern Pacific Railway. The Great Northern Railway, the Chicago, Milwaukee, and St. Paul Railway, and the Oregon and Washington Railroad and Navigation Company (Union Pacific) also enter the city. Numerous steamship lines, including several transpacific lines, make it a port. Tacoma has an attractive situation, rising about 300 feet above the sea level. It is particularly a city of homes. The Olympic Mountains on the west, the Cascade Mountains on the east, and Mount Rainier, also known by the Indian name, Tacoma (14,408 feet), 60 miles to the southeast, afford beautiful mountain views. The principal buildings include the United States Post Office, customs and judicial building, the city hall, county courthouse, the National Realty, Fidelity, and Tacoma office buildings, and the Tacoma Hotel. Other public buildings are the State Historical Society and Ferry Museum of Art. Among the educational institutions are the College of Puget Sound (co-ed. Methodist Episcopal), the Annie Wright Seminary, an endowed school for girls (Protestant Episcopal), and the Pacific Lutheran University. The public schools include 2 high schools and 35 grade schools, with an enrollment of 15,338. Adjoining one high school is a steel and concrete stadium seating 30,000. The hospitals include the Tacoma General, St. Joseph's, Northern Pacific and County hospitals. There are 1090 acres in public parks, 191 miles of paved and 291 miles of graded streets. The average rainfall is 36 inches. Excellent transportation facilities both by land and sea and a vast and highly productive tributary country have made Tacoma a leading business centre of the Pacific coast. The factories number 408, employing 11,557 at an average monthly pay roll of $787,000. Coal in abundance is mined but a few miles away, and there are rich agricultural and timber lands near by. Tacoma has a large wholesale trade, as well as large manufacturing industries and extensive coastwise and foreign commerce. The principal articles of commerce are lumber, wheat, flour, coal, coke, fish, and fruit. In 1913 the census of manufacture showed $25,000,000 of capital invested in industries and products valued at $59,000,000. The chief industries include lumber, furniture, flour, foundry and machine-shop products. There is also a large smelter, and the Northern Pacific car shops are located here.

Tacoma has the commission form of city government, with a mayor and four commissioners. The city revenues for 1914 include general receipts, $1,155,122; city dock, $33,968; water department, $451,056; light department, $632,349; local improvements, $892,117. The city owns its own gravity water system and light and power plant. The total value of property owned by the city is $26,000,000.

The present city of Tacoma was organized in 1883 by the consolidation of Old Tacoma (1868) and New Tacoma (1874). Pop., 1890, 36,006; 1900, 37,714; 1910, 83,743; 1915 (U. S. est.), 108,094.

TACOMA, Mount. A peak of the Cascade Range. See Rainier, Mount.

TACON′IC MOUNTAINS, or **TAGHKANIC MOUNTAINS.** A low mountain range on the east boundary of New York State and occupying a small area in Massachusetts and Vermont (Map: Massachusetts, A 2, 3). It extends from the Highlands east of the Hudson in a north-northeast direction, becoming gradually higher as it enters the northwest corner of Massachusetts, and passes into southwest Vermont, where it connects with the Green Mountains. Its highest peaks are Mount Equinox in Vermont, 3816 feet, and Greylock (q.v.) in Massachusetts, 3505 feet. It consists chiefly of metamorphosed Cambrian and Silurian rocks, to which it has given the name Taconic System (q.v.).

TACONIC SYSTEM. A name applied by Emmons in 1842 to a series of rocks found in eastern New York, western Massachusetts, and Vermont, and considered by him to be of pre-Potsdam age because of their metamorphosed character and the supposed absence of fossils. It was afterward shown that the formations were really the equivalents of the normal Cambrian and Ordovician strata in the adjoining undisturbed areas, so that the name has fallen into disuse. Consult Emmons, *Geology of New York*, part ii (Albany, 1842), and Dana, "A Brief History of Taconic Ideas," in *American Journal of Science*, third series, vol. xxxvi (New Haven).

TACTICS (from Gk. *τακτικός*, *taktikos*, relating to arrangement, especially in war, from *τακτός*, *taktos*, arranged, from *τάσσειν*, *tassein*, to arrange), Military. From the eighteenth century until 1870 the word "tactics" was accepted to mean the art of giving battle, and included the plans of commanding and other generals on the one hand, and the execution of these plans by the troops on the other. This definition still holds; but it is nevertheless true that in the general case, since 1870, tactics are held to mean the execution of the dispositions furnished by strategy, whether on or off the battlefield. General tactics are distinguished from the tactics of the respective arms. Further, the subject is subdivided into as many branches as there are modes of activity by troops. Thus we have march tactics, combat tactics, supply tactics, etc.; we shall consider combat tactics alone, omitting also the history and evolution of the subject.

When used alone the word means battle tactics, or, as often put, the tactics of the three arms. Grand tactics and minor tactics are sometimes mentioned, meaning respectively the operation of great units, as divisions and corps, on the one hand, and those of smaller bodies on the other, such as would naturally carry out minor operations. But this division is not recommended. The following development of the subject applies, save when otherwise indicated, more to the open battlefield than to the conditions that prevailed in France and Flanders during the great war. These conditions, while greatly increasing the intensity of artillery and of infantry action, at the same time localized their effect both tactically and topographically.

TACTICS OF INFANTRY

Infantry, except during a single period, the Era of Knights or the Age of Chivalry, has always been the principal arm, that is to say numerically the strongest, and in its action the most decisive; ever since the introduction of firearms it has been gaining in importance. It is the only arm which can act independently, that is, without the assistance of the other arms, under all conditions of ground, weather, and other circumstances, in attack or defense, while in motion or when at rest, in closed or open order, with fire action or shock action; it can operate on all kinds of ground; it is more independent of circumstances than other arms; movement and effective firing may be combined to a far greater extent than in other arms; it can come into action more easily and readily, it is equally effective in attack and defense; it is more easily and cheaply equipped and maintained than other arms; and it can be more quickly made efficient. But it is limited in rate of movement, hence the advantage of combining cavalry with it; and in the range of effective action, hence the advantage of combining artillery with it for battle and cavalry for reconnoissance.

Infantry holds its high position mainly on account of its great fire action combined with its capacity to utilize fully the configuration of the ground. The fire of the present breech-loading rifle begins to make itself felt at 2500 yards, but does not become effective as aimed fire until about 1000 yards from the enemy; at 500 yards it is decisive, and at 300 practically annihilating. Constant improvement gradually increases these distances, and in the Boer War it was noticed that the British attack usually came to a standstill at 900 yards. The perfection of firearms and the more extended utilization of the configuration of the ground have greatly increased the power and significance of fire action. The introduction of an automatic firearm is now only a question of a short time, and this will still further increase fire effect. The bayonet attack comes into play only under special conditions, to confirm the results of previous fire action. The latter takes the longer time and makes the highest demands on strength and endurance; moreover, its annihilating effect punishes promptly any rash resort to the bayonet. Nevertheless the necessity for the bayonet remains; not always in hand to hand conflict, but as a threatening measure in the assault of a position, and because of the confidence it inspires and the power of initiative it confers.

The power of infantry fire necessitates cover, and the utilization of the natural configuration of the ground to secure this has acquired vital importance. The crossing of open spaces is avoided as much as possible, or postponed to decisive moments; hence the battle usually crystallizes around woods, villages, and groups of buildings. But in broad open fields, or where troops are opposed in strong natural or artificial positions for a considerable time, artificial cover must be obtained, consequently intrenchment is resorted to, and an intrenching tool is necessary for the soldier's equipment.

The formations in which infantry moves and fights are not the result of haphazard theory. Infantry can fight only when the distance from the enemy or the available natural or artificial cover permits it to fire, and effective fire can be obtained only when the soldier has room to use his arm freely, consequently this arm fights in open or dispersed order, the closed order being used only for troops in rear of the firing line. The greatest difficulty in leading infantry is the loss of control by the officers due to this dispersed order, and this can be overcome only by training, discipline, drill, and the example of the officers.

The tactics of infantry are designed to facilitate, as far as possible, that great object of every commander—to make himself stronger than the enemy at the time and place of actual combat. This can be done only by preserving unity of command, concerted action, and mobility, combined with the least exposure to loss. The formations in use attempt to fulfill these conditions, and the main principles governing in modern infantry tactics are: individual training and instruction to develop a high degree of initiative combined with perfect subordination; the greatest development of fire in the firing line; a subdivision into fire units of such strength as to insure complete fire control by commanders; in the attack, pressure against the flank combined with a frontal attack; the reënforcement of the firing line by a succession of lines gradually closing to the front; and, if possible, the accumulation of a greater depth of forces opposite the portions of the enemy where the attack is to be concentrated.

The front line in the attack is composed of the fighting line and its reserve, and the former is subdivided into the actual firing line and its supports. The battalion is the tactical unit, and the front it covers, as well as the particular nature of the action, determines the number of companies it places in the fighting line. The battalion covers normally about 400 yards of front and a company about 100 yards. The progress of the attack will proceed in general outline as follows: before entering the zone of artillery fire (or at about 3000 yards) each regiment forms from column of march into line; the battalions then designate the companies to form the fighting line and those to form the reserve; the companies of the fighting line then designate the sections for the firing line and for the supports. Within effective infantry fire the column must deploy, since the bullet from the modern firearm can pass through two men at 1500 yards, and at 400 yards it can go through four men, so that the column, if preserved here, must expect heavy losses. The successive lines, deployed in open order or in company column of sections, depending on the effect of the enemy's fire, continue to advance. When within effective range fire is opened by volleys, or a designated number of rounds at will, the skirmishers halting to deliver their fire, then advancing. In open country, within 1100 yards skirmishers can no longer remain standing. The supports gradually close on the firing line, deploy as skirmishers and begin to reënforce the firing line. Then begins the advance by rushes, by alternate subdivisions, and portions of the reserve are added to the firing line, the rest still held in reserve in rear of the point of main attack. The final act is the charge, the reserves being brought up to insure victory and hold the position. The engagement is in general decided at about 900 yards' distance.

One of the principal conditions for the success of the attack is that fire once opened should be kept up to about the same strength, and this again indicates the necessity for comparatively weak lines at first; on the other hand, the enemy should be met with superior forces from the beginning, and this superiority kept up. Between these two limits the commander must decide.

Decisive action is usually sought on a flank, but not necessarily an extreme outer flank of the line, for a modern line, from various causes, may have a number of inner flanks, which are also points of weakness. Early in the engagement the enemy must be forced to unveil his position, and then these interior flanks can be determined, and the commander may decide where to concentrate forces, for superiority is desired only at decisive points. The rest of the front can be held by comparatively weak forces. This also indicates the necessity for keeping as many troops as possible in reserve; but it must be borne in mind that the requisite number to insure superiority must be put in the firing line from the beginning, and this apart from all other considerations. The reserves must be added to the firing line in dispersed order, for the commander who hopes to force a decisive action by means of reserves in closed order disregards the effects of modern firearms. In an ideal action all the rifles are in use at the decisive moment, but this is not possible in long lines. Still the troops remaining in close formation will find other uses. To cover a retiring skirmish line only those reserves can be used that stand far enough to the rear to be readily placed in a defensive position to which the line may fall back; if they are already on the way to the front they had better be thrown into the skirmish line, to turn the tide, if possible.

Breaking through the front of a line is a very difficult undertaking and hardly possible to-day. Consequently the reserves should not be in rear of the centre, because they are of no use there, and would have to be kept so far in rear, to avoid the effects of the enemy's fire, that they might not enter the action in time. Their place is on one or both flanks, and so far beyond the flanks that they can enter the fight by a simple, direct forward movement, without any lateral gaining of ground. A regiment held in reserve, e.g., should be placed in rear of the flank and about 600 yards beyond it. The main reserve is always behind the flank where the decisive action is expected to be brought about.

The regimental commander can assign to each battalion only its general duty; the execution must be left to the battalion commanders. On the defensive he assigns to each his section of ground, on the offensive his point of attack. A skirmish line fires only when at a halt, and the position taken depends on the range, but lying prone is now regarded as best because it gives the enemy's artillery no opportunity to get the range. Before opening fire the distance must be estimated, a difficult matter even for those well trained in time of peace. The skillful designation of the target also requires much practice. The firing may be by volley or at will, the former being advantageous when the range has been determined and the ground is suitable for observation of the fire, but in general is merely a drill-ground exercise of little practical use. The conduct of the fire and all fire control is in the hands of the company and subordinate commanders, and one of the most difficult duties of these officers is the observation of the effects of the fire.

TACTICS OF CAVALRY

The prominent characteristic of cavalry is rapidity of movement, and its greatest duty is the service of security and information: a cavalry which is superior to the enemy's in screening its own army and clearing up that of its adversary will more than pay for itself. Its duty next in importance is pursuit, as it alone is capable of overtaking and holding a retreating enemy till the arrival of the infantry. On the battlefield its use is important, but limited. Cavalry is the arm of surprise, of sudden and vigorous attack; but its power of defense is comparatively poor, consequently it cannot hold for any length of time the ground it has gained. It is greatly dependent on the configuration and character of the ground, and its use in conjunction with the other arms is limited to favorable movements. Cavalry for most effective action requires broad, open country, rarely available on modern battlefields. For this reason, and on account of the increased range, rapidity of fire, and accuracy of firearms, cavalry can seldom decide battles. Surprise is to-day absolutely essential for the success of a cavalry attack, but to seize the proper moment is difficult, and requires constant watching of the progress of the battle and even anticipation of the enemy's movements in order to place the cavalry in readiness to grasp the fleeting moment before too late, consequently the cavalry must often wait for hours even under fire; but of course this has its limits, and after a certain percentage of losses the cavalry must retire out of range, and thus give up temporarily any opportunities for attack that may possibly arise.

The true action of cavalry in battle in former times was shock action, its fire action being quite subordinate and employed mainly on the defensive. Under present conditions the precise sphere of activity for the arm in battle is a subject of debate. Positions seized by an advancing cavalry may sometimes be held by its means until the infantry comes up, or it may be used to check the advance of the enemy; occasionally it may serve to support infantry. As a rule fire action of cavalry is delivered dismounted, but mounted fire action, although rare, has been used with advantage in covering a retreat when the pursuit was very active. The formation of cavalry used in the attack is the line, composed of two ranks in Europe. At other times the cavalry is generally kept in columns. The line allows of the simultaneous use of the greatest number of weapons, but because of its unwieldiness the squadron front is not exceeded for any formations other than the attack. Columns serve to assemble the troops in a narrow space and render movement up to the moment of attack easy; they must be open to facilitate forming line, with comparatively narrow front and full distances.

In the attack of cavalry against cavalry, victory can be gained only by the rapid assault of closed lines. In the advance of two opposed lines towards each other the respective lines will necessarily be more or less broken, the closed portions of the line still remaining on either side will penetrate the open places, both fronts will thus be broken through, and a hand-to-hand conflict begins. The extent to which either side retains closed lines up to the last will be of great effect on the result, hence the necessity of keeping closed and advancing with determination. The enemy should be kept uncertain as to the direction of the proposed attack as long as possible, so that he cannot prepare to meet the attack on his flank or rear, where it is usually directed. The principles applying to the subdivision of the forces are the same as for infantry. Enough men must be put into action at the beginning to insure success, and the first contact should decide the affair, consequently the forces directed against the flanks must be so directed from the beginning, and therefore must have an entirely different base from those directed against the front. In the front it will hardly be possible to put more men than the enemy has, and overlapping flanks will charge against nothing. More than necessary for decisive action should not be put in at first, because a reserve will be necessary to meet other approaching troops. However, if all the troops are needed for the first effect there can be no reserve, but one should be formed as soon as possible out of the reassembled squadrons. After the attack the action gradually changes into flight on one side and pursuit on the other, and the latter should be kept up till new infantry or artillery stops it, or the horses are exhausted.

In the attack of cavalry against infantry victory can result only when the attack is so sudden that the infantry has no time to fire at all, or when the latter is badly demoralized by previous losses. Cavalry against artillery has a better chance for success, because a firing artillery line cannot protect itself towards the flanks, and in the early part of an engagement such unprotected lines will often be found. Fighting on foot enables cavalry to act for a time independently of the other arms, especially when it is supported by horse artillery, and is the only means by which cavalry can continue its advance through defiles, woods, or villages occupied by weak forces of the enemy. The action of dismounted cavalry is limited in general to holding particular points, such as defiles or villages, until the arrival of stronger forces. There are, however, instances where cavalry on account of their extreme mobility can be used advantageously in foot fighting, and modern tacticians are paying increased attention to this point. Such cavalry, however, must be distinguished from mere mounted infantry as they have a far wider tactical use.

The principal duty of the horse artillery attached to the cavalry is to support the latter, since it can clear out the enemy from positions which a cavalry force would have hard work to take. In the attack of cavalry against cavalry horse artillery cannot always find application, but it can aid when its cavalry is deploying from a defile. While the opposed cavalries are still manœuvring the artillery takes the enemy's cavalry as its target, and pays no attention to its artillery unless its fire is masked by its own cavalry or to facilitate the deployment of its own cavalry. The artillery should be massed, but artillery duels to prepare the action would be absurd. There will probably be no time for any change of position until after the cavalry attack is decided, when the artillery takes part in the pursuit. In case of defeat it will not have time to take up a new position, but must remain firing in its previous position.

These are in outline the principles involved in cavalry tactics, though they are constantly undergoing modifications and the discussion of the true sphere and use of cavalry is a favorite topic for military authorities. The solution reached in the United States is freely to use cavalry dismounted if circumstances call for this mode of fighting: in other words, no brief is held in favor of mounted action to the exclusion of dismounted. It is believed that this is the correct view of the proper use of cavalry and that foreign armies are slowly accepting it.

TACTICS OF FIELD ARTILLERY

The artillery is the arm of destruction, and, on account of its great moral effect and the fact that it can reach troops in every part of the field, in all kinds of ground, and behind all artificial field cover, it is essentially the arm for preparing for the attack, demoralizing the enemy, and facilitating the work of the other arms. The use of artillery in masses is the great feature of a modern battle, and this use results from the long range of the guns, which enables them to do in one position that which formerly required a number. Its mass action begins the battle, prepares it, supports the action of the other arms, and ends it, and as an arm of pursuit artillery ranks with cavalry. The disadvantages of artillery are that it is tied for a considerable period to a particular position, and cannot act alone, consequently it is always an auxiliary arm. Moreover, it is cumbersome in its movement and defenseless when moving. It is also expensive and difficult to train. Leaving out of consideration the artillery of the seacoast and that used in the attack and defense of land fortifications, which have tactics of their own, treated elsewhere (see Coast Defense and Fortifications, Attack and Defense of), the artillery taken along by the field army may be divided into light artillery and heavy artillery, the former comprising field, horse, and mountain batteries, the latter guns of position. The field batteries include howitzer and mortar batteries for curved or high-angle fire. The formations of the artillery of practical use in the field are simply a formation for going into battery, and the formation in battery, ready for firing. Beyond the range of firearms the artillery can move in column of platoons, but within that zone it appears only in the open order (in line at full intervals) or in column of sections. Artillery in action always stands in the open order (in battery), and this formation in open order is also the best for advancing into position, where it can be used, but the column of sections will be more generally applicable in coming into position.

The greater range of artillery naturally makes it the arm to open the battle; the desire to rapidly overpower the enemy's artillery, in order that it may take under fire the point selected for attack by the infantry, or, on the defensive, the enemy's infantry during the attack (the real duty of the artillery), as naturally leads to the accumulation of the artillery in masses. The support of the infantry attack is the true purpose and the real duty of the artillery, and everything else is only a means to this end. Consequently, the object which the commander in chief has in view determines the time, place, and strength in which the artillery is first placed in position, and he also must give the orders therefor. The artillery should, of course, endeavor to utilize its long range, and if possible come into position beyond the range of the enemy's infantry fire. It should mask itself from sight on all occasions when the tactical situation or the configuration of the ground permits, since an unmasked battery invites annihilation by the enemy's artillery; but it must not hesitate to take up positions in the open when that is the only means of efficaciously assisting the infantry. It is the duty of the neighboring troops of other arms to protect the artillery against infantry fire. This does not, however, relieve the artillery from the duty of reconnoitring the ground, especially on the flanks, and artillery scouts or patrols have become a necessity on the battlefield. The artillery, once in position, remains there, the losses being made good from the reserve, the ammunition train, and finally the drivers, while ammunition when exhausted can only be awaited. The battery is never relieved, but constantly strengthened and supported from the rear. Before occupying a position the ground must be carefully reconnoitred, and in selecting positions the principal condition is effective action, with concealment if possible. Indirect fire is the rule to-day: this requires that the observers shall be able to see the target, unless the fire is directed by aëroplane observation. This direction by aircraft is becoming more and more the standard. (See MILITARY AËRONAUTICS.) As to the distance from the enemy, no rule can be laid down; aircraft observation of hits makes longer ranges possible than were formerly contemplated. Other things equal, fire may be opened at any range within the power of the piece, subject to the possibilities of observation. Effect is more important than cover; consequently, if artillery finds that its fire from a good covered position is not effective, it must enter the danger zone. The great masses accumulated on battlefields to-day greatly limit the choice of position, and in most cases the problem will be less the selection of a position than making the best use of a given position.

The brigade commander rides over the ground, considers the available space, and with due regard to the targets to be taken under fire, decides what front will be occupied. The regimental and battalion commanders are then given their orders, and the latter indicate to the batteries their respective positions. The batteries then enter their position, keeping the roads as long as possible, and after that utilizing cover when practicable. In large masses it may be necessary to take up first a preparatory position under cover, so that, moved to the front, the batteries may open fire simultaneously, but this is rarely practicable. Brigade and regimental commanders merely indicate the target in general, while battalion commanders designate the special target for each battery and also decide on a change of targets; the ranging, selection of kind of firing, and the actual firing are left to the battery commanders. Changes of position are, in general, ordered only by the commander in chief, but in special cases the artillery must act on its own responsibility. In large masses this change of position takes place by echelons, portions of the line remaining in position and continuing the fire while others advance to the new position.

The attack of the infantry must be supported by the artillery in such wise that the former may overcome the enemy's infantry, consequently the artillery of the attack should be superior to the enemy's from the first. This does not mean necessarily in numbers, because a smaller force by greater rapidity of movement into position and subsequent ranging may gain the upper hand of a large force. If a weaker artillery fears being overpowered it can await in a preparatory position the arrival of reënforcements, but this will not always be possible, because circumstances may demand its action at once. In this case the artillery endeavors to make best use of the ground. In the attack on a prepared defensive front the entire artillery must be in position before opening fire. By superiority of fire is not meant complete silencing of the enemy's artillery, but such an effect that, after the artillery duel, which first takes place, the enemy's artillery is no longer able to direct a destructive fire on the attacking infantry. As soon as the attacking infantry approaches too near the enemy the artillery must direct its fire on the ground beyond the objective, to prevent the advance of subdivisions from the rear. This sort of attack received a notable development in the European War; the tir de barrage, or curtain fire, has simply placed a continuous sheet of projectiles between the attacking infantry, and any hostile troops that might otherwise have come up.

The principal duty of the artillery of the defense is to take the attacking infantry, even though it may have overcome by its fire the infantry of the defense, under such a hail of shrapnel as to cause its attack to break down. But in the beginning it will have to take up the artillery duel, and here it has the advantage of selecting and strengthening its positions. It will not do, however, to occupy its positions at the beginning, because if it should be forced to change it will lose all its advantages. Consequently, it takes up at first a preparatory position, until the direction of the attack becomes known, and this has the additional advantage of preventing the attacker from getting an insight into the defender's plans before the battle opens. The artillery of the defense, however, cannot devote all its attention to the attacker's artillery. Wherever the infantry of the attacker gains a strong foothold it must be taken under fire. As soon as the attacking infantry prepares for the final assault the entire situation changes, and the defender's artillery takes up its rôle. The main effort is directed against the enemy's infantry, and his artillery is only kept occupied by a few guns. During the artillery duel the guns of the defense were kept under cover; now they must come out for their work. If the artillery of the defense is overpowered it may retire to be placed in position again during the infantry assault, but this will rarely be possible or effective. It is better to keep it in position, the men lying down for better protection, entering into action again at the decisive moment. Should the enemy's attack be successful, the batteries of the defense remain in position firing to the last, for the loss of the guns is no longer a disgrace on the battlefield, provided the situation demands it.

Every army takes into the field batteries of position, heavy batteries, for breaking down obstacles which the ordinary field artillery cannot deal with. These must combine great power with a mobility sufficient to enable them to keep up with the troops. Since they are necessarily some distance behind the other troops on the road, the arrival of these batteries must be awaited. They are used very much like the field batteries, but in the selection of the positions there will usually be more freedom, and their duties and changes of position are ordered only by the commander in chief. The employment of artillery of large calibre by armies in the field is one of the features of the Great War.

TACTICS OF THE THREE ARMS COMBINED

For most efficient action all three arms are combined, although under certain circumstances and in small bodies infantry and cavalry can act alone, and under others only two of the arms are combined, as infantry and cavalry, infantry and artillery, and cavalry and artillery.

The addition of artillery to the larger bodies of cavalry confers on the latter the possibility of preparing its attack by artillery fire and strengthening its line when fighting on foot; but the absence of infantry prevents it from fighting an infantry enemy in difficult ground, or in villages, woods, or intrenchments. It is therefore used mainly in reconnaissance and pursuit. The addition of artillery to infantry greatly increases the offensive and defensive power of the latter; but absence of cavalry prevents this combination from obtaining timely information of the enemy or properly screening the forces from his view. The addition of cavalry to infantry confers on the latter security on the march and in battle; but for reconnaissance or pursuit the presence of the infantry interferes with the mobility of the combination, and for battle it is weak in offense or defense, on account of the absence of artillery.

The combination of the three arms is, therefore, the only complete one for the battlefield. For the influence of air craft on tactics, see Military Aëronautics.

The subject of organization is closely associated with tactics. Therefore, the reader should consult the article Army Organization and the articles Armies; Artillery; Cavalry; Infantry; Infantry, Mounted; Staff; Advance Guard; Outpost; Reconnaissance; and Battle. Strategy naturally must have its relation to tactics and should be read in this connection. The various arms and materials of war mentioned will be found treated either under such collective titles as Ordnance and Small Arms, or under their own heads.

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TACTICS, Naval. The science of arranging combinations, groupings, movements, and methods of handling of ships and other naval weapons, and the art of carrying these plans into effect. Roughly speaking, tactics may be said to solve the question how a certain operation may be performed; strategy to furnish the reason why it is likely to be desirable. They are necessarily mutually dependent; tactics only provides for effecting conditions found desirable by strategy; and strategy is confined to operations which are tactically practicable. In its broad sense naval tactics includes the manipulation of all naval weapons—the movements of a ship or of a fleet, the methods of mounting and placing guns and of handling them, the placing of torpedo tubes and their handling, etc. In a narrower and more usual sense it is understood to mean the handling of a ship and her weapons or of several ships, leaving the tactics of the gun per se to be included in gunnery, and those of the torpedo to be studied under torpedo tactics.

Of the abstract principles of strategy the most important is to oppose to the enemy at the point of contact a superior force. This may mean more powerful ships, numerical superiority, or a better arrangement for attack and receiving attack. The first point must be secured by superior design; the vessel's guns must be more powerful, better mounted, better protected, or she must carry more of them; or her protection or speed must be superior. Nu-

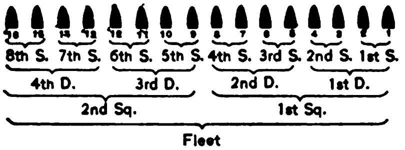


FIG. 1. FLEET IN LINE, NATURAL ORDER.

Showing numbers of section (*S*), division (*D*), and squadron (*Sq.*).

merical superiority where the opposing ships are equal in number and supposedly equal in power may be attained only by good manœuvring and is likely to be only temporary; but a clever tactician and strategist would be likely to reproduce the inequality whenever opportunity offered. The best disposition of the fleet for attacking and receiving attack must depend upon many circumstances; advantage should be taken of the strong points of your own vessels and the weaknesses of the enemy's. For instance, the better protected ships should seek close action, the others avoid it; ships having heavy bow and stern fire should seek action compelling bow and stern fighting if the enemy is particularly weak in bow and stern guns but relatively strong in broadside fire, etc.

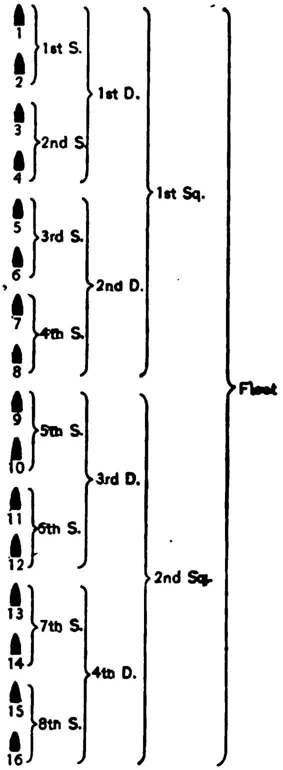


FIG. 2. FLEET IN COLUMN, NATURAL ORDER.

Showing numbers of sections (*S*), divisions (*D*), and squadrons (*Sq.*).

The battle tactics of to-day resemble more nearly those of the galley period than those of the epoch of sail, because steam, like manual power, enables any sort of combination of ships to be made and kept with reasonable precision. And the development of signaling has added to the facility of effecting these combinations, though the most experienced naval officers believe that after a fleet action has begun the changes of formation should be simple and few in number.

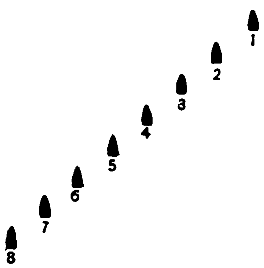


FIG. 3. SQUADRON IN ECHELON, NATURAL ORDER

There are three principal formations, line (Fig. 1), column (Fig. 2), and echelon (Fig. 3). In England line is frequently called "line abreast" and column styled "line ahead." In Figs. 1 and 2 a fleet of 16 ships is shown divided into two squadrons of eight ships each. If the fleet consisted of 12 ships it might be divided into three squadrons of four ships each, or two squadrons of six. In the various navies of the world the subdivisions of a fleet are different. Some have units of two, others of three. In the United States navy a fleet consists of two or more squadrons; a squadron, of two to eight ships; a division is half of a squadron which consists of more than five ships; a section is a pair of ships forming part of a division or squadron. Vessels, sections, divisions, and squadrons are numbered from van to rear when in column and from right to left when in line. When vessel No. 1 is leading in column or is on the right when in line the fleet is said to be in natural order; if vessel No. 16 is leading or on the right the fleet is said to be in inverted order. Vessels not intended for the line of battle are separately formed and manœuvred and constitute the reserve and auxiliary squadrons according to their character or the circumstances of the case. Vessels which have a distinct fighting value but are not fast enough or powerful enough to join the fighting line would form the reserve; supply ships, colliers, repair ships, etc., would form the auxiliary squadron. The following terms are used:

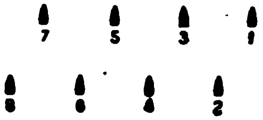


FIG. 4. SQUADRON IN INDENTED LINE, NATURAL ORDER.

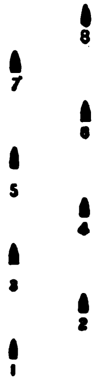


FIG. 5. SQUADRON IN INDENTED COLUMN, INVERTED ORDER.

About. A change of course of 180 degrees. *Advance.* Distance gained to the front in turning. *Alignment.* The direction of the line. *Arc of train or fire.* The angle through which guns may be trained or fired. *Column.* A formation in which vessels are in a line which is in the direction in which they are steering. *Double column* is a similar formation except that there are two parallel lines. In *indented column* the even-numbered ships are moved slightly to one side instead of being directly in rear of the odd-numbered ones. *Distance.* The linear distance (in yards) between the centres or foremasts of ships when in ordinary formation. This is usually 500 yards for a battleship or battle cruiser squadron or fleet. *Half distance* is half this. *Double distance* is twice distance. *Echelon.* A formation in which the line of bearing of the ships makes an angle of about 45 degrees with the direction in which they are steering, as in Fig. 3. *Evolution.* The combination of movements by which a fleet is changed from one formation to another. *Flank.* The sea to the right of the fleet is called the right flank; that to the left is called the left flank. *Formation.* The particular arrangement of the fleet. Simple formations are column,

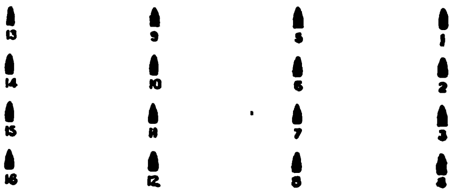


FIG. 6. FLEET IN LINE OF DIVISION COLUMNS, NATURAL ORDER.

line, echelon, etc. Compound formations are double column, line of division columns, etc. *Front.* The direction in which the fleet is steaming except when obliquing. The battle front is the direction of the enemy. *Guide.* The ship designated as the one upon which the formation is arranged for alignment and distance. *Interval.* The distance between divisions or squadrons when in compound formation. *Line.* A formation in which the line of bearing of the ships is at right angles to the direction in which they are steaming. *Line of bearing.* An imaginary line passing through the centres or foremasts of ships when in a particular formation. In compound formations each part has its own line of bearing. *Movement.* One of the component parts of an evolution. A movement is simultaneous when all ships execute it together, and successive when executed by each ship or group of ships in turn. *Oblique.* A change of course of less than 90 degrees. The ordinary oblique is three or four points. *Order.* The arrangement of the fleet (see preceding pages). *Point.* One thirty-second of a circle or 11¼ degrees. *Rear.* The direction opposite to the front. *Speed.* Standard or battle speed is that designated for battle or manœuvres. Full speed is a designated speed greater than standard; half speed is a designated speed less than standard; and slow speed is still less. *Tactical diameter.* The perpendicular distance between the course at the beginning of a turn of 180 degrees and the course after the completion of the turn. *Transfer.* Distance gained to the right or left (i.e., towards the flank) in turning. *Turn.* A turn is a change of course of 90 degrees; a half turn is a change of 45 degrees. *Van.* The leading unit of a formation. *Wheel.* A movement in line in which the vessels preserve their relative positions but the line of bearing is revolved.

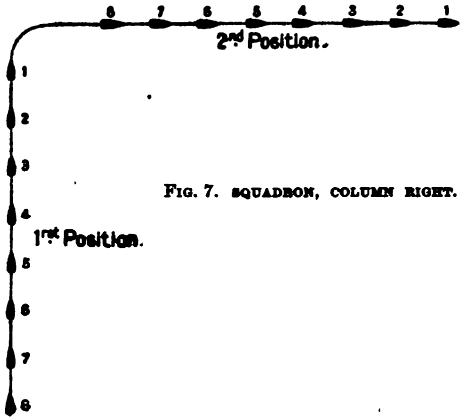


Fig. 7. SQUADRON, COLUMN RIGHT.

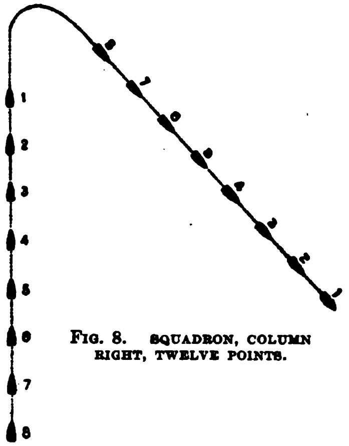


Fig. 8. SQUADRON, COLUMN RIGHT, TWELVE POINTS.

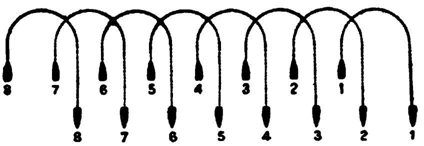


Fig. 9. VESSELS, RIGHT ABOUT (EXECUTED FROM LINE).

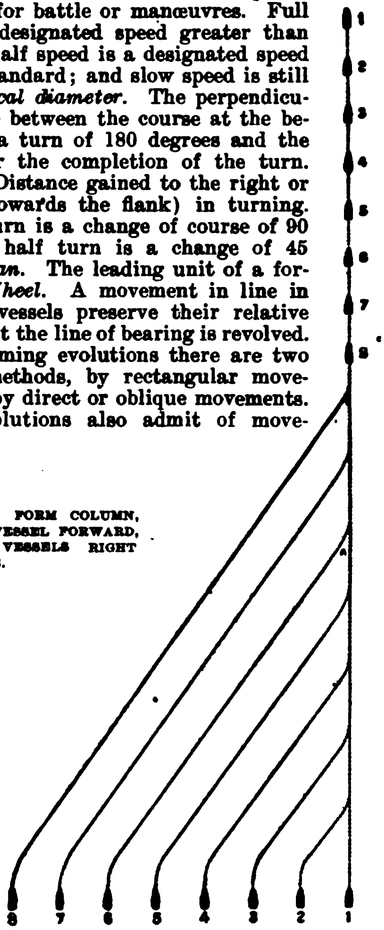


Fig. 10. FORM COLUMN, RIGHT VESSEL FORWARD, OTHER VESSELS RIGHT OBLIQUE.

In performing evolutions there are two principal methods, by rectangular movements and by direct or oblique movements. Certain evolutions also admit of movement by isodrome and others by conversion or wheel. The ease of movement attainable with bodies of men is not possible with ships. There can be no turning with fixed pivots, because ships must continue in motion or they cannot be kept under control; nor are sudden halts possible, for a heavy ship moving at high speed

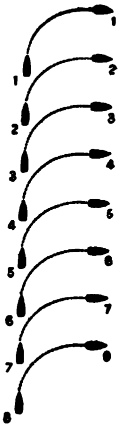


Fig. 11. VESSELS, RIGHT TURN.

The manœuvre changes column to line in this instance.

cannot be stopped in a less distance than several times her length. These and other considerations have led to the general acceptance of certain rules.

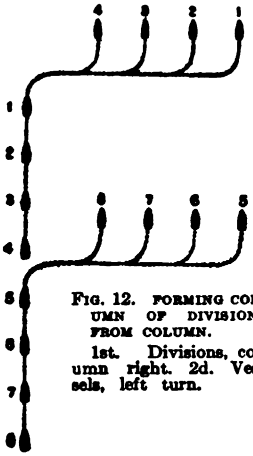


Fig. 12. FORMING COLUMN OF DIVISIONS FROM COLUMN.
1st. Divisions, column right. 2d. Vessels, left turn.

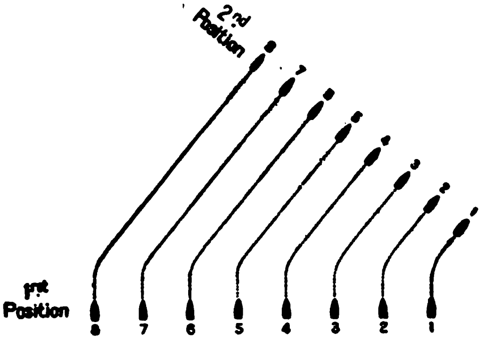


Fig. 13. SQUADRON, RIGHT WHEEL, FOUR POINTS.
Executed similarly for any given number of points.

First. Movements during battle should be as simple as possible.

Second. Changes in speed, particularly during evolutions, should be avoided as far as possible.

Third. Evolutions should be performed by the method which requires the least time and the least space.

Fourth. Ships of like characteristics should be separately grouped as far as possible; this is particularly true as regards speed and hardly less so as regards power and arrangement of battery and armor.

Fifth. When approaching the enemy and until in position to deliver attack the fleet must be kept concentrated and in condition to assume any desired formation.

These rules preclude the use of oblique movements, except under special circumstances, as they require more time and more space than rectangular movements as well as different and constantly changing speeds in all ships. The movement by isodrome has no advantage over the ordinary rectangular, is more dangerous, and keeping distance between ships is impossible; it is therefore no longer used.

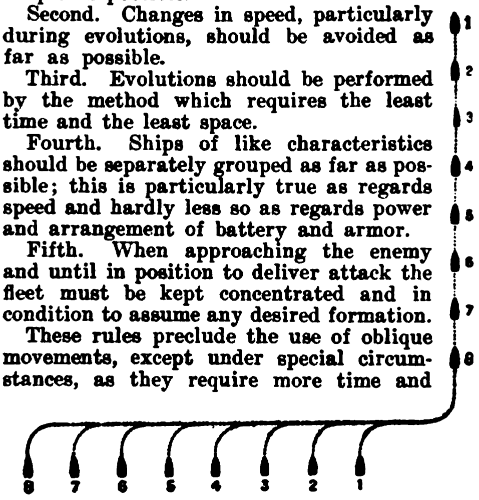


Fig. 14. FORMING COLUMN TO THE FRONT, RECTANGULAR METHOD.
1st. Vessels, right turn. 2d. Squadron, column left.

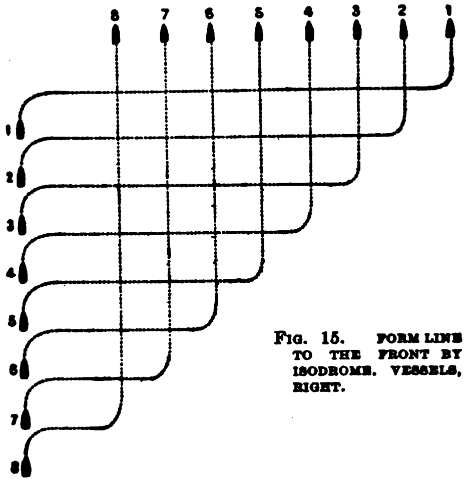


Fig. 15. FORM LINE TO THE FRONT BY ISODROME. VESSELS, RIGHT.

The accompanying figures show the various formations commonly used and the method of passing from one to the other. With the exceptions of Figs. 1, 2, and 6, the plans show the movements of a squadron of eight ships; the evolutions would be similar for a fleet of 16 ships.

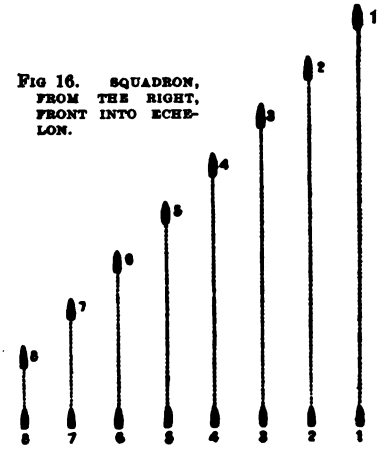


Fig 16. SQUADRON, FROM THE RIGHT, FRONT INTO ECHELON.

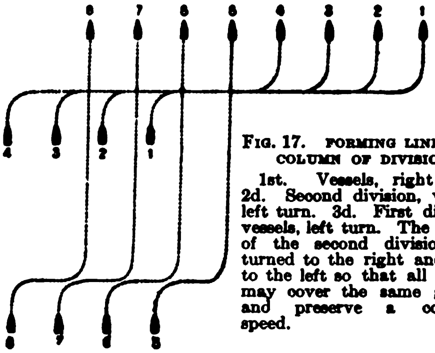


Fig. 17. FORMING LINE FROM COLUMN OF DIVISIONS.
1st. Vessels, right turn. 2d. Second division, vessels, left turn. 3d. First division, vessels, left turn. The vessels of the second division are turned to the right and then to the left so that all vessels may cover the same ground and preserve a constant speed.

Bibliography. F. A. Parker, *Steam Fleet Tactics* (New York, 1863); Saint Farret, *Etudes comparatives de tactique navale* (Paris, 1883); W. B. Hoff, *Examples, Conclusions, and Maxims of Modern Naval Tactics* (Washington, 1884); Sir G. Elliot, *Treatise on Future Naval Battles* (London, 1885); Gabriel Darrieus, *War on the Sea* (Eng. trans. by P. R. Alger, Annapolis, 1908); A. W. Grant, *School of the Ship* (ib., 1910); René Daveluy, *Genius of Naval Warfare* (Eng. trans. by P. R. Alger, 2 vols., ib., 1910–11); Romeo Bernotti, *Fundamentals of Naval Tactics* (Eng. trans. by McIntosh, ib., 1911); also *Proceedings of the United States Naval Institute* (Annapolis) and *Proceedings of the Royal United Service Institution* (London). See Advance Guard.

TACUBAYA, tä′kōō-bä′yȧ. A Mexican town in the Federal District, the head of the prefecture of that name, three miles southwest of the City of Mexico (Map: Mexico, C 9). It is a fashionable suburb and is famous for its gaming establishments and handsome villas. It is pleasantly situated, partly on a plain and partly on a hillside, which is crowned by an ancient episcopal palace, now used as one of the national observatories. Pop., 1910, 37,552.

TACUL′LI (Carriers), or Takulli. A tribe of Athapascan stock (q.v.) residing about Stuart and McLeod lakes, on the headwaters of the Peace and Fraser rivers, in Central British Columbia. Their social organization was based on the clan system. Their canoes were neatly made from birch bark; they hunted during the winter season on snowshoes; and their women spun yarn from the hair of the mountain goat and also made a coarse pottery. They are all now Christianized through the efforts of French Catholic missionaries, who devised for their language a syllabic alphabet in which nearly all have learned to read and write, although they have no schools. The Taculli are gathered on small reservations, and numbered in 1916 about 800 individuals.

The Déné syllabary, as it is called, is the invention of the Rev. Adrien Morice, who began his mission work among the Athapascan tribes of British Columbia in 1880. It consists of 30 characters, which by inversion of position and the use of accompanying dots or dashes can be made to indicate nearly 200 distinct syllables or sounds common to the Taculli, Chilcotin, and other neighboring cognate languages. Its printed literature consists of textbooks, religious works, and the *Carrier Review*, a monthly journal formerly published by Father Morice at Stuart Lake. Consult Adrien Morice, in *Transactions of the Canadian Institute* (Toronto, 1893).

TADEMA, tä′dē-mȧ, Alma-. See Alma-Tadema.

TAD′MOR. Another name for Palmyra (q.v.).

TADPOLE (ME. *tadpolle, taddepol*, from *tadde, tade*, toad, AS. *tādige, tādie*, toad + *polle*, head, poll). The larval form of anurous amphibians. For its metamorphosis see Toad.

TAEL, tāl (Portug. *tael*, from Malay *tail, tahil*, weight, tael, from Hind. *tōla*, weight, from Skt. *tulā*, balance). The name commonly given to the Chinese *liang*, a money of account in China, and worth from 0.724 to 0.806 of an American dollar, but varying in value in different parts of the Empire.

TAE′NARUM. See Cape Matapan.

TÆ′NIA. An animal parasite developed in the intestines of man and some animals. See Tapeworm.

In architecture, a narrow projecting fillet or square molding along the upper edge of the architrave in a classic or neoclassic entablature. See Entablature and Orders of Architecture.

TÆ′NIOP′TERIS (Neo-Lat., from Gk. ταινία, *tainia*, band, ribbon + πτερίς, *pteris*, fern). A genus of fossil ferns found in rocks of late Paleozoic and Triassic age. They have long leathery fronds of linguate form with entire margins, a strong central rib, and numerous closely parallel veins that run at right angles from the midrib to the margins. The fruiting frond is not known. See Fern.

TAENSA, tä-ĕn′sȧ, or **TENSA.** An historic American Indian tribe living, when first known to the French, about the year 1700, in seven villages between the Tensas River and the Mississippi, in the present Tensas Parish of Louisiana, about 20 miles from Natchez. Like the neighboring Natchez (q.v.), with whom they seem to have been closely connected, they were sun-worshipers and kept a sacred fire constantly burning in a temple. A part of the tribe, driven out by the Chickasaw (q.v.), was afterward colonized by the French on the west side of Mobile Bay, in the neighborhood of Mobile, Ala., where the local name still remains. The settlement contained 100 cabins about 1750. At a later period they removed higher up the Alabama River near the site of the present Tensaw. They were probably merged finally into the Choctaw or the Creek Confederacy. Nothing is known positively of their language, the *Grammaire et vocabulaire de la langue Tænsa* by Haumonte, published in Paris in 1882, having been proved to be a transparent fraud. According to contemporary French testimony, however, the language was cognate with that of the Natchez. Consult J. R. Swanton, *Indian Tribes of the Lower Mississippi Valley and Adjacent Coast of the Gulf of Mexico* (Washington, 1911).

TAFELBERG, tä′fel-bĕrG. See Table Mountain.

TAFFANEL, Jacques Pierre. See La Jonquière, Marquis de.

TAF′FETA (OF., Fr. *taffetas*, from Pers. *tāftah*, taffeta, woven, p.p. of *tāftan*, to weave). A term of somewhat general application in silk manufacture. It was formerly applied to all plain silks simply woven by regular alternations of the warp and filling (see Weaving), and is by some writers supposed to be the first kind of silk weaving known even to the Chinese, from whom it came to us. Modifications have, however, been introduced, by varying the quality of the warp and filling, and by the substitution of various colors for the single one of the original taffeta. It has therefore become a sort of generic term for plain silk, or silk woven in lines so fine as to appear plain woven. Taffeta has the same appearance on both sides. See Plate of Textile Printing.

TAFFRAIL LOG. See Log.

TAFFY. See National Nicknames.

TAF′ILET′. A large oasis in the northwestern part of the Sahara, belonging to Morocco, and situated at the southern base of the Atlas Range, 200 miles south of Fez. Area, about 500 square miles. The chief product is dates, but the oasis is mainly important as one of the principal trading stations between Morocco and the Sudan. The oasis includes about 150 towns and villages, the largest and the most important commercial centre being Abuam. Population of the oasis, about 120,000.

TAFT, Charles Phelps (1843–). An American newspaper owner and editor, half brother of Henry W. Taft and William H. Taft. He was born at Cincinnati, Ohio, graduated from Yale in 1864, and studied at Heidelberg, Berlin, and Paris. Admitted to the bar in 1866, he practiced law from 1869 to 1879, when he purchased the Cincinnati *Times*. This paper he consolidated with the *Star* in 1880 as the *Times-Star*, of which he was thereafter editor. He served as a member of the Ohio House of Representatives in 1871, and of the 54th Congress (1895–97). From 1898 to 1908 he was president of the Cincinnati Board of Sinking Fund Trustees. In the latter year he was a delegate to the Republican National Convention.

TAFT, Henry Waters (1859–). An American lawyer, brother of William H. Taft and half-brother of Charles P. Taft. Born at Cincinnati, Ohio, he was educated at Yale (A.B., 1880), and studied at the Cincinnati and Columbia law schools. After 1882 he practiced law in New York City. Until his resignation in 1907 he was special assistant to the United States Attorney-General in the prosecution of the Tobacco Trust. He served as trustee of the College of the City of New York in 1903–05, and of the New York Public Library after 1908, and became chairman of the council of the University Settlement.

TAFT, Lorado (1860–). An American sculptor. He was born at Elmwood, Ill., was educated at the University of Illinois, and studied art at the Beaux-Arts, Paris, under Dumont. Returning to America, he settled in Chicago, becoming in 1886 an instructor at the Art Institute. Here he exercised considerable influence upon western artists. He became widely known as a public lecturer, and in 1909 he was appointed professorial lecturer in the University of Chicago. His sculpture is well composed with a happy combination of ideal and realistic tendencies, but is somewhat lacking in strength. The most important works include the Washington Monument, Seattle; a military group at Jackson, Mich.; various fountains, such as the "Columbus Memorial Fountain," Washington; and ideal subjects, as "The Blind," inspired by Maeterlinck's drama (1909), and "Solitude of the Soul" (Art Institute, Chicago). Taft undertook to carry out a grand scheme of sculptural decoration for Chicago, made possible by the bequest of Benjamin F. Ferguson in 1905. One group, the "Spirit of the Lakes," was finished in 1913, and another, the colossal "Fountain of Time," was nearing completion in 1916. Taft was elected to the National Academy (1911), the National Sculpture Society, and the National Institute of Arts and Letters. He published a *History of American Sculpture* (1903), the best work on the subject treated.

TAFT, William Howard (1857–). The twenty-seventh President of the United States, born Sept. 15, 1857, in Cincinnati, Ohio. He graduated from Yale in 1878, second in a class of 121, and from the Cincinnati Law School in 1880, dividing with another the prize for scholarship. Instead of entering practice immediately he became law reporter for the Cincinnati *Times* (Charles P. Taft's paper) and later for the *Commercial*. In 1881–82 he was assistant prosecutor of Hamilton County, in 1882–83 was a collector of internal revenue. From 1887 to 1890 he served as a judge of the Superior Court of Ohio, and had been elected to succeed himself when he was appointed United States Solicitor-General in 1890 by President Harrison. His able argument and opinions in the Bering Sea Cases (*In re Cooper*, 138 U. S., 404; 143 U. S., 472; see Bering Sea Controversy) and the tariff cases brought him wide notice and a national reputation. In 1892 he was appointed a judge of the newly created Circuit Court of Appeals (sixth circuit), serving until 1900. He had occasion to hand down certain decisions relative to railroads, corporations, and organized labor which were of far-reaching consequence in the development of the law of injunctions (q.v.). In the case of Moore *v.* Bricklayers' Union, he declared a secondary boycott illegal. Although holding that labor has the legal right to organize in unions, he declared that unions must refrain from acts injurious to society. Thus when Debs (q.v.), in 1894, endeavored to tie up traffic, Taft granted an injunction against his agent, F. W. Phelan. From 1896 to 1900 Taft was dean and professor of law at the University of Cincinnati.

In 1900 he resigned his judgeship to become the chairman of the commission appointed by President McKinley to institute civil government in the Philippine Islands (q.v.), although he had been opposed to annexation. In his four years' residence in the Islands he not only fulfilled the objects of the appointment, but attained a wide and well-founded popularity as an able colonial administrator. Order having been gradually effected, he began to introduce the rudimentary forms of civil government. The government was organized, good roads were built, post offices established, schools and American teachers introduced, banks founded, and civic improvements made. Sanitation removed much of the danger of epidemics of contagious diseases. In 1902 Mr. Taft visited Rome to negotiate with Pope Leo XIII terms for the purchase of the friars' lands. Having succeeded, he induced Congress to appropriate $7,239,000 for this purchase, and then sold the lands to the tenants and inhabitants on easy terms. He regarded the Filipinos as unprepared to govern themselves and urged that they be educated for that purpose before the United States should contemplate giving them independence. He advocated free trade and the development of sympathy between them and Americans. He won the trust of a large portion of the natives, who asked him to remain with them, in 1903, when he was offered a place on the Supreme Court bench by President Roosevelt. In 1904, however, he succeeded Elihu Root as Secretary of War in Roosevelt's Cabinet, and soon was regarded as the friend and spokesman of the administration. He represented it in many important trips in the United States and in foreign states. In 1906 he was temporarily the civil Governor of Cuba (q.v.) after the intervention of the United States in that year. In 1907 he visited the Panama Canal zone in order to familiarize himself with the problems and conditions there. In 1907, also, he visited the Philippines to be present at the opening of the Legislative Assembly. He then went to Japan to confer with that government relative to the problem of the Japanese in the United States and succeeded in arranging matters satisfactorily for the time. He proceeded to China, where he undertook important negotiations relative to Chinese boycott of American commodities, and then to Russia.

Before 1908 President Roosevelt had let it be known that he favored Taft as his successor and in that year actively supported the latter's candidacy. Because of the President's powerful influence and his own popularity, Taft easily secured the Republican nomination for the presidency. He was overwhelmingly elected over Bryan, the Democratic candidate, securing 321 electoral votes against 162. Four years later, in 1912, he acknowledged his indebtedness to Roosevelt, and it was well known that he had indorsed the Roosevelt policies.

In his inaugural address and message to Congress, he urged a revision of the tariff on the basis of affording American business interests protection equal to the difference between the cost of producing manufactured articles at home and abroad, a graduated inheritance tax, a postal savings bank system, a strong navy, and mail subsidies for American ships. He called a special session of Congress in order to secure revision of the tariff law. The result was the enactment of the Payne-Aldrich Tariff Act, which he signed and in 1910 defended at Winona. The widening of the breach between the "standpatters" and the insurgents within the party caused many to think Taft a failure as a party leader. The tariff act was unpopular, and the Ballinger-Pinchot controversy (see Conservation; Ballinger, R. A.; Pinchot, Gifford) and certain other scandals connected with the Department of Agriculture brought the administration into disfavor and encouraged the Progressive movement. The result appeared in the overthrow of "Cannonism" and the defeat of the party in the Congressional elections of 1910. The President's defense of Ballinger and of the tariff act together with his coöperation with the conservatives in Congress caused him to be regarded as a reactionary. His championship of Canadian reciprocity in 1910 and the adoption of it by aid of Democratic votes was nullified in the public mind by its failure in Canada and by his vetoes of tariff reform bills which were passed by Congress in 1911. This action was regarded as a failure to conform to platform pledges. In 1910–11 he made a notable effort to secure the ratification of peace and arbitration treaties which had been negotiated with Great Britain and France, and subsequently he was known as one of the most prominent advocates of world peace and arbitration.

By 1912 Taft and Roosevelt had broken relations. Both announced their candidacy for the Republican nomination and waged a bitter campaign. (See Roosevelt; Progressive Party.) Taft secured the nomination on the first ballot, but, in competition with Roosevelt, now head of the Progressive party ticket, and Woodrow Wilson, Democrat, he was defeated in the election by Wilson, receiving only 8 electoral votes. During the last month of the administration, there was a revival of his personal popularity and of confidence in his administrative ability. On retirement, in 1913, he became Kent professor of law at Yale University, and in the same year was elected president of the American Bar Association. In 1915 he criticized severely the Wilson administration's attitude towards the Philippine Islands. In 1916 he became chairman of the Central Committee of the American Red Cross. Mr. Taft wrote: *Four Aspects of Civic Duty* (1906); *Present-Day Problems* (1908); *Political Issues and Outlooks* (1909); *The Anti-Trust Act and the Supreme Court* (1914); *The United States and Peace* (1914); *Popular Government* (1915); *Ethics in Service* (1915); *The Presidency: Its Duties, Opportunities, and Limitations* (1916). Consult Mrs. W. H. Taft, *Recollections of Full Years* (New York, 1914); J. G. Wilson (ed.), *Presidents of the United States, 1789–1914*, vol. iv (ib., 1914). See United States, *History*.

TAGABILI, tȧ-gȧ-bē′lē. A Malay people said to inhabit a part of the country bordering on Lake Buluan in southern Mindanao. See Philippine Islands.

TAGAKAOLO, tȧ-gȧ-kȧ-ō′lō (or Kagan or Kalagan). A turbulent Malay tribe inhabiting the lower slopes of the mountain ranges west of Davao Gulf, in Mindanao. They practice a little agriculture, but the men are essentially hunters and warriors, who for many years have carried on a lucrative slave trade with the coast Moro. Consult F. C. Cole, *Wild Tribes of Davao District* (Field Museum publication, 1913). See Philippine Islands.

TAGALOG, tȧ-gä′lŏg (Tagala, Tagal). A people inhabiting central Luzon, the district surrounding Manila Bay, and parts of neighboring islands, particularly the coasts of Mindoro. At the time of the Spanish conquest they had acquired some culture, were in possession of a native alphabet, and were carrying on considerable trade with the Chinese and Moro. Upon the advent of the Spaniards, Manila became the most important city of the archipelago, and many advantages, denied to the natives of other tribes, were secured by them. Their country received by far the greater number of emigrants, intermarriage with whom has resulted in a large population of mixed blood. Numerically the Tagalog rank second among the Philippine tribes, but because of their greater advancement they are to-day the dominant people of the Islands. See Philippine Islands.

TAGANROG, tăg′*a*n-rŏg′. A district town and seaport in the Province of the Don Cossacks, Russia, on the north coast of the Sea of Azov, 18 miles northwest of the mouth of the Don (Map: Russia, E 5). The harbor has now become very shallow and the trade of the town is decreasing. The principal export is grain. The manufacturing industries are well developed and the principal products are flour and tobacco. The town contains the famous Chekhov Museum, founded in honor of the great Russian writer, who was born here in 1860. Pop., 1910, 68,369.

TAGASASTE. See Cytisus.

TAGBANUA, tȧg-bä′nōō-ȧ (Palawan). A pagan people inhabiting a large part of the island of Palawan, and some of the adjacent islands of the Calamian group. They are broken up into several divisions, the members of which differ in looks and culture according to the amount of intercourse they have had with the pygmy tribes, or coast Mohammedans. Those who have had extensive dealings with the latter have borrowed from them their type of dress and many articles used in daily life. The tribe has a syllabic alphabet with which they write their language. Smooth joints of bamboo are used as a substitute for paper, and on them the characters are scratched. Consult M. H. Venturello, "Manners and Customs of the Tagbanua," in Smithsonian Institution, *Miscellaneous Collections*, vol. xlviii, part iv (Washington, 1907). See Philippine Islands.

TAGGART, Thomas (1856-). An American politician, born in Ireland. He arrived at Indianapolis, Ind., in 1872 and after a time opened a small hotel. Subsequently he became proprietor of the Grand Hotel at Indianapolis and finally acquired most of the stock of the French Lick Springs Hotel Company. As a Democrat he was elected auditor of Marion Co., Ind., in 1886, an office then reputed to yield a large total in fees. Two years later he was appointed Democratic county chairman and succeeded in carrying the county against Benjamin Harrison, candidate for the presidency. For this feat he was rewarded with the State chairmanship of the party in 1892. Elected mayor of Indianapolis in 1895, he was twice reëlected and refused a fourth nomination. As chairman of the Democratic National Committee he conducted the presidential campaign of Alton B. Parker (q.v.) in 1904. Taggart was beaten in his contest for the senatorial nomination by John W. Kern in 1910 and by Benjamin F. Shively in 1914, but upon the latter's death in 1916 he was appointed by his political ally, Governor Ralston, to fill the vacancy. In 1915 Taggart was indicted by a grand jury for alleged election frauds at Indianapolis, but the case was later dropped.

TAGHKANIC (tȧ-kă′nĭk) **MOUNTAINS.** See Taconic Mountains.

TAGILSK, Nizhni. See Nizhni Tagilsk.

TAGINÆ. See Gualdo Tadino.

TAGLIACOZZO, täl′yȧ-kôt′sȯ. A town in the Province of Aquila, Italy, about 50 miles from Rome, near which, on Aug. 23, 1268, Charles of Anjou decisively defeated Conradin of Swabia (q.v.), the last of the Hohenstaufen.

TAGLIONI, tä-lyō′nē, Maria (1804–84). An Italian ballet dancer. She was the daughter of Filippo Taglioni (1777–1871) who was ballet master successively at Stockholm, Cassel, Vienna, and Warsaw, and composed many ballets. Maria, who was born at Stockholm, was trained by her father, in one of whose ballets she first appeared at Vienna in 1822. Five years later she made her Paris début, which was a tremendous success. She became particularly famous for her dancing in *La Sylphide*, the best of her father's ballets, and in *Guillaume Tell*, *Robert le Diable*, and other operas. Throughout Europe Taglioni became a name to conjure with. In 1832 she married Count Gilbert de Voisins. In 1847 she retired from the stage. Later, after she had lost money by speculation, she supported herself by teaching court etiquette in London. Taglioni died at the home of a son in Marseilles.

Her brother Paul (1808–84) was appointed ballet director of the Royal Theatre, Berlin, in 1869, and as a composer of ballets earned a reputation by *Flick und Flock* and *Fantasca*. His daughter, Maria (1833–91), also a dancer, was a great favorite at the Royal Theatre in Berlin and later at San Carlo in Naples. In 1866 she married Prince Joseph Windischgrätz.

TAGORE, tȧ-gōr′, Sir Rabindranath (also written Ṭhakura, Ravīndranāth) (1860–). A Hindu poet. Long popular in India, he gained an international reputation and was awarded the Nobel prize in literature for 1913. Born in Calcutta of a distinguished family, at the age of 17 he went to Europe to complete his education. On his return to India he first became known as an educator and philosopher, being the founder of a university in Bengal. To a magazine conducted by his family he was also a frequent contributor. Tagore's native language was Bengali (q.v.), and his poetry possessed an extraordinary power of appeal to his compatriots—a power which was measurably felt among alien and Western peoples who read the English versions of parts of his work, which he himself had translated in a style of remarkable charm, suppleness, and finish. His verse, which in his early years was sensual and romantic, became with his maturity more spiritual and idealistic. Tagore spent some time in America at Urbana, Ill., and in New York. He was knighted by King George in 1915. There are English versions of his: *The Crescent Moon* (1913), children's poems; *The Gardener* (1913), poems; *Gitanjali* (1913), prose translations of poems; *Sādhānа: the Realization of Life* (1913), a series of essays; *Chitra* (1913), a one-act play; *The King of the Dark Chamber* (1914); *The Post Office* (1914); *Short Stories* (1915). Consult Ernest Rhys, *Rabindranath Tagore* (New York, 1915), and B. K. Roy, *Rabindranath Tagore* (ib., 1915).

TAGOSATI, tä′gō-sä′tē, or **TOGASASTI,** tō′-gȧ-säs′tē. A shrub (*Cytisus proliferus albus*) of the family Leguminosæ. It is a native of the Madeira and the Canary islands, where it is an important fodder plant and whence it has been introduced into southern Australia. It is well adapted to dry soils and climates, but cannot be depended upon where there is danger of frost.

TAGUAN, tä′gwän (East Indian name). A large Old World flying squirrel (*Pteromys petaurista*). See Flying Phalanger.

TA′GUS (Sp. *Tajo*, Portug. *Tejo*). The largest river of the Iberian Peninsula. It rises in the Sierra de Albarracin on the west boundary of the Spanish Province of Teruel, 88 miles east of Madrid, and flows in a general west-southwest direction through Spain and Portugal, emptying into the Atlantic Ocean shortly after passing the city of Lisbon (Map: Spain, D 2). Its length is 565 miles. In its upper course it traverses the arid plains of New Castile, but at Toledo it plunges through a wild gorge between high granite cliffs. About 40 miles above Lisbon it divides into two branches, which inclose a low, marshy island, and which reunite in the Mar da Palha (Straw Sea), an expansion of the river about 18 miles long and 5 miles wide, deep and sheltered, forming one of the best harbors in the world. At Lisbon the river again contracts, and enters the ocean through a narrow and deep channel, which, but for the bar at the mouth, would be accessible for the largest ships. The navigation of the Tagus ends within the Portuguese frontier.

TAHAR′KA (?–c.668 b.c.). The name of the third King of Egypt of the twenty-fifth or Ethiopian dynasty, who ruled from c.694–693 to 668–667 b.c. He is the Tirhakah of the Bible, the Τάρκος or Ταρκός of Manetho, and the Tarqû of the Assyrian inscriptions. He seems to have been a usurper who seized upon the throne on the death of Shabataka, and strengthened his hold upon it by marrying the widow of King Shabako. In the Old Testament (Isa. xxxvii. 9; 2 Kings xix. 9) he is said to have come to the aid of Hezekiah, King of Judah, when Jerusalem was besieged by Sennacherib. It would seem that no battle took place between the Egyptian and Assyrian forces, but that the latter, before they met, were forced to retreat by a pestilence.

In 670 B.C. Esarhaddon, son of Sennacherib, invaded Egypt, defeated Taharka in several engagements, sacked Memphis, and marched to Thebes, which surrendered to him. Taharka retired to Nubia, but returned the next year and established himself in Memphis. Learning of this, Esarhaddon gathered an army and was proceeding to the relief of his Egyptian vassals when he died on the way. His army continued the march and drove Taharka out of Lower Egypt. Retreating to Thebes, Taharka seized that city and was preparing to renew the contest when he died. Memorials of Taharka are found in many parts of Egypt and Nubia. At Napata (Jebel Barkal) he built a temple whose sanctuary was hewn out of the solid rock of the mountain, and he restored the temples of Thebes, his capital. Consult K. A. Wiedemann, *Aegyptische Geschichte* (Gotha, 1884–88), and W. M. Flinders Petrie, *A History of Egypt*, vol. iii (New York, 1905).

TAHITI, tȧ-hē'tē, or **OTAHEITE**. The largest of the Society Islands (q.v.), in lat. 17° 45′ S., long. 149° 20′ W. (Map: World, Western Hemisphere, L 6). Area, 600 square miles. The island consists of two unequal and nearly circular portions connected by a narrow isthmus. These are the remnants of old volcanoes, and rise in a succession of concentric terraces to the summits, the higher of which has an altitude of 7688 feet. The mountains are, however, very much eroded by numerous streams, which have cut large valleys and deep gorges down the slopes, leaving in many places isolated crags which make the scenery very romantic. The climate is warm, but equable, the temperature ranging from 60° F. to 90° F. The rainfall is abundant, and the whole island is covered with a luxuriant vegetation. The central peaks are surrounded by a low strip of coastland consisting of volcanic detritus, which, mixed with coral sands from the surrounding reefs, makes an extremely fertile soil. Nevertheless agriculture is in a backward state, and only a few square miles of land are under cultivation. The population in 1910 was 11,691. The chief town is Papeete, the capital of the French establishments in the eastern Pacific, with a cathedral, arsenal, hospital, and a population in 1910 of 3617, about one-half of whom were French. For history and political and economic conditions, see SOCIETY ISLANDS.

The Tahitians are typical Polynesians. They make bark cloth, produce fire by means of the fire plow, tattoo, use kava as a stimulant, and depend on vegetable products for their food, which in the absence of pottery is baked or roasted. A remarkable institution of the Society Islanders was the Areois (q.v.), a society for the cultivation of poetry, the dance, and the drama combined with the indulgence of the sexual passion. Another noteworthy feature of their culture was the fire walk, in which the natives walked on rocks that had been heated for hours. Consult: Lutteroth, *O-Taïti* (Paris, 1843); Vincendon, *Iles Taïti* (ib., 1844); Buschmann, *Aperçu de la langue des îles Marquises et de la langue taïtienne* (Berlin, 1843); P. Huguenin, *Raiatea la sacrée* (Neuchatel, 1902).

TAHITI APPLE. See HOG PLUM.

TAHITI ARCHIPELAGO. See SOCIETY ISLANDS.

TAHLEQUAH, tä'lē-kwä'. A city and the county seat of Cherokee Co., Okla., 36 miles by rail east of Muskogee, on the Illinois River, and on the St. Louis and San Francisco Railroad (Map: Oklahoma, G 3). It is the seat of the Northeastern State Normal School, and contains the Cherokee Training School and a Carnegie library. The chief industrial establishments are cotton gins, grain elevators, and flour mills. Pop., 1900, 1916; 1910, 2891.

TAHLTAN, tăl'tan. See NAHANE.

TAHOE, tä'hō *or* tä'hō, LAKE. The largest lake in the Sierra Nevada, on the boundary between Nevada and California (Map: California, E 3). It is 22 miles long by about 10 miles broad, and lies at an altitude of 6225 feet. Its greatest depth is over 1600 feet, and its water is remarkably clear. It discharges through the Truckee River into Pyramid Lake, and it has been planned to draw its water through tunnels for irrigation purposes.

TAHPANHES, tȧ-păn'hēz (Heb. *Takhpankhēs*), or TEHAPHNEHES (Heb. *Tekhaphnekhēs*). A city of northeastern Egypt mentioned in the Bible. It is probably to be identified with the town called by the Greeks Daphnæ, which was situated in the delta about 25 miles southwest of Pelusium. Daphnæ was a military post of some importance in the time of Psammetichus I (q.v.), who fortified it and established in it a garrison of Greek mercenaries. The site, represented by the modern Tel Defenneh, was explored by Petrie in 1886. Consult W. M. Flinders Petrie, *Tanis*, part ii (London, 1887), and id., *A History of Egypt*, vol. iii (New York, 1905).

TAHR. See THAR.

TAHUTIMES, tä-hōō'tē-mēs. See THOTHMES.

TAIGNANFU, tīg'năn'fōō'. A departmental city of the Province of Shantung, China, situated at the foot of the famous Mount Tai (see TAI SHAN), 60 miles south-southeast of Tsinanfu, the capital of the province. The importance of Taignan is due chiefly to the immense numbers of pilgrims who come to visit Mount Tai. Its suburbs on the south and west, however, are large, populous, and prosperous. The most important of the numerous temples of Taignan is the Tai Temple, covering several acres, surrounded by a strong wall and containing many fine old cypresses. Pop., with suburbs, about 80,000.

TAIKUN. See TYCOON.

TAIL'FER, PATRICK. An American colonist, remembered for the polemic entitled *A True and Historical Narrative of the Colony of Georgia in America from the First Settlement thereof until the Present Period* (1741). Tailfer, a physician who had emigrated to Georgia, disapproved of the administration of the Colony. In 1740 he went to Charleston, S. C., where, with the assistance of Hugh Anderson and David Douglass, he published the work mentioned above. In this he mercilessly attacked Governor Oglethorpe.

TAILHADE, tȧ'yȧd', LAURENT (1854–). A French poet, born at Tarbes and educated at the lycée of Pau. He was early a journalist. His first writing, which shows a Parnassian (see PARNASSIENS) influence, was well received by De Banville (q.v.). Tailhade is noted for ballads and satirical verse. His best work is in *Le jardin des rêves* (1880); *Au pays du mufle* (1891); *A travers les grouins* (1899); *Poèmes aristophanesques* (1904); *Poèmes élégiaques* (1907); *Un monde qui finit* (1909); *La forêt* (1910); *Pages choisies* (1912).

TAILLANDIER, tȧ'yäN'dyā', RENÉ GASPARD ERNEST, commonly called SAINT-RENÉ TAILLANDIER (1817–79). A French writer on literature and history, born in Paris. He studied law, but turned to literature and philosophy, and in 1840 attracted some attention with his long poem *Béatrice.* In 1841 he studied at Heidelberg, and at the end of that year became a member of the Faculty of Letters at Strassburg. In 1843 he received the doctor's degree at Paris for his *Scot Erigène et la philosophie scholastique,* and then was called to the chair of French literature at Montpellier. From 1863 he was a professor in the Faculty of Letters at Paris, and in 1873 became a member of the Academy. Especially noteworthy are his writings on German literature and philosophy, which began in 1843 in the *Revue des Deux Mondes.* His works include: *Histoire de la jeune Allemagne* (1848); *Etudes sur la révolution en Allemagne* (1853); *Allemagne et Russie* (1856), a study made timely by the Crimean War; *Histoire et philosophie religieuse* (1860); *Littérature étrangère, écrivains et poètes modernes* (1861); *La Comtesse d'Albany* (1862); *Correspondance entre Goethe et Schiller* (1863); *Corneille et ses contemporains* (1864); *Maurice de Saxe* (1865), a critical biography; *La Serbie au XIXème siècle: Kara-George et Milosch* (1875); *Dix ans de l'histoire d'Allemagne* (1875); and *Le roi Léopold et la reine Victoria* (1878).

TAILLE, tāl; *Fr. pron.* tȧ'y'. In mediæval England and France an arbitrary tax enacted by a seignior from his vassal. In France, specifically it became a royal tax which was originally imposed for the maintenance of the national defense, and which in the course of time came to fall on the lower classes only, exemption from the tax being in fact the great mark of distinction between the privileged and nonprivileged classes, the taillables and nontaillables. See France; Serf.

TAILLE, Jean de la. See La Taille, Jean de.

TAILLON, tȧl'yôɴ', Sir Louis Olivier (1840–). A Canadian statesman. He was born at Terrebonne, Province of Quebec, and educated at Masson College. Called to the bar in 1865, he practiced his profession in Montreal and became one of its leaders in the province. He was elected a Conservative member of the Provincial Legislature in 1875 and sat therein until 1896. He was Speaker of the Legislative Assembly (1882–83), Attorney-General (1884–86), Premier (1887; 1893–96), leader of the Opposition (1887–90). In 1896 he was appointed Postmaster-General in the Dominion cabinet of Sir Charles Tupper, but resigned on the latter's defeat the same year. In 1900 he was an unsuccessful candidate for the House of Commons. He was knighted in 1916.

TAILOR, Robert. An English dramatist, of whose life very little is known. He is remembered for his comedy *The Hog Hath Lost his Perle,* which was presented in London in 1613 and printed the following year. The play is valuable for its many dramatic allusions, but has little merit. Tailor is supposed to be the author of *Sacred Hymns,* 50 rather meritorious paraphrases from the Psalms.

TAILOR BIRD. One of a group of small Oriental thrushes or warblers of the genus *Orthotomus,* which stitch together leaves to sustain their nest. There are many species and allies, but the tailor bird proper is *Orthotomus sutorius,* which is common in India and eastward about gardens. It has a back of olive green, is white beneath, the crown of the head is chestnut, and in the male two middle tail feathers are greatly elongated. The bill is long, straight, and slender. It is said to make its nest of cotton and other soft materials, drawing one leaf or more, generally two, on each side of the nest, and stitching them together with threads picked up. The process has been witnessed, however, by few competent observers. The fullest account extant is in Hume, *Nests and Eggs of Indian Birds* (2d ed., London, 1890); also consult Douglas Dewar, *Birds of the Plains* (New York, 1908). The birds of a related genus, *Cisticola* (see Fantail), "ply the same trade on stems of grass, confining them by stitches above the nest, which is built among them and takes a globular form." See Plate of Pensile Nests of Birds accompanying Nidification.

TAILOR'S GOOSE. See Goose, Tailor's.

TAIMYR, tī-mēr'. A large peninsula of northwest Siberia, in the Government of Yeniseisk, extending into the Arctic Ocean and forming the northernmost part of the Asiatic mainland (Map: Asia, L M 1). The peninsula is divided by Taimyr river, lake, and bay into two parts, of which the more easterly is the larger and reaches the parallel of lat. 77° 34′ N. This part of the peninsula has many headlands and contains the Byrranga Mountains, which are only about 1000 feet in height. The Taimyr River rises in lat. 73° N., flows through the large Lake Taimyr (about 1000 square miles), and empties into Taimyr Bay at 75° 35′. The flora is poorer than in that part of Greenland which is not covered by the ice cap. The country is only occasionally visited by nomadic Samoyeds and Ostiaks. It was first explored by the Russian traveler Alexander Theodor von Middendorff.

TAINAN, tī'nän'. A city of south Formosa, known as Tai-wan fu until 1886, and the capital of the island until 1896 (Map: Japan, D 8). It is on a level plain of considerable extent, 3 miles east of Formosa Channel, with which it is connected by a canal. Its walls have a circuit of about 6 miles and inclose many open spaces, the principal markets being in the western suburbs. The Dutch made it their capital in the seventeenth century. Tainan was a treaty port under Chinese rule; under Japanese control it has the same status. It has three steam sugar mills and one rice mill. Pop., 1913, 53,794, including few foreigners.

TAINE, tān, Hippolyte Adolphe (1828–93). A French historian and critic of literature and art, born at Vouziers, April 21, 1828. He went to Paris in 1841, entered the Ecole Normale in 1848, where he showed much independence and restiveness under its philosophic eclecticism. In 1851 he was appointed to the chair of philosophy at the College of Toulon, but he immediately resigned, studied medicine and the sciences, and so brought himself into touch with the spirit of the rising generation, with whom his essays on *La Fontaine, Livy,* and *Les philosophes français du XIXème siècle* (1853–56) won immediate recognition, while his *Voyage aux eaux des Pyrénées* (1855) showed his mastery of orderly and minute observation. Thus he compelled recognition, and the government that had thought him dangerous in 1854 made him professor in the Ecole des Beaux-Arts in 1864. Here he gave several series of lectures on the history of art that are models of philosophic criticism and, applying the same principles in another field, published a monumental *Histoire de la littérature anglaise* (1864). Then followed *Idéalisme anglais* (1864); *Positivisme anglais* (1864), the latter a study of J. S. Mill; *Philosophie de l'art* (1865); *Philosophie de l'art en Italie* (1866); *Voyage en Italie* (1866–72); *L'Idéal dans l'art* (1867); the cynically amusing *Notes sur Paris* (1867); the important *De l'intelligence* (1870); *Notes sur l'Angleterre* (1872); and finally his greatest work, *Origines de la France contemporaine*, consisting of *Ancien régime* (1875), *La révolution* (1878–84), and *Régime moderne* (1890). Most of his works have been translated into various languages.

Taine was the theorist of naturalism, of immense yet systematized erudition, and of a logic that was almost mechanical. He represents in criticism the scientific spirit that was making itself felt almost simultaneously in all branches of French intellectual activity, in the poetry of the Parnassians, the philology of Renan, the fiction of Flaubert, the dramas of the younger Dumas, the high art of Meissonier, and the low art of Forain. The analytic, meticulous spirit of his generation found in his "little facts, well chosen, important, significant, amply substantiated, minutely noted, the material of every science." He sought to make psychology, æsthetics, and literary criticism into exact sciences, capable of rigorous analysis and systematic deduction. His is always the interest of the naturalist, not of the artist. The style was like the man and like the philosophy, grave, sincere, simple, almost always serene. There is in his work hardly a trace of irony, of strain, or of enthusiasm, none at all of sentimentality or of mysticism. His system may not have been deep, but it was wonderfully opportune, and Taine was a guiding light to the intellectually productive men of France almost until his death. Oxford gave him an honorary degree of LL.D. in 1871. He was tardily elected to the French Academy in 1878.

Bibliography. *H. Taine: sa vie et sa correspondance* (3 vols., Paris, 1902–05; Eng. trans. by Devonshire, London, 1902–08); Paul Bourget, *Essais de psychologie contemporaine*, vol. i (Paris, 1887); Jules Lemaître, *Les contemporains*, vol. iv (ib., 1890–92); M. E. Boutmy, *Taine, Scherer, Laboulaye* (ib., 1901); V. Giraud, *Hippolyte Taine* (ib., 1901); P. Lacombe, *La psychologie des individus et des sociétés chez Taine* (ib., 1906); A. Aulard, *Taine, historien de la révolution française* (ib., 1907); F. B. Gummere, in *Democracy and Poetry* (Boston, 1911).

TAIN'TER, Charles Sumner (1854–). An American inventor. He was born at Watertown, Mass., and was educated in the public schools. In 1874 he was a member of the United States Transit of Venus Expedition to the Southern Pacific. He became known chiefly for his invention of a graphophone, for which he was made an Officer of Public Instruction (France) in 1889 and was awarded the John Scott medal by the city of Philadelphia in 1900. Tainter was also associate inventor of the radiophone, an instrument for transmission of sounds by the agency of light, and for his work in this connection was awarded a gold medal at the Paris Electrical Exhibition (1881).

TAI-PEH, tī'pā', or **TAI-PAK**, tī'păk' (pronounced by the Japanese *Dai-hokŭ*, dīhŏk'o͞o). The capital of the Japanese island of Formosa (q.v.). It is a small walled city, about 13 miles from Tamsui (q.v.), with which it is connected by rail as well as with Kelung (q.v.). Near it is found the large and populous town of Bangka or Mangka, the centre of the tea trade. The total population of Tai-peh proper and of the suburbs was, in 1911, 99,208, including nearly 6000 Japanese.

TAIPING (tī'pĭng') **REBELLION** (1850–64). The greatest civil war of Chinese history. It started as an obscure religious movement and soon changed into a revolt against the Manchu monarchy. It spread rapidly over south China, and by 1853 the old capital of Nanking was captured. An expedition against Peking failed. The organization of an Imperial army corps on modern military principles by the American Ward (died 1863), who was succeeded by General Gordon, practically saved the Manchu dynasty. By July, 1864, Nanking was recaptured and the rebellion collapsed. Estimates of the number of people killed in the revolt run into the millions (some authorities say 20,000,000), while the property and economic loss to China is incalculable. See China, *Modern History;* Hung Siu-ts'euen; Manchus; Ward, F. T.

TAIRA, tä'ē-rä. A Japanese clan of Imperial descent, one of the four great families, Fujiwara, Minamoto, and Tokugawa being the others, which have been most distinguished in the history of Japan. The Taira family was established in the ninth century, when some of its members were given the control of provinces in the west. In 814 another house, the Minamoto, also of Imperial descent, had been put in control in the east. For centuries the Taira and the Minamoto were content in their respective spheres, but in the twelfth century they came into conflict over the succession to the Imperial throne. The head of the Taira was Kiyomori, a man of great ability and of large experience in warfare. He was successful in his plans, defeated the Minamoto, and made himself supreme in the Empire. He took the office of Prime Minister from the Fujiwara family, married his daughter to the Emperor, filled all important offices with his clansmen, humiliated the Fujiwara nobles, and attempted the extermination of the Minamoto family. After his death, in 1181, the Minamoto clan obtained possession of the eastern part of Japan and then of Kyoto. The Taira retreated westward, were pursued by Yoshitsune, and finally defeated in 1185 in the sea fight of Dan-no-Ura. The clan was nearly exterminated and never regained its importance.

TAIRA, tī'rȧ. A South American weasel-like carnivore. See Tayra.

TAIREN, tī'rĕn'. The Japanese name for Dalny (q.v.).

TAI SHAN, tī'shăn'. The most easterly of the Five Yo or great sacred mountains of China, whose worship goes back into the fabulous period of Chinese history. It is a great massive complex of rugged limestone ridges, buttressed on the east and southeast by the mountains and hills which cover most of the Shantung peninsula. Its highest peak is 4111 feet above the level of the sea. It is about 60 miles south-southeast of Tsinanfu, the capital of Shantung (q.v.), and is dotted, especially on the south side, with Buddhist and Taoist temples, monasteries, and pavilions. It is annually visited by tens of thousands of pilgrims from all parts of the country.

TAIT, tāt, Archibald Campbell (1811–82). Archbishop of Canterbury. He was born in Edinburgh and was brought up as a Presbyterian. During his studies at the University of Glasgow (1827–29) he determined to enter the ministry of the Church of England and went up to Balliol College, Oxford, in 1830. He took his degree there (1833), was fellow (1834), and ordained (1836). He refused to be carried away by the Oxford movement and joined with three other tutors in a famous protest against the principle involved in Tract XC. In 1842 he succeeded Dr. Arnold as head master of Rugby, which he left in 1850 for the deanery of Carlisle. He was a member of the important Oxford University Commission (1850–52). In 1856 he became Bishop of London and, amid the difficulties of times full of bitter controversy, won the respect of all by his devotion and impartiality. The same may be said of his administration of the primacy, on which he entered at the beginning of 1869. Though liberal in sympathy, he was tolerant towards the ritualists throughout the excitement which caused the passing of the Public Worship Regulation Act in 1874, and on all questions showed independence and firmness. Consult: A. C. Bichley, *Public Life of the Late Archbishop of Canterbury* (London, 1883); Davidson and Benham, *Life of Archibald, Campbell Tait* (2 vols., ib., 1891); James Bryce, *Studies in Contemporary Biography* (New York, 1903); Paul Thureau-Dangin, *English Catholic Revival in the Nineteenth Century* (2 vols., London, 1914).

TAIT, Sir Melbourne McTaggart (1842–). A Canadian jurist. He was born at Melbourne, Province of Quebec, studied at St. Francis College, and graduated in law at McGill University in 1862. Called to the bar in 1863, he practiced his profession at Richmond and later in Montreal, where he became a partner of Sir J. J. C. Abbott and a leader of the provincial bar. He was appointed a puisne judge of the Superior Court of the Province of Quebec in 1887, Assistant Chief Justice thereof in 1894, and was Chief Justice from 1906 until 1912, when he retired. In 1897 he was knighted.

TAIT, Peter Guthrie (1831–1901). A Scottish physicist, born at Dalkeith and educated at Edinburgh University and Peterhouse, Cambridge, where he was made a fellow in 1852. He was appointed professor of mathematics in Queen's College, Belfast, in 1854, and was professor of natural philosophy in the University of Edinburgh from 1860 to the time of his death. He carried on many important investigations in mathematics and physics, particularly on the mathematical and theoretical side of the latter science. His most famous work in mathematics was on quaternions, while his studies in thermodynamics and thermoelectricity were of unusual value. His papers on the kinetic theory of gases are among his many important contributions to science, and his works cited below are marked by conciseness and lucidity of statement. He was the author of *Dynamics of a Particle* (1865); the important *Natural Philosophy* (1867), with Lord Kelvin (then Sir William Thomson); *Quaternions* (1867); *Thermodynamics* (1868); *Recent Advances in Physical Science* (1876); *Heat* (1884); *Light* (1884); *Properties of Matter* (1885); *Dynamics* (1895). He also wrote, with Balfour Stewart (q.v.), *The Unseen Universe* (1875; new ed., 1901). His *Scientific Papers* were collected in two volumes (1899–1900). Consult C. G. Knott, *Life and Scientific Work of P. G. Tait* (Cambridge, 1911).

TAIT, Robert Lawson (1845–99). A British gynæcologist, born and educated at Edinburgh. He settled in 1870 in Birmingham, where he became the leading gynæcologist of his time and country. A violent opponent of Lister and his theory, he asserted that there was no connection between bacteria and disease. He performed hundreds of gynæcological operations with hardly a death, the secret of his success lying partly in his great skill and partly in the use of warm or boiled water for flushing the field of operation—in reality this was the best asepsis. In 1879 Tait first excised the normal ovaries and thus became the pioneer in this kind of gynæcological operation. Among many important operations he introduced hepatomy in 1880. Besides numerous essays he published carefully prepared statistics on his operations. He stated it as a rule in medicine that an exploratory laparotomy should be performed in every case of obscure abdominal or pelvic disease that seemed to threaten life.

TAI-TSU. See Hung-Wu.

TAITTIRIYA, tī'tē-rē'yȧ (Skt., from *Tāittiri*, name of an ancient Hindu sage). The title of a school and of a redaction of the Yajur-Veda. See Veda.

TAIWAN, tī'wän' (Chin., terraced bay). The name by which the island of Formosa (q.v.) is known to both the Chinese and the Japanese.

TAIYUENFU, tī'yōō-ĕn'fōō', or **TAIYUEN**. A walled city of China, capital of the Province of Shansi (Map: China, K 4). It stands between loess-covered hills near the head of a fertile plain, 30 or 40 miles wide, about 70 miles long, 3000 feet above the level of the sea. Both coal and iron are worked near the city on the west, and there are silver mines about 65 miles north. The coal is bituminous and is of fine quality. The city consists, like Peking, of an inner and an outer city, the inner on the north and the outer on the south. The former measures 2⅔ miles by 1⅔, is surrounded by walls of moderate height, and has eight gates with towers over each and on the corners. The outer city is surrounded by mud walls, with three gates, one of which was kept closed for Imperial use. Among the buildings worthy of mention is the Wan-Show Kung (palace of ten thousand ages), arranged as a temple, roofed with yellow tiles, and containing one room. The city has one of the best educational institutions in China, known as Shansi University. Taiyuenfu also possesses a gun and cannon foundry. Pop., 250,000.

TAJAÇU, tä'yȧ-sōō'. See Peccary.

TAJIKS, tȧ-zhēks'. The term applied particularly to the rural population of eastern Persia and generally to their representatives and congeners scattered from Constantinople to the borders of China and from Orenburg to the Indian Ocean. It is sometimes more of a descriptive than a racial epithet. There are "mountain Tajiks" and "Tajiks of the Plain"—the Galchas (q.v.) of the Pamir being also known as "mountain Tajiks." The tajiks are rather above the average in height, brachycephalic, and show traces of Turkish intermixture. Consult Henry Houssay, *Les races humaines de la Perse* (Paris, 1887), and Ujfalvy, *Les Aryens au nord et au sud de l'Hindou Kouch* (ib., 1896).

TAJ MAHAL, täj mȧ-häl′ (Pers., crown of Mahal). A mausoleum of white alabaster, a mile east of Agra (q.v.), India, built (1629–50) by Shah Jehan as a burial place for his favorite wife, Mumtaz-i-Mahal. It is said to have cost over $9,000,000. The building is octagonal, 130 feet in length and width and 70 feet high, exclusive of the dome, which rises 100 feet above the main mass. Four exquisite cylindrical minarets, 133 feet high, mark the corners of the superb platform on which it stands. In the central chamber, above the vault containing the bodies of the Emperor and his wife, are two cenotaphs surrounded by an alabaster screen of delicate open-work inlaid with precious stones. The interior is lighted by the diffused daylight which filters through the translucent alabaster of the dome and through windows fitted with perforated alabaster screens. The exterior is covered with arabesques and passages from the Koran in inlays of precious stones. The whole edifice on its platform is set in a foursquare inclosure adorned with a magnificent gateway and two mosques, all of red sandstone and white marble. The Taj is unquestionably the most beautiful edifice of the seventeenth century in any land, and the supreme achievement of Mohammedan art (q.v.).

TAKABE, tä′kä′bȧ, HIKOJIRŌ KENKŌ (1664–1739). A distinguished Japanese mathematician, born in Tokyo (then Yeddo). He was the favorite and most distinguished pupil of Seki (q.v)) and was very influential in making the *yenri* (circle principle), or native Japanese calculus, known to his countrymen.

TAKAHASHI, tä′kȧ-hä′shė, KOREKIYO, BARON (1854–). A Japanese financier, born in Yeddo. He studied in America in 1867–68, became an official in the Japanese Department of Agriculture and Commerce in 1881, and later was director of the Patent Bureau. Between 1892 and 1913 he was connected with the Bank of Japan, for several years being its governor. After 1906 he was also president of the Yokohama Specie Bank. He visited England and America twice between 1904 and 1906 to arrange loans in connection with the Russo-Japanese War, and for his services was created Baron in 1907. He served as Minister of Finance in 1913–14.

TAKAHIRA, tä′kȧ-hē′rȧ, KOGORO (1854–). A Japanese diplomat, born in Iwate. He held several minor positions, was Consul General at New York in 1887, and after acting as Minister at The Hague, Rome, and Vienna, and as Assistant Foreign Minister (1899), was Minister at Washington (1900–05). He served as the junior Japanese plenipotentiary at the Portsmouth Peace Conference in 1905. Takahira was created Baron in 1905 and became a member of the House of Peers in 1906. He was appointed Ambassador to Italy in 1907 and served in the same capacity at Washington in 1908–09.

TAKAMATSU, tä′kȧ-mät′sụ. The capital of the Prefecture of Kagawa in Japan, on the north coast of Shikoku (Map: Japan, D 6). It has a fine landscape garden in its southern suburb. Pop., 1908, 42,578.

TAKAMINE, tä′kȧ-mē′nĕ, JOKICHI (1854–). A Japanese-American chemist. He was born in Takaoka, Japan, and graduated (1879) as a chemical engineer at the University of Tokyo, afterward studying for two years at Glasgow. In 1881 he was made chief chemist of the Japanese Department of Agriculture and Commerce and later was Assistant Commissioner of the Patent Office. In 1890 he came to the United States and established a research laboratory in New York City. He gave much attention to the study of diastatic ferments and produced takadiastase, used as a starch digestant. With Aldrich he also isolated adrenalin (q.v.). Honors came to him from Japanese and other societies.

TAKAMORI, SAIGO. See SAIGO TAKAMORI.

TAKAO. See TAKOW.

TAKAOKA, tä′kȧ-ō′kȧ. A town in the Prefecture of Toyama, central Hondo, Japan, 10 miles by rail northeast of Kanazawa (Map: Japan, E 5). It manufactures dyes and hardware. Pop., 1908, 33,603.

TAKASAKI, tä′kȧ-sä′kė. A town in the Prefecture of Gumma, central Hondo, Japan, situated 63 miles by rail northwest of Tokyo (Map: Japan, F 5). It has manufactures of cotton and silk. Pop., 1898, 30,893; 1908, 39,961.

TAKASHIMA, tä′kȧ-shē′mȧ. A small island of Japan, about 8 miles southwest of the entrance to the harbor of Nagasaki (Map: Japan, J 2). It has an extensive coal mine, which dates from the middle of the eighteenth century.

TAKATA, tȧ-kä′tȧ. A town in the Prefecture of Niigata, north Hondo, Japan, 42 miles by rail north of Nagano. It has extensive manufactures of cotton goods (Map: Japan, F 5). Pop., 1898, 20,315; 1908, 28,021.

TAKELMA, tȧ-kĕl′mȧ, or **TAKILMAN** (tȧ-kĭl′man) **STOCK**. A small linguistic family of Indians in southwestern Oregon, with a culture similar to that of other northern California tribes. They were reduced to a single representative in 1910. Consult Sapir, *American Anthropologist*, vol. ix (1907).

TAKIN, tä′kēn, or GNU GOAT. A goatlike animal (*Budorcas taxicolor*) of eastern Tibet, allied to the serow (q.v.), but having horns (in both sexes) bent at right angles.

TAKOW, or **TAKAO**, tä′kou′. A village on the west coast of Formosa, thrown open in 1864 by the Chinese for foreign residence and trade and continued as a treaty port by the Japanese (Map: Japan, D 9). It lies 20 miles south of Tainan (q.v.), with which it is connected by rail, and on the edge of a fertile plain inhabited chiefly by immigrants from Kwangtung and producing good crops of rice, sugar, etc. There is a considerable export of sugar. Pop., 1911, 14,649.

TAK-TI-KESRA. See CTESIPHON.

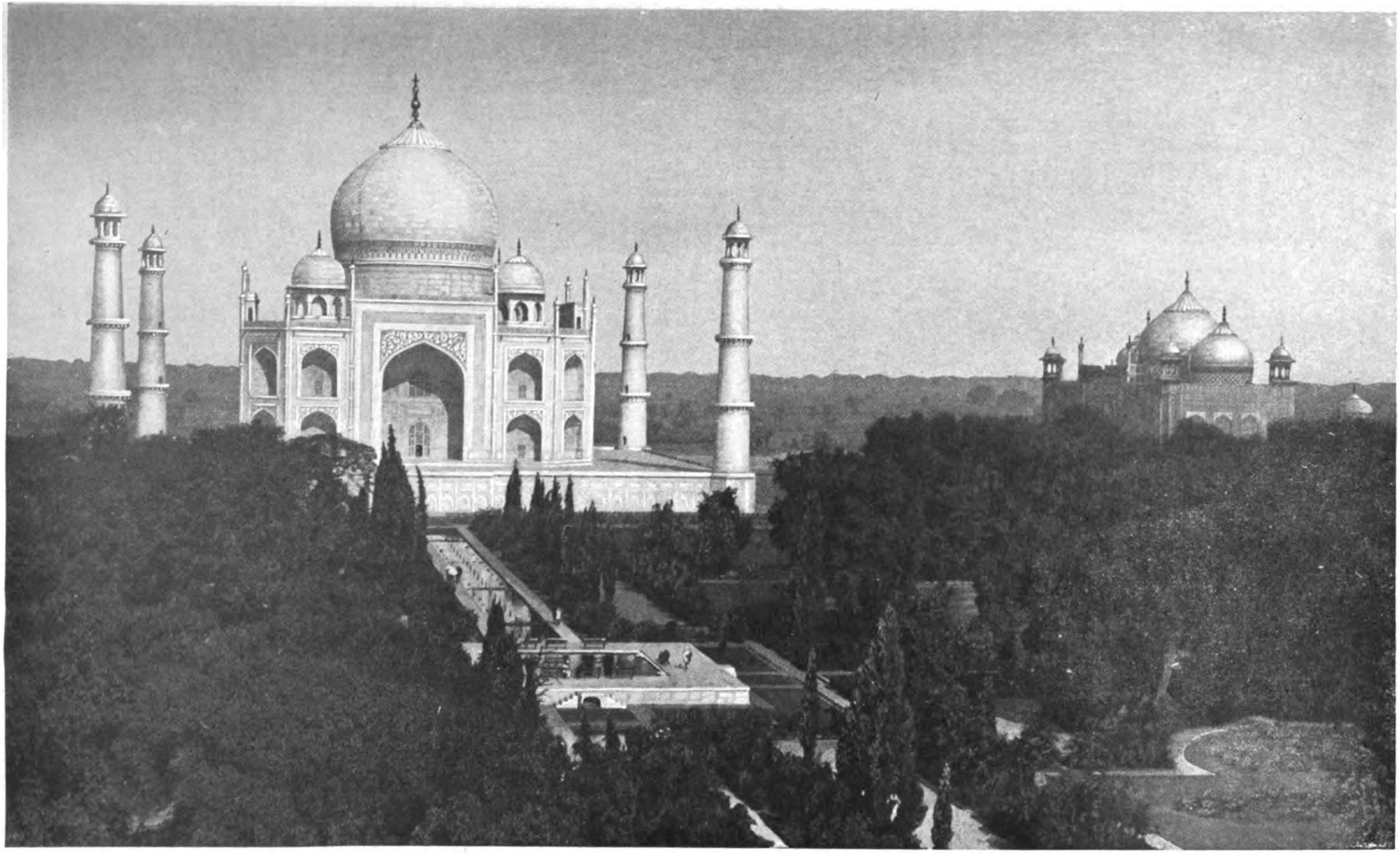
TAKU, tä′ko͞o′. A village in the Province of Chihli, north China, near the mouth of the Pei-ho, 30 miles east of Tientsin (Map: China, L 4). It is known for its strong fortifications, which were taken by the British and French in 1860 and by the allied troops on June 17, 1900, during the Boxer uprising.

TAKU, tä′ko͞o. See TLINKIT.

TAKULLI. See TACULLI.

TALAING, tȧ-lä′ĭng. See INDO-CHINESE; KLINGS; MONS.

TALAVERA DE LA REINA, tä′lȧ-vā′rȧ dȧ lȧ rā′ē-nȧ. A town of New Castile, Spain, in the modern Province of Toledo, 83 miles by rail southwest of Madrid, on the Madrid-Valencia de Alcántara Railroad (Map: Spain, C 2). It is charmingly situated on the right bank of the Tagus, which is here spanned by a quarter-



THE TAJ MAHAL

mile bridge of 35 arches. The town is in a fertile, well-watered valley and boasts a silk-weaving industry, important potteries, and cloth, hat, leather, soap, and varnish factories. Pop., 1900, 9990; 1910, 12,357. An important battle took place here July 27 and 28, 1809, in which Wellington and the Spanish forces defeated the French under Joseph Bonaparte, Jourdan, and Victor.

TALBOT, tạl′bŭt. See Hound.

TALBOT, Arthur Newell (1857–). An American civil engineer. He was born at Cortland, Ill., and was educated at the University of Illinois (B.S., 1881; C.E., 1885). He engaged in civil-engineering work and made investigations of steel, brick, reënforced concrete, and other materials of construction. After 1890 he was professor of municipal and sanitary engineering and in charge of theoretical and applied mechanics at the University of Illinois. Talbot served as president of the Society for the Promotion of Engineering Education in 1910–11 and of the American Society for Testing Materials in 1913–14. He wrote: *The Railway Transition Spiral* (3d ed., rev., 1901); *Tests of Concrete* (1906); *Tests of Reinforced Concrete Beams* (1909); *Tests of Columns* (1912); *Tests of Reinforced Concrete Buildings under Load* (1913).

TALBOT, Charles, twelfth Earl and only Duke of Shrewsbury (1660–1718). An English statesman. He was the son of the eleventh Earl, his mother being the notorious Anna Maria Brudenell, the mistress of the Duke of Buckingham, who in a duel killed Charles's father. He was educated as a Roman Catholic, but after the Popish Plot attached himself to the Anglican church. Although a prominent official at the coronation of James II in 1685, he was one of the seven noblemen who invited William, Prince of Orange, to England. He was Secretary of State for the northern province from 1689 to 1690 and again in 1694, on the latter occasion being made Knight of the Garter and created Marquis of Alton and Duke of Shrewsbury. In 1710 he was appointed Lord Chamberlain by Queen Anne, in 1712 Ambassador to France, and in 1713 Lord Lieutenant of Ireland. Two days before her death, in 1714, the Queen appointed him Lord High Treasurer. Under George I he was Lord Chamberlain.

TALBOT, Henry Paul (1864–). An American chemist. He was born in Boston, Mass., and graduated in 1885 at the Massachusetts Institute of Technology, where by 1902 he had become professor of inorganic and analytical chemistry, with charge of the department of chemistry and chemical engineering. In 1890 he had taken his Ph.D. at Leipzig. During 1892–94 he lectured on chemistry at Wellesley College. He published many papers in technical chemistry, on which he became an authority, and *Introductory Course of Quantitative Chemical Analysis* (1897); *Bibliography of the Analytical Chemistry of Manganese* (1902); *The Electrolytic Dissociation Theory* (1905), with A. A. Blanchard.

TALBOT, John, first Earl of Shrewsbury (c.1388–1453). An English general of Welsh descent. Henry V appointed him Lord Lieutenant of Ireland in 1414, where he was engaged in subduing some of the septs and in other military operations. In 1419 he went to France and took an active part at the sieges of Melun and Meaux and in the battle of Verneuil. In 1424 he received the Order of the Garter and again became Lord Lieutenant of Ireland under Henry VI. In 1427 he again returned to France and after numerous successes in Brittany was taken prisoner at Patay in 1429 by Joan of Arc. The ransom demanded for his release was so high that he did not regain his freedom until 1433 and then by exchange. In 1442 he was created Earl of Shrewsbury and in 1446 Earl of Waterford, Lord of Dungarvan, and Steward of Ireland. With the exception of an interval of rule in Ireland from 1445 to 1447, the rest of his life was spent in France, where he was killed at the battle of Castillon in 1453.

TALBOT, John (1645–1727). One of the early Church of England missionaries in America. He was rector of Freetherne, but resigned his living to come to America with the first missionaries sent by the Society for the Propagation of the Gospel. He was the founder and first rector of St. Mary's Church, Burlington, N. J., and labored diligently there and in other Colonies. There is considerable evidence for believing that he was consecrated Bishop by the Nonjurors (q.v.) in 1722, 60 years before Seabury obtained consecration from the Scottish bishops. Talbot is said occasionally to have assumed the episcopal dress and to have administered confirmation privately. In 1724 he was forbidden to officiate because he refused to take the oath of allegiance. Consult Hills, *John Talbot, the First Bishop of North America* (Trenton, 1878), and id., *History of the Church in Burlington* (2d ed., ib., 1885).

TALBOT, Richard, Duke and Earl of Tyrconnel. See Tyrconnel, Richard Talbot, Duke and Earl of.

TALBOT, Silas (1751–1813). An American naval officer, born in Dighton, Mass. He was engaged, as a boy, in the coasting service and in June, 1775, after the outbreak of the Revolutionary War, entered the American army as lieutenant, serving at Boston and becoming a captain of infantry in January, 1776. At New York in 1776 he made an attempt, by means of a fire ship, to destroy a part of the English squadron in the harbor, and on Oct. 7, 1777, Congress promoted him to the rank of major. He was wounded (Oct. 23, 1777) at Fort Mifflin, served with gallantry at Butt's Hill (Aug. 29, 1778), and on Oct. 28, 1778, in command of a small sloop, captured off Newport the British blockading schooner *Pigot*. For this he was commissioned lieutenant colonel by Congress on November 14. He became a captain in the United States navy Sept. 17, 1779, and was directed to protect the Long Island coast and to keep General Gates's communications open. In May, while in command of the *Pigot* and the *Argo*, he captured the British schooner *Lively* and two privateers, and subsequently defeated and captured the *King George* and the *Dragon*, the latter after a four hours' battle. He was taken by the British in 1780 and treated with severity, being confined in the prison ship *Jersey* and afterward in the Old Sugar House, and then being taken to England, where he was exchanged in 1781. After the war he was a member of Congress (1793–94). The frigate *Constitution* (q.v.) was built under his supervision and in 1799 was his flagship during a cruise in the West Indies. Owing to a dispute with Commodore Truxtun concerning priority in rank, he resigned in 1801. Consult Tuckerman, *The Life of Silas Talbot* (New York, 1850).

TALBOT, WILLIAM HENRY FOX (1800–77). An English photographer and philologist, known as one of the pioneers in photography. He was educated at Cambridge and for a short time was member of Parliament for Chippenham. The first problem to attract his attention was that of fixing shadows, and by patient research he was gradually led to the discovery of a process of obtaining and fixing sun pictures. On the dissemination of a report as to Daguerre's successes in the same field, Talbot secured his just rights by publishing a paper (*Phil. Mag.*, March, 1839) in which the successive steps of his investigation and their result were detailed. This process was subsequently improved by his invention (1841) of the calotype process. His discoveries and inventions in photography are described in his *Pencil of Nature* (1844–46). In later life he devoted himself to the study of philology and archæology and was one of the first to read the cuneiform inscriptions of Nineveh. Among his works are: *Hermes, or Classical and Antiquarian Researches* (1828–39); *Illustrations of the Antiquity of the Book of Genesis* (1839); and a work on *English Etymologies* (1846). See CALOTYPE; PHOTOGRAPHY.

TALC (Fr. *talc*, Sp. *talco*, *talque*, from Ar. *ṭalq*, talc). A silicate of magnesium containing a small percentage of water. It has a pearly or semimetallic lustre, is soft, and is silvery white to gray or green in color. Talc seldom occurs in crystals, and its system of crystallization is still in doubt; it is usually found in foliated or granular masses. Talc is an exceedingly common mineral and in some regions is found in large beds. The granular massive varieties are commonly known as soapstone and find extensive use in commerce as slabs for hearthstones, mantels, sinks, etc., and when powdered, as a pigment, in paper making, as a lubricator, for dressing skins and leather, etc. The fine granular or cryptocrystalline varieties are used for marking purposes under the name of French chalk. In 1913, 149,271 tons, valued at $1,280,020, were mined in the United States.

TALCA, täl'kȧ. A province of Chile (Map: Chile, E 5). Its area is 3834 square miles. It is mountainous, with the Andes in the east and the lower coast range in the west, and the central portion is covered with plains interspersed with low hills. The mountains are well wooded, and the interior is very fertile. Wheat is the chief agricultural product, and grazing is carried on extensively. Pop., 1907, 132,155; 1910, 132,730.

TALCA. The capital of the Province of Talca, Chile, on the left bank of the Claro River, a tributary of the Maule, 140 miles south of Santiago on the Santiago-Concepción Railway (Map: Chile, E 5). It has a variable and disagreeable climate. The chief industry is the weaving of *ponchos* (woolen blankets). Pop., 1903, 43,331; 1912 (est.), 39,097.

TALCAHUANO, täl'kȧ-wä'nō. A seaport of Chile, on the Pacific coast, 9 miles north of Concepción. The town is located on a peninsula which partly incloses an excellent harbor, the entrance of which is protected by the island of Quiriquina and a breakwater. Government arsenals and dockyards are located here. Talcahuano will be the Pacific terminus of the transcontinental railway from Bahia Blanca, Argentina. Wheat grown in the interior provinces of Santiago and Valdivia, with which the town has railway connection, is exported. Pop., 1912, 16,261. Talcahuano was founded as a military post in 1780 and was almost totally destroyed by an earthquake in 1835.

TALC ROCK. See SOAPSTONE.

TALENT (Lat. *talentum*, from Gk. *τάλαντον*, *talanton*, talent, weight, balance; properly, a supporter, as connected with *τλῆναι*, *tlēnai*, to bear, support, Lat. *tollere*, to lift, Skt. *tulā*, balance). The maximum unit of weight and value among the later Greeks; the equivalent of 60 minæ or 6000 drachmæ. In the Homeric poems the word is used to signify a small weight of gold (two talents are worth less than a handsome bronze caldron). While the name is Greek, the weight came from Babylonia and Phœnicia. There a system of 60 shekels to a mina (q.v.) and 60 minæ to a talent was employed in early times and in two forms, a common and a royal, the latter being about one-twentieth heavier than the common. Furthermore, both forms had a heavy and a light system. Moreover, in weighing gold, 50 shekels were reckoned to a mina, or 3000 instead of 3600 to a talent. For silver, again, a new standard was introduced, so arranged that while the ratio in value of silver to gold was 1 to 13½, the ratio of weight should be 1 to 10 (Babylonian) or 1 to 15 (Phœnician). The royal forms seem also to have varied at different times. The Greeks, in borrowing these systems, naturally varied them somewhat, and we therefore find considerable variety among the different Greek states. A very slight variation in the weight of the shekel, or drachma, would make a large difference in the talent. Of the chief Greek systems the Æginetan is not exactly identical with any of the Eastern standards, but is perhaps connected with a Babylonian royal form, and at any rate seems to have been adapted to the trade of Ægina with Asia Minor. This talent weighed about 37.8 kilograms. The other common standard was the Euboic-Attic with a talent of about 26 kilograms, which has been usually connected with the common light Phœnician standard, though recent writers prefer to connect it with the Babylonian. In Athens this was used in reckoning money, while in the market a talent of about 37 kilograms was employed. The value of the Attic silver talent, which was not a coin but a sum of money, was about $1080. Consult the article "Pondera," in William Smith, *A Dictionary of Greek and Roman Antiquities*, vol. ii (3d ed., London, 1891), and G. F. Hill, *Handbook of Greek and Roman coins* (ib., 1899). See DRACHMA; MINA; SHEKEL.

TALENTI, tȧ-lĕn'tē. The name of two Florentine architects, father and son. FRANCESCO TALENTI, the father, was probably born about 1305 at Pontelieve, near Florence, and was employed as early as 1329 on the cathedral of Orvieto. He appears to have succeeded Taddeo Gaddi as architect of the campanile of the cathedral of Florence, begun by Giotto (q.v.), of which he built the upper three stories. In 1555 he was employed to make a new and enlarged design for the nave of the cathedral, which was built after his model and nearly completed at his death (c.1370).

His son SIMONE assisted him in preparing the model and in 1375 was appointed chief architect of the cathedral. In association with Benci di Cione, Simone designed the Loggia dei Lanzi and supervised the greater part of its erection.

He also designed the lower part, at least, of the granary church of the Or San Michele. The dates of his birth and death are not known.

TALE OF A TUB. 1. A comedy by Ben Jonson, licensed in May, 1633, and printed in folio in 1640. 2. A religious satire by Jonathan Swift, published anonymously in 1704. It deals with the various alterations which three brothers make in the coat which their father has bequeathed to them. Peter stands for the Roman Catholic church, Martin for the Lutherans, and Jack (from John Calvin) for the extreme Protestants.

TALE OF TWO CITIES, A. An historical novel by Charles Dickens, first published serially in *All the Year Round* in 1859, and later in book form. Its scene is laid partly in London and partly in Paris during the French Revolution. See Defarge, Thérèse.

TALE SAP. See Tonle Sap.

TALES′MEN (from Lat. *tales*, nom. pl. of *talis*, such, from the initial word in the summons of the original Latin phrase *tales de circumstantibus*, such of the bystanders + Eng. *men*). Men called to supply a deficiency in the number of jurors in a panel. In some jurisdictions a list of competent men is kept by the proper officials for this purpose, and in many States, in an emergency, the court may call upon bystanders to fill the panel. Jurors thus summoned are called talesmen. See Jury.

TALES OF A GRANDFATHER. A collection of historical pictures, by Sir Walter Scott, of England, Scotland, and France.

TALES OF A TRAVELER. A series of sketches and stories by Washington Irving (London and New York, 1824), the scenes of which are laid in England and France.

TALES OF A WAYSIDE INN. A collection of poetical narratives by Henry Wadsworth Longfellow (q.v.), published in three parts in 1863, 1872, and 1873, later combined. The Wayside Inn was an old tavern at Sudbury, Mass., where three of the characters of the *Tales* spent their summers—T. W. Parsons, Luigi Monti, and Daniel Treadwell (qq.v.). The other persons introduced include Ole Bull (q.v.) as the Musician, Israel Edrehi as the Spanish Jew, and Henry Ware Wales as the Student.

TALES OF MY LANDLORD. The name given by Sir Walter Scott to four different sets of his novels. Their publication was begun in 1816 under the fictitious editorship of Jedediah Cleishbotham (q.v.). The first set contained *The Black Dwarf* and *Old Mortality;* the second (1818), *The Heart of Midlothian;* the third (1819), *The Bride of Lammermoor* and *The Legend of Montrose;* and the fourth (1832), *Count Robert of Paris* and *Castle Dangerous.*

TALES OF THE CRUSADERS. The name given by Sir Walter Scott to *The Betrothed* and *The Talisman* (1825).

TALES OF THE GENII. A series of Oriental stories, modeled on the *Arabian Nights*, by James Ridley, published in London in 1764.

TALFOURD, ta̤l′fẽrd, Sir Thomas Noon (1795–1854). An English lawyer and author, born at Reading in Berkshire. He studied law with Joseph Chitty (q.v.) and was called to the bar at the Middle Temple (1821). He was eventually elected to the bench in the Court of Common Pleas (1849). His famous case was a defense of Edward Moxon, who was prosecuted for publishing Shelley's *Queen Mab.* Entering Parliament in 1835, he championed the copyright bill (1837), which he himself had introduced. In recognition of his service *Pickwick* was dedicated to him. With Lamb his name is especially associated by *Letters of Charles Lamb with a Sketch of his Life* (1837) and *Final Memorials of Charles Lamb* (1848). In 1875 these two books were published together under the title *Memoirs of Charles Lamb.* They have since been edited by Percy Fitzgerald (London, 1892). Talfourd's great literary success was *Ion*, a tragedy performed by Macready (May 26, 1836). It was followed by *The Athenian Captive* (1838) and *Glencoe* (1840). Consult the *Tragedies* (Routledge's Pocket Library, New York, 1889); *Critical and Miscellaneous Writings* (Philadelphia, 1842); his essays in *Modern British Essayists*, vol. vii (ib., 1848–50); and *A Memoir of Mr. Justice Talfourd* (London, 1854).

TALIAFERRO, tȧl′yȧ-fĕr′rō̇, Mabel (1887–). An American actress, born in New York City. She first appeared on the stage when two years old and played child parts with J. A. Herne in *Shore Acres*, and with Chauncey Olcott. She first attracted notice as Esther Ansell in *The Children of the Ghetto* (1899). Other rôles included Lovey Mary in *Mrs. Wiggs of the Cabbage Patch* (1903); Polly in *Polly of the Circus* (1907), a great success; Edith in *My Man* (1910). In 1913–14 she played in *Young Wisdom.* Her sister, Edith Taliaferro, also became known as an actress.

TALIAFERRO, tŏl′ĭ-vẽr, William Booth (1822–98). A Confederate soldier, born at Belleville in Gloucester Co., Va. He attended Harvard College and graduated at William and Mary College in 1841. At the beginning of the Civil War he was made a colonel in the provisional Army of Virginia. He participated in most of the battles fought by the Army of Northern Virginia prior to March, 1863, and was promoted brigadier general in March, 1862. In March, 1863, he was put in command of the district of Savannah, Ga. In the following July, at the time of the desperate attacks on Fort Wagner, he was in command of the defenses on Morris Island and in August of those on James Island. In 1864 he commanded the Seventh Military District, comprising a part of South Carolina, and in December was given command of the entire State. He was promoted major general Jan. 1, 1865. After the war he resumed the practice of law and served for 10 years in the Virginia House of Delegates.

TA-LIEN-WAN, tä′lī-ĕn′wăn′. A bay on the east coast of the Liaotung Peninsula in Manchuria (Map: China, M 4). It is deep, roomy, ice-free throughout the year, and protected at the entrance by two islets. At its head lies the port of Dalny (q.v.), or Tairen. Ta-lien-wan with the surrounding territory was leased by China to Russia in 1898 and surrendered to Japan in 1905.

TALIESIN, tăl′ĭ-sĭn. A British bard, who is supposed to have lived about the middle of the sixth century. Nothing definite is known as to his career, and some scholars hold that he is a mythical personage. According to legend he was called "the chief of the bards." The "Book of Taliesin" contains 56 poems, which were formerly attributed to Taliesin. All are now generally believed to be of a later date. Consult W. F. Skene, *The Four Ancient Books of Wales* (2 vols., Edinburgh, 1868), in which the "Book of Taliesin" is included; for the legends, Lady Charlotte Guest, *Mabinogion* (London, 1902).

TALIPES, tăl'ĭ-pēz. The technical term for clubfoot (q.v.).

TAL'IPOT PALM (Hind. *tālpāt*, from Skt. *tālapatra*, palm-tree leaf, from *tāla*, palm tree + *patra*, leaf), Great Fan Palm (*Corypha umbraculifera*). The noblest palm of the East Indies, a native of Ceylon, Malabar, etc. Its straight cylindrical trunk, 40 to 80 feet high, is crowned with a tuft of enormous palmate plaited leaves, divided near the outer margin into numerous segments, and united to the trunk by spiny leafstalks. The leaves are usually about 10 to 20 feet in diameter, exclusive of the leafstalk, which is 7 or 8 feet long. At the age of 30 or 40 years the tree produces a long pyramidal cluster of whitish flowers, rising to the height of 30 feet from the midst of its crown of leaves, and dividing into simple alternate branches, the lower of which sometimes extend laterally 20 feet. After maturing the numerous globose fruits (about 1½ inches in diameter) the tree generally dies. The leaves are used for covering houses, for making tents, and for many other purposes. The leaves of this palm are used in Malabar for writing upon, characters being traced with an iron style. They are prepared for this by boiling, drying, damping, rubbing, and pressing. The soft central part of the stem yields a kind of sago. The large ivory-like seeds are used for making buttons, ornaments, etc.

TALISAY, tä'lê-sī'. A town of Cebū, Philippines, situated 6 miles southwest from Cebū, near Lipata Point. Pop., 1903, 13,636.

TALISMAN, tăl'ĭs-man *or* tăl'ĭz- (Sp., Portug. *talisman*, from Ar. *tilsam*, *tulsam*, *tilism*, pl. *tilsamān*, talisman, from Gk. *τέλεσμα*, *telesma*, consecrated object, talisman). In its strict sense, a species of charm, consisting of a figure engraved on metal or stone when two planets are in conjunction or when a star is at its culminating point, and supposed to exert some protective influence over the wearer of it by keeping away diseases or bringing luck. While the proper distinctive character of the talisman thus resides in its astrological character, in common usage the terms "talisman" and "amulet" (q.v.) are synonymous, referring to any object used as a charm against evil spirits or evil influences. Consult Elworthy, *The Evil Eye* (London, 1895).

TALISMAN, The. A novel by Sir Walter Scott, published, with *The Betrothed*, in June, 1825. The action takes place in Palestine during the Crusades.

TALITE, tăl'īt. See Mannite.

TALKING MACHINE. An apparatus designed to reproduce vocal, musical, and other sounds from appropriate records or by combination of various elemental sounds in some mechanical form. The reproduction of human speech has been a problem that has appealed to physicists and investigators for many years, but the complexity of sounds due to minute variations in pitch, as shown in the overtones as well as in the amplitude of the vibrations, has rendered this a difficult accomplishment. In the phonograph (q.v.) the vibratory movement of a diaphragm was transferred through the cutting stylus to a cylinder covered with tin foil, and when this operation was reversed, a corresponding movement of the same or another diaphragm resulted in the reproduction of the original sound. The improvement of the phonograph, especially the use of a wax record cylinder or disk, has made possible a wide variation of its applications. It has been used to record sound reproduction for record, for the transmission of intelligence, for use in dictation and transcribing, and in the rendering of vocal and instrumental music. In each of these, as well as in other fields, talking machines have been developed especially adapted for the purpose in view, and they have become widely employed and with considerable success. The greatest vocal artists of the opera and concert stage have recorded their voices for reproduction in this way. Instruction in modern languages, with the aim of securing the proper pronunciation and accent, thus can be carried on, and records of notable vocal utterances can not only be made permanent, but can be reproduced practically without limit through the manufacture of wax disks or cylinders on which the original record has been impressed. See Gramophone; Graphophone; Phonograph.

TAL'LADE'GA. A city and the county seat of Talladega Co., Ala., 60 miles by rail east of Birmingham, on the Southern, the Birmingham and Atlantic, and the Louisville and Nashville railroads (Map: Alabama, C 2). It is the seat of State schools for the deaf, dumb, and blind; of Talladega College (Congregational), an institution for colored students; of the Alabama Synodical College for Young Ladies (Presbyterian); and of a Presbyterian Orphans' Home. It contains a Carnegie library. Talladega has cotton mills, cottonseed-oil mills, a chemical plant, foundries and machine shops, and manufactures hosiery and fertilizers. It is a market for white marble. The city adopted the commission form of government in 1911. On the site of Talladega General Jackson, at the head of 2000 men, defeated a force of 1000 Creek Indians on Nov. 9, 1813, the Indians losing about 300 and the Americans 15 killed and 86 wounded. Pop., 1900, 5056; 1910, 5854.

TAL'LAHAS'SEE. The capital of Florida and the county seat of Leon County, 165 miles west of Jacksonville, on the Seaboard Air Line and the Georgia, Florida, and Alabama railroads (Map: Florida, B 1). It is finely situated on an eminence in the vicinity of several picturesque lakes and has wide and beautifully shaded streets. The Florida State College for Women (occupying a site overlooking the city), the Florida State Normal and Industrial College for colored students, the Lincoln High School for colored students and the Leon County High School are the leading educational institutions. The State Library has 9500 volumes, and there are also in the city the Supreme Court Library, with more than 7000 volumes, and the David S. Walker Library (formerly the University Library), with 6000 volumes. Other prominent features are the State Capitol, the county courthouse, the post office, and several parks. The district produces cotton, tobacco, and sugar cane and has dairying and stock-raising interests. Cottonseed oil, lumber, naval stores, iron products, and cigars constitute the principal manufactures. Tallahassee was laid out in 1824 on a site selected one year earlier as the seat of the Territorial government and was incorporated as a city in 1827. Pop., 1900, 2981; 1910, 5018.

TALL BUILDINGS. See Steel Skeleton Construction.

TALLEMANT DES RÉAUX, tȧl'mäN' dȧ rȧ'ō', Gédéon (1619–92). A French writer, born at La Rochelle and connected with the famous Rambouillet family. He took his degrees in law, but refused to go into the magistracy.

He employed his leisure in literary work, wrote verses in the taste of the time, and began a tragedy of *Œdipe*. He is chiefly remembered by his *Historiettes*, a series of biographical, anecdotal, and character sketches of contemporaries. Light, witty, cynical, less restrained than modern taste demands, they are an invaluable document of the period and particularly of the Hôtel de Rambouillet. They have been collected by Monmerqué, Levavasseur (1840), and Techener (1860). Tallemant also began the *Mémoires de la régence d'Anne d'Autriche*, intended to throw light upon the administration of Cardinal Mazarin. These have not come down to us.

TALLEYRAND-PÉRIGORD, tȧ'lȧ'räɴ'-pȧ'-rē'gôr', Charles Maurice, Duke de, Prince of Benevento (1754–1838). A French statesman, born in Paris. His father was an officer in the French army and fought through the Seven Years' War. Charles Maurice was the eldest son; on account of an accident in infancy which rendered him lame for life, he was trained for the Church at Saint-Sulpice, the Sorbonne, and Rheims. He showed brilliant talents, but neither moral purpose nor a calling for the Church. He obtained, however, several ecclesiastical benefices, among them the abbacy of Saint-Denis in the diocese of Rheims (1775) in the year of his ordination. Appointed agent general for the clergy in 1780, a lucrative and important post which brought him into close connection with the government, he began a serious apprenticeship in public business, but led a notoriously licentious life. In 1788 his administrative abilities secured for him the bishopric of Autun. As representative of his diocese in the States-General of 1789, he favored uniting with the Third Estate and thus won the good will of the popular party. He was one of the commission to draw up a constitution for the nation. He assisted in framing the Declaration of Rights, proposed (Oct. 10, 1789) the confiscation of Church property as belonging of right to the nation, and on Feb. 16, 1790, became President of the National Assembly. He was among the first of his order to take the oath to obey the constitution and urged the clergy of his diocese to follow his example. Excommunicated by the Pope, he was compelled to resign his bishopric. In January, 1792, Talleyrand was sent to London in a semiofficial capacity, the object being to conciliate England. It was suspected that he was a person "disposed to serve the King," and he was put on the list of *émigrés*. He remained in England until January, 1794, then spent more than a year in the United States, and after the fall of the Terrorists procured the revocation of his banishment and in March, 1796, reëntered Paris, having paved the way for a favorable reception by a series of adroit and judicious intrigues. He attached himself to the group of constitutionalists and in 1797, mainly through Madame de Staël's influence, was named Minister of Foreign Affairs.

Talleyrand shrewdly saw the significance of the rise of Napoleon Bonaparte, attached himself to the young Corsican, and became his ally and confidant in the coup of the 18th Brumaire, when the Directory was overthrown. After this Talleyrand, who had been reappointed Minister of Foreign Affairs by Bonaparte, directed his efforts towards consolidating the power and authority of his master. In diplomatic negotiations following the victories of France under the Consulate he had the principal part; he was the prime mover in the execution of the Duke d'Enghien and assisted in the establishment of the Empire and in the organization of the Confederation of the Rhine. For these services he was made Prince of Benevento in 1806. He opposed Napoleon's disastrous policy with regard to England and soon after Tilsit (1807) laid down his office as Foreign Minister and after some intriguing retired from active life (1809), residing on his estates and preparing for the turn of the tide. When, after the French disasters of 1812, Europe rose against Napoleon, Talleyrand became the centre of a group of malcontents, whose influence grew with the advance of the allied armies, and finally communications were opened with the Bourbons. Talleyrand dictated to the Senate the terms of the deposition of Napoleon, and on the restoration of the Bourbons he became Minister of Foreign Affairs in the first government of Louis XVIII. He represented France at the Congress of Vienna and played there a game of masterly politics, working on the jealousies of the Powers and by appealing to the principle of legitimacy gaining solid advantages for France. He had succeeded in bringing about a secret alliance between Austria, Great Britain, and France against Russia and Prussia when Napoleon's return from Elba shattered his plans. Henceforth he had little part in public affairs. He resumed the office of Foreign Minister in May, 1814, after the Restoration, but soon resigned, owing to the hostility of the old nobility. After the July revolution Louis Philippe employed him as Ambassador at the English court, where he contrived to bring about a friendly feeling between the new monarchy and the English government and negotiated the Quadruple Alliance of 1834 between France, Great Britain, Spain, and Portugal. He returned to France in 1835 and died at Valençay, May 17, 1838. Talleyrand stands out preëminently as the type of the unscrupulous diplomat and politician. A skeptic in religion and a cynic in morals, he possessed a remarkable insight into the grosser nature of man and almost unexampled adroitness for playing on the lower motives. He had a rare talent for caustic epigram, and his disillusioned view of human nature is attested by numerous witty sayings which have become part of the world's narrower wisdom.

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TALLIEN, tȧ'lyäɴ', Jean Lambert (1769–1820). A French revolutionary leader, born in Paris. He was educated by his father's employer, the Marquis de Bercy. He early imbibed the spirit of the Revolution, was attached to the *Moniteur*, and started a journal, *L'Ami des Citoyens*, in imitation of Marat's *Ami du Peuple*. His *Discours sur le causes qui ont produit la révolution française* appeared in 1791. He acquired great influence with the people and became a leader in extreme and sanguinary measures. On Aug. 10, 1792, he was made secretary to the Revolutionary Commune of Paris, was later chosen to the Convention, and there became the apologist of Marat, voted for the death of Louis XVI, and was eager for the destruction of the Girondists (q.v.). Late in 1793 he was sent to Bordeaux as the representative of the Committee of Public Safety. A passion there conceived for Madame de Fontenay, whom he married Dec. 26, 1794, made him amenable to her influence, which was on the side of clemency. On March 22, 1794, he was chosen President of the Convention. Robespierre, who felt that he could not be trusted, denounced him in the Convention. Tallien recognized his danger and rallied the remnants of the Dantonists, Hébertists, and other factions against the government of Robespierre, Saint-Just, and Couthon, and brought about the events of the 9th Thermidor (July 27, 1794), which caused the fall of the triumvirate. Tallien became head of the Committee of Public Safety, lent his aid in suppressing the Revolutionary Tribunal and the Jacobin Club, and drew up the accusations against Carrier, Le Bon, and others of the Terrorists. He was a member of the Council of Five Hundred (1795–98), where, however, his influence rapidly diminished. He accompanied Bonaparte to Egypt, editing the official journal, *Décade Egyptienne*, and, when returning to France, was captured by an English cruiser and taken to England, where he was lionized by the Whigs (1801). Soon after he returned to France and was sent in 1805 as Consul to Alicante. He died in Paris, Nov. 16, 1820. Under the Directory Madame Tallien's salon was one of the most brilliant in Paris. While Tallien was absent in Egypt, she was divorced from him and married in 1805 Count de Caraman, afterward Prince de Chimay. Consult J. Turquan, *Souveraines et grandes dames* (Paris, 1898), and Louis Gastin, *La belle Tallien* (ib., 1909). See CHIMAY, JEANNE MARIE IGNACE THÉRÈSE DE CABARRUS, PRINCESS DE.

TAL'LIS, THOMAS (c.1510–85). An English organist and composer. He achieved great proficiency in organ playing and was organist at Waltham Abbey for many years. About 1542 he was appointed gentleman of the chapel royal and served under Henry VIII, Edward VI, and the queens Mary and Elizabeth. He was also organist to Elizabeth. In 1575–76 he obtained, with William Byrd, letters patent giving the exclusive right for 21 years of printing music and ruled music paper. The first work printed under this patent was their *Cantiones quæ ab Argumento Sacræ Vocantur Quinque et Sex Partium* (London, 1575), containing 34 motets, by Tallis and Byrd, the work being a beautiful specimen of typography. About this time he composed his famous motet of 40 parts, *Spem in Alium non Habui*, adapted to English about 1630. Tallis's compositions consist of Church music, *Order of Daily Service; Full Cathedral Service; Order for Morning Prayer, with the Litany Noted* (all of which were edited in the nineteenth century); Te Deums, chants, hymns, motets, etc. His manuscripts are in the Oxford and Cambridge University libraries and in the British Museum.

TALL'MADGE, BENJAMIN (1754–1835). An American soldier, born in Brookhaven, N. Y. He graduated at Yale in 1773; taught school at Wethersfield, Conn.; in June, 1776, became lieutenant and adjutant of a Connecticut regiment, rising to the rank of captain in December, 1776, and of major in April, 1777. On Sept. 5, 1779, without loss, he captured 500 Tory marauders at Lloyd's Neck, Long Island, and in May, 1780, captured Fort George at Oyster Bay. He was present at the battles of Brandywine, Germantown, and Monmouth, had the custody of Major André until that officer's execution, and served at Washington's headquarters in 1781–83. After the war he became a successful merchant at Litchfield, Conn. His *Memoirs* were printed privately by his son in 1859.

TALLMADGE, NATHANIEL PITCHER (1795–1864). An American legislator and governor, born in Chatham, N. Y. He graduated at Union College in 1815 and in 1818 was admitted to the bar. He served in the State Legislature (1828–33) and was then elected to the United States Senate as a Democrat. Afterward he allied himself with the Whigs and served by reëlection until 1844, when he resigned to accept the appointment of Territorial Governor of Wisconsin, tendered him by President Tyler, and served until removed by President Polk in 1846.

TALLOW (MDutch *talgh*, *talch*, Dutch *talk*, Ger. *Talg*, tallow; possibly connected with AS. *tælg*, color). A mixture of stearin, palmitin, and olein (qq.v.) derived from animal fat in the process of rendering. This fat is generally obtained from beef or mutton by melting and separation by heat, usually under pressure. It is no longer regarded exclusively as a mixture, but may be considered as a chemical union of its various ingredients. According to this belief the differing physical properties of tallow from various sources are actually due to variations in composition. From beef and mutton fats, distearo-palmitin, dipalmito-stearin, and dipalmito-olein have been isolated. The natural form of tallow known as suet is still highly regarded as a fat food and is the source of edible stearin. Tallow is a white and almost tasteless substance in its pure condition, but the commercial article is usually of a yellowish color. It is insoluble in water and has a specific gravity which varies from 0.925 in the case of beef tallow to 0.937 in the case of mutton tallow. It melts between 100° F. and 120° F. Tallow is employed in making candles (q.v.) and soap. It may also be used as a lubricant. Tallow substitutes of synthetic composition are produced from various oleins by the process of hydrogenation. See FATS.

TALLOW, MINERAL. See MINERAL TALLOW.

TALLOW TREE. Various trees which produce a thick oil or a somewhat resinous substance which may be used for making candles. The tallow tree of Malabar (*Vateria indica*), a tree of the family Dipterocarpaceæ, has leathery leaves, 4 to 10 feet long, and panicles of white fragrant flowers. From incisions in the stem (often 16 feet in circumference) East Indian copal is obtained. Its seeds yield a firm, white, odorless vegetable tallow valued for soap and candle making. The tallow tree of China (*Sapium sebiferum*) belongs to the family Euphorbiaceæ. The nearly hemispherical seed and the capsules yield a white vegetable tallow, which the Chinese obtain by crushing and boiling both capsules and seed and skimming off the fluid fat

The vegetable tallow is exported from China in hard white cakes weighing 50 to 60 pounds each. This tree has been introduced into North America, is cultivated about Charleston and Savannah, and is almost naturalized in the maritime parts of the Carolinas. It is beautiful at the approach of winter, when the leaves become bright red, among which hang the white seeds suspended by threads. The name "tallow tree" is sometimes given to *Aleurites triloba*, a species of candlenut (q.v.). The tallow tree, or butter-and-tallow tree, of Sierra Leone is *Pentadesma butyracea*, of the family Guttiferæ, the fruit of which furnishes an oil as butter. See CANDLEBERRY.

TALLQVIST, täl′kvist, KNUT L. (1865–). A Swedish Orientalist, born at Kyrkslätt. Educated at Helsingfors (Ph.D., 1894), at Leipzig, and at Berlin, he became professor of Oriental literature at Helsingfors in 1899. In 1893–95 he traveled in Syria, Palestine, and Egypt. Among his works are: *Die Sprache der Contracte Nabû-Nâ'ids* (1890); *Babylonische Schenkungsbriefe* (1891); *Die assyrische Beschwörungsserie Maqlû* (1895); *Arabische Sprichwörter und Spiele* (1897); *Ibn Sa'id, Kitâb al-muġrib*, Buch iv (1899); *Neubabylonische Namenbuch* (1905).

TALLY (OF., Fr. *taille*, cut, size, figure, tax, from Lat. *talea*, rod, cutting twig). The name given to the notched sticks once used in England for keeping accounts in Exchequer. They were well-seasoned rods of hazel or willow, inscribed on one side with notches indicating the sum for which the tally was an acknowledgment, and on two opposite sides with the same sum in Roman characters, with the name of the payer and the date of the transaction. The tally was cleft through the middle by the deputy chamberlain with knife and mallet, and one-half was retained by the payer as his receipt, while the other was preserved in Exchequer. They accumulated there until 1834, when an Act of Parliament ordered them to be burned.

TALLYWAG. See SEA BASS.

TALMA, tȧl′mȧ′, FRANÇOIS JOSEPH (1763–1826). A French tragedian, born in Paris. In 1787 he made his début on the stage of the Comédie Française. Some time afterward in a minor part in the tragedy of *Brutus* he attracted attention by a novelty of costume. It was the fashion for actors to appear in the garb of their own country and even their own time, and Roman senators stalked about the stage attired as Parisian dandies of the eighteenth century. Talma saw the absurdity of the custom and, setting out to reform it, appeared clothed in a Roman toga and with arms bare. His first great triumph was in Chénier's *Charles IX*, produced in 1789. In the division of the Comédie Française (q.v.) which soon followed in the months of Revolutionary confusion, Talma and those who adhered to him went over to the new theatre in the Rue Richelieu, which was for a time known as the Théâtre de la République. There many of his greatest successes were won. Though irritable and often at strife with his fellow actors, he was a great favorite with Napoleon, of whom it was jestingly said that he took lessons of his friend Talma in the art of behaving like an Emperor. Talma was, however, equally well received later by Louis XVIII. Consult his "Quelques réflexions sur Lekain et sur l'art théâtral," prefixed to the *Mémoires de Lekain* (Paris, 1825); *Mémoires de Talma* (ed. by Alexander Dumas, ib., 1849–50); Lumière, *Le Théâtre Français pendant la Révolution, avec plusieurs lettres inédites de Talma* (ib., 1894).

TAL′MAGE, T(HOMAS) DE WITT (1832–1902). An American clergyman and pulpit orator, born at Bound Brook, N. J. After taking a partial course at the University of the City of New York (now New York University) he entered the theological seminary of the Dutch Reformed Church at New Brunswick, N. J., where he graduated in 1856. In the same year he became pastor of the Reformed Church at Belleville, N. J. He filled pastorates in churches of the same denomination at Syracuse, N. Y. (1859–62), and at Philadelphia (1862–69). In 1869 he was called to the pulpit of the Central Presbyterian Church of Brooklyn, N. Y., which, from the new edifice erected in 1870, came to be known as the Tabernacle. During his occupancy of this pastorate, where he remained until 1894, he became widely known as a sensational preacher. The Tabernacle Church, after being twice burned and rebuilt (in 1872 and 1889), was again burned in 1894, after which the church organization ceased to exist. Dr. Talmage preached for a time in the New York Academy of Music and from 1895 to 1899 was associate pastor of the First Presbyterian Church of Washington, D. C. His influence was increased by frequent lecturing tours, both in America and England, and by the publication of his sermons in book form and through syndicates in more than 3600 weekly newspapers in the United States, Canada, and Great Britain. They were also translated and published in a number of foreign languages. He was editor of *The Christian at Work* (1873–76); *The Advance* (1877–78); *Frank Leslie's Sunday Magazine* (1879–89); *The Christian Herald* (1890–1902). Among his more important works were: *The Almond Tree in Blossom* (1870); *Old Wells Dug Out* (1874); *Every Day Religion* (1875); *Woman: Her Powers and Privileges* (1886); *From the Pyramids to the Metropolis* (1892); *From Manger to Throne* (1894); *The Earth Girdled* (1895); *The Pathway of Life* (1895). Dr. Talmage's sermons were written in a popular vein and were characterized by extravagant statements and fantastic figures of speech. Consult: C. F. Adams, *Life and Sermons of T. De W. Talmage* (Chicago, 1902); C. E. Banks, *Life and Works of T. De W. Talmage* (New York, 1902); W. C. Wilkinson, in *Modern Masters of Pulpit Discourse* (ib., 1905).

TAL′MUD (Aram. *talmūd*, instruction; connected with Heb. *lāmad*, to learn). The name given to the comprehensive compilation of laws and ceremonial regulations pertaining to rabbinical Judaism together with the elaborate discussion of those laws and regulations. As already implied in this definition, the Talmud consists of two divisions, which in the compilation are kept distinct: (1) the laws and regulations which are technically comprised under the designation *Mishnā* (lit. teaching, then used concretely for "the law," as that which is taught or which is the outcome of teaching); (2) the discussion and elaboration of the laws, comprised under the term *Gĕmārā* (lit., supplement, completion, and then also in the sense of tradition, doctrine). The language of the Mishna is Hebrew; that of the Gemara, Palestinian or Babylonian Aramaic.

Of these two divisions, the compilation of the Mishna comes first in the order of time and also in importance. In its present form it consists of six main divisions known as *Sĕdārîm*, comprising 63 treatises, or *Massektôth*. This comprehensive compilation, which is attributed to Rabbi Jehuda ha-Nasi (c.219 A.D.), represents the culmination of an intellectual and religious process that may be said to date from the acceptance of the Law as the supreme and sole standard of religious observances and secular regulations. The observer of the Law was the only type of the faithful Jew possible under this conception of religious duty. Such a principle necessarily led to the study of the Law as the highest vocation of the individual. The Law could not be observed unless it was known and thoroughly understood, and generations of scholars arose who strove to determine the exact meaning of the enactments in the codes and to account for numerous existing practices not specifically recorded in them, by deduction from principles underlying the code itself. The attempts to deduce the established religious practices and the constantly growing ceremonial details from the Law itself resulted naturally in the formation of smaller and larger collections, which may have served either as notes for the pupils or as guides for the teachers, and despite a certain opposition that always manifested itself against committing to writing the large body of oral tradition, which, according to the theory of rabbinic theology, was revealed simultaneously with the written Law at Sinai, it was inevitable, if the practices established by or based upon this oral tradition were to maintain their hold as ingredient parts of Judaism, that they should be given a fixed form equally with the written Law. We have direct evidence for the existence of Mishnaic compilations prior to the days of Rabbi Jehuda ha-Nasi, but the general acceptance which his compilation met naturally drove the earlier (and probably more incomplete) ones out of the field. Traces of these are to be found in the Talmud and in Midrashim, where enactments and observations are referred to which differ from those found in the Mishna; they are designated as the *Bāraithā* (i.e., outside). A separate collection of this kind is known as the *Tôsephtā* (addition), which, however, partakes of the character of the Gemara.

Passing on to the supplement to the Mishna, its rise represents the natural continuation of the process which led to the Mishna. In the course of several centuries there was a large accumulation of material that could only be preserved by being committed to writing. The combination of the Mishna with the Gemara forms the Talmud proper, and for the Babylonian schools the first authoritative compilation of the discussions of the several generations was made by Rab Ashi, the head of the school at Sura, who flourished from 375 to 427; but additions were made by later authorities, such as Rab-Abina, and the final touches were given to it about the first half of the sixth century. In a certain sense, however, the Gemara was never finished, for of the 63 treatises of the Mishna 26 have no Gemara. The Palestinian schools also compiled their discussions, and in this compilation the influence of Rabbi Johanan (189–279), head of the school at Tiberias, is paramount, though the redaction of the Palestinian Talmud—the work of a series of authorities—did not take place until the fourth century, while additions continued to be made to it in the fifth century, Jose ben Abin taking an important part in the final redaction. Considerable portions of this Palestinian Talmud are lost. In fact, the Mishna of only the first four Sedarim or divisions has been preserved, and a portion of one treatise in the sixth division. In the second division the Gemara is not complete, four chapters of one treatise being wanting, and likewise in the fifth division the Gemara is lacking to the last chapter of one treatise and to two other treatises. That the Palestinian Talmud once existed in a more complete form is certain, and it is more than likely that there was a Gemara to most of the treatises of the entire six divisions. The loss of such a considerable portion is due in part to the almost constantly disturbed conditions that prevailed in Palestine, and in part to the subsequent neglect of the Palestinian Talmud, which never acquired the authority that came to be enjoyed by the Babylonian compilation. The Babylonian Gemara in fact drove its rival entirely out of the field, and as a consequence the Babylonian Talmud became the main factor in the history and development of Judaism.

To characterize and convey an idea of the contents of the Mishna is a comparatively simple matter, but it is almost an impossible task to indicate the heterogeneous character of the Gemara, more particularly of the Babylonian Talmud. The discussions on the Mishna led the rabbis and their pupils far away from the subject, at times, indeed, a section coming to a close without a return to the starting point. In the course of these digressions, anecdotes, bits of historical gossip, folklore, the popular science of the day, and mathematical calculations are intermixed with sober and playful exegesis of the Old Testament by the application of a series of hermeneutical principles evolved in the schools of Palestine and Babylonia. Sophistry and hair-splitting dialectics are suddenly interrupted by charming parables and poetic allegories. The Gemara is a veritable encyclopædia of rabbinical knowledge, and only the lack of system prevents the justifiable application of that term to this remarkable compilation. To distinguish the purely legal from the extraneous material, a division is commonly made into Halacha (lit., norm) and Haggada (lit., tale).

The history of the Talmud is the history of Judaism from about the beginning of our era to the dawn of the nineteenth century. In that history we may distinguish the following periods: 1. To the completion of the Mishna, during which time the rabbis bear the name of *Tannaim* (teachers); five generations are enumerated. 2. The growth of the Gemara, the rabbis of this second period being known as *Amoraim* (speakers), comprising seven generations. 3. To the completion of the Talmud, the rabbis of this period being distinguished as *Saboraim* (examiners). 4. To the struggle in the ninth and tenth centuries between the Karaites and the adherents of the Talmud known as the Rabbanites, marked by the labors of Saadia (q.v.). 5. The adjustment of Talmudical Judaism to the prevailing form of Aristotelianism, which arose under the influence of Islamic theology. This period extends well into the thirteenth century and is dominated by the influence of Maimonides and the Spanish school of Jewish thinkers. It led eventually, after a long conflict between the adherents and opponents of Maimonides' attempt to codify the Talmudical enactments and regulations in systematic form, to the compilations of the codes of Joseph Karo (born 1487), known as the *Shulchan Aruch* (spread table), which became the standard guide implicitly followed by orthodox Jews to the present time and may be regarded as marking a sixth and final period.

In the course of the last two periods the study of the Talmud spread gradually into southern Europe and thence made its way into Germany, Galicia, Hungary, and Russia. Commentators arose who devoted themselves to the interpretation of the Gemara, much as the Amoraim and Saboraim elaborated the Mishna, and supercommentaries were added to these commentaries. The most notable of the Talmudical commentators was Rabbi Solomon Yisḥaki (or Isaac), known as Rashi (q.v.), whose work, almost invariably added to the Talmudic text, is still used as the basis of Talmudical study. A school of Talmudists arose in Germany and France during the twelfth and thirteenth centuries known as *Tosaphists* (supplementers), whose comments are likewise written on the margins of the Talmud—a method that follows the example of the Mohammedan theologians. Other commentators of more recent date whose works acquired a high degree of authority were Solomon Luria (died 1573), Elijah Wilna (died 1797), and Akiba Eger (died 1837). From Germany, which remained for several centuries the centre of Talmudical study, that centre gradually shifted to the east of Europe, and at the present time the traditional methods of Talmudical study are still carried on with vigor in Galicia and Russia, while the centre of the scientific study of the Talmud based on adequate philological acquirements and the application of proper historical principles may be said to be Germany, whence the study is spreading into France, England, and the United States, as the value of the Talmud for the student of language, of history, and of religion is coming to be recognized. Christian theologians are also beginning to take it up, and notable contributions have been made by some of these. See GEMARA; HAGGADA; HALACHA; MISHNA.

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TALON, tȧ'lôɴ', JEAN BAPTISTE (1625–91). A French official in Canada, born in Picardy. He entered the civil service and, after serving in subordinate capacities in France, was appointed in 1663 intendant of justice, police, and finance in Canada, Acadia, and the other French possessions in North America. Talon built ships, began trade with the West Indies, and built a brewery to lessen the consumption of brandy. Exploring parties were sent to Hudson Bay and to the country of the Upper Lakes, and the purchase or seizure of New York was urged. In 1668 he returned to France on account of failing health, but returned in 1670 and remained until 1672. Later three of his seigniories were erected into baronies, and he assumed the title of Comte d'Orsainville. His *Mémoire à Sa Majesté sur l'état présent du Canada* (1667) is a valuable original source of information.

TALTAL, tȧl-tȧl'. A town of the Province of Antofagasta, Chile, on the Bay of Taltal, Pacific Ocean, 527 miles north of Valparaiso (Map: Chile, E 3). It is the terminus of the railway of some 95 miles running to the mining town of Cachinal and is the point of export for the nitre beds and silver and copper mines of the deserts of Atacama (q.v.). Taltal was founded about 1855. Pop., 1903, 6720.

TA'LUS (Lat., heel). The heap of fragments that accumulates at the base of cliffs and mountain slopes. Weathering is the most important process in the production of such masses, which tend to move slowly downward until they come within reach of the valley stream. The inclination of the surface of the talus varies with the size of the fragments, but it rarely exceeds an angle of 35° with the horizontal.

TAL'VJ. See ROBINSON, THERESE ALBERTINE LUISE.

TAMAGNO, tȧ-män'yō, FRANCESCO (1851–1905). An Italian operatic tenor, born in Turin. He made his début in Palermo in 1873 in *Un Ballo in Maschera*, and for 30 years was famous throughout Italy and Europe in such operas as *Otello* (the chief part of which he created in Milan in 1887), *Il Trovatore*, *Aïda*, etc. He made several visits to the United States, the first in 1893. In 1902 he retired from the stage. He died at Varese.

TAMANACA, tä'mȧ-nä'kȧ. A tribe of Cariban stock (q.v.) who formerly lived on the Cuchivero River, a southern affluent of the Orinoco, central Venezuela. They were at one time one of the most powerful tribes of Venezuela, and were Christianized and gathered into mission villages by the Spanish missionaries before the year 1780, but by the incessant attacks of the savage Carib (q.v.) they were so wasted that before the year 1840 the name had disappeared, and they are supposed to be entirely extinct.

TAMAN'DUA. See Ant-Eater.

TAMANOIR, tȧ'mȧ'nwär'. See Ant-Eater.

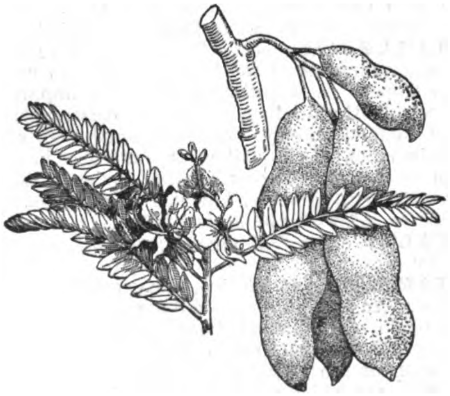
TAMAQUA, tȧ-mạ'kwȧ. A borough in Schuylkill Co., Pa., 17 miles northeast of Pottsville, on the Little Schuylkill River and on the Philadelphia and Reading, the Lehigh and New England, and the Central of New Jersey railroads (Map: Pennsylvania, J 5). It is known for its extensive coal-mining interests. The leading manufactures are foundry and machine-shop products, stoves, powder, flour, hosiery, silks, shoes, furniture, shirts and shirt waists, knit goods, and beer. The city contains a State hospital. Tamaqua was settled in 1799 and was incorporated as a borough in 1833. Pop., 1900, 7267; 1910, 9462; 1915 (U. S. est.), 10,618.

TAMAR, tä'mär. A picturesque river which rises in the north of Cornwall, England, and after a southeast course of 60 miles enters the English Channel by its estuary the Hamoaze and Plymouth Sound (Map: England, B 6). It forms the boundary of the counties of Cornwall and Devon for 45 miles and is navigable as far as Launceston. Consult Bray, *The Tamar and the Tavy* (London, 1879).

TAM'ARACK (North American Indian name), *Larix laricina.* An American timber tree, 30 to 90 feet tall, common in swamps. Its hard resinous wood is valued for posts, poles, ties, etc. It is less ornamental than its close relative, the European larch, which is more frequently planted. See Larch.

TAMARAO, tä'mȧ-rä'ō (native name). A small, sturdily built native buffalo (*Bos mindorensis*) of the Philippines. It is about 3½ feet high at the shoulders, is clothed with thick brown hair, and has short, triangular, massive horns, which have a lyrate curvature upward from the face. Cf. Buffalo.

TAM'ARIN. See Marmoset; Negro Monkey.



TAMARIND AND FRUIT.

TAM'ARIND (ML. *tamarindus,* from Ar. *tamr Hindī, tamr al-Hind,* date of India), *Tamarindus indica.* A beautiful spreading tree, of the family Leguminosæ, a native of India, very generally cultivated in warm climates. It bears brown, many-seeded pods about 6 inches long and ¾ of an inch thick, filled with acidulous, reddish-brown pulp which is exported in jam-like masses to Europe. Tamarinds are generally preserved by pouring hot sirup on the ripe pulp; a better method is to put alternate layers of tamarinds and sugar in a stone jar, the color and taste being thus more like the fresh pulp. The wood of the tamarind and especially of its roots is extremely hard and, though worked with difficulty, is valued for cabinetwork. There are several species of *Dialium,* known as velvet tamarind, closely related to *Tamarindus,* that yield a similar pulp. Tamarind pulp is used in India as a cooling food, for sherbets, etc. Tamarind trees are grown to some extent in Florida, but were not satisfactory when tested at Berkeley, Cal.

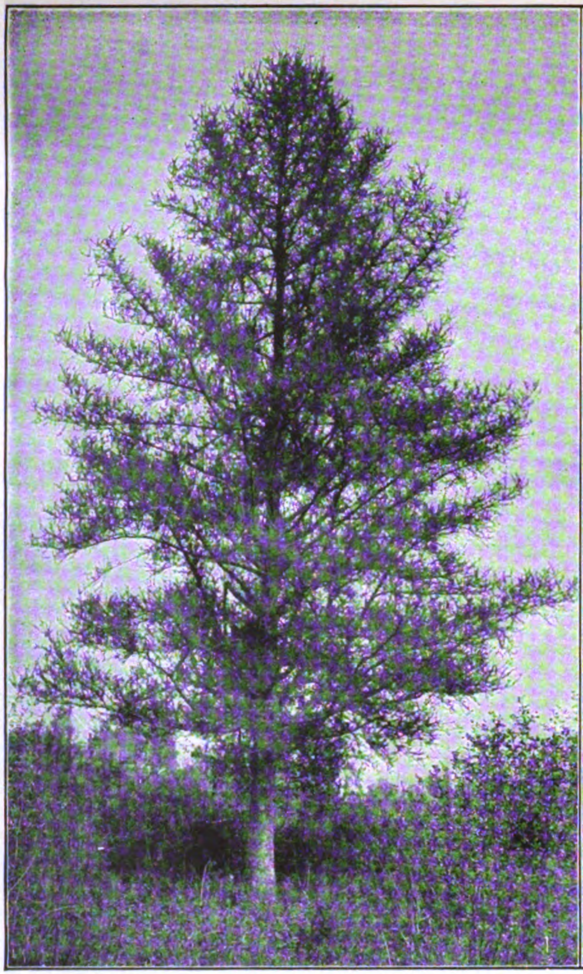
COMMON TAMARISK.

TAMARISK (Lat. *tamariscus, tamarix, tamarice,* tamarisk; perhaps connected with Skt. *tamālaka, tamāla,* a sort of tree with dark bark, *tamas,* darkness), *Tamarix.* A genus of plants of the family Tamaricaceæ. The common tamarisk (*Tamarix gallica*) grows in sandy places in the Mediterranean region and is often planted for ornament in Europe and the United States. It sometimes attains a height of 30 feet. The twigs were once in repute as a tonic. The Oriental tamarisk (*Tamarix articulata*) is one of the few indigenous trees in the Arabian and African deserts. It is called atle or ethel. Its wood is used for fuel and for economical purposes. The galls found on some East Indian species are valued in dyeing. *Tamarix mannifera,* perhaps a variety of *Tamarix gallica,* owing to the punctures of an insect, yields Mount Sinai manna. The German tamarisk (*Myricaria germanica*) belongs to another genus of this order.

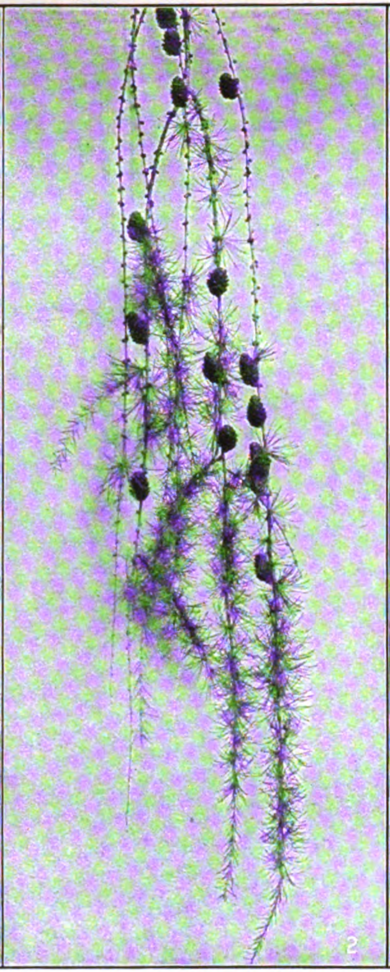
TAMASHEK, tăm'ȧ-shĕk. The name applied to the Berber and Tuareg languages of Mauretania and the Sahara. It occurs in various dialectic forms as Tamahâg, Tahahûg, and Tamazigt. The last form (T-ama-zig-t) survives in the Amzigh or Imazighen (q.v.), the common name of Mauretanian Berbers and thought to be identical with the Maxyes of Herodotus. Consult: Freeman, *Grammatical Sketch of the Temahug or Towarek Language* (London, 1862); Hanoteau, *Essai de grammaire de la langue tamachek* (2d ed., Algiers, 1896); Kaoui, *Dictionnaire français-tamâheq* (ib., 1894); id., *Dictionnaire pratique tamâheq-français* (ib., 1900).

TAMATAVE, tä'mȧ-tä'vȧ. The most important seaport of Madagascar. It is on the east coast, in lat. 18° 10′ S., on a small peninsula (Map: Africa, K 6). It is fortified and has a good roadstead, owing to the outlying coral reefs, but the facilities are not superior for loading and unloading vessels. South of the

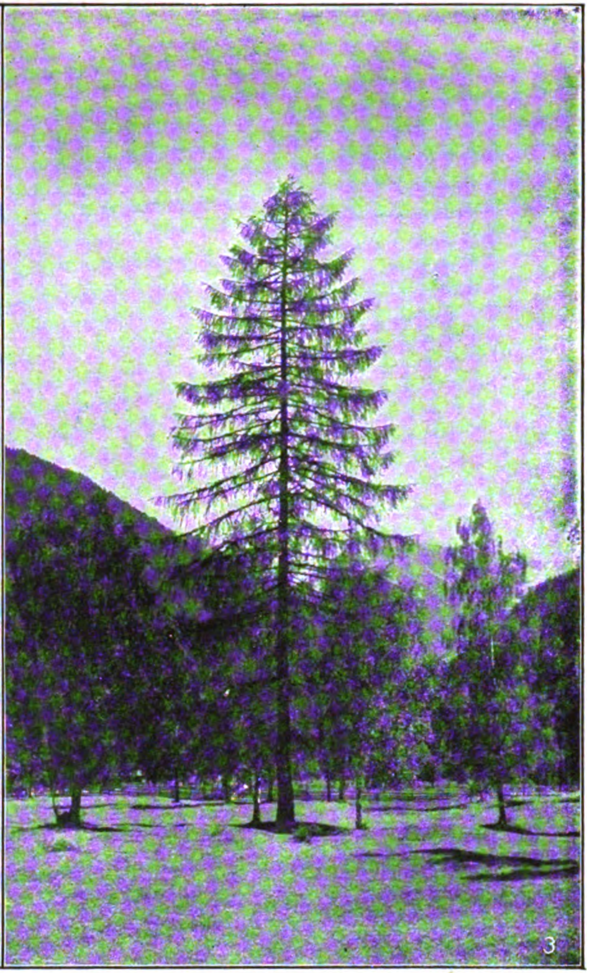
TAMARACK AND LARCH



1. TAMARACK (Larix Americana).



2. SPRAY WITH CONES OF EUROPEAN LARCH.



3. EUROPEAN LARCH (Larix Europæa).

city is a series of lagoons which have been connected by canals and thus add to the transportation advantages of the town. In 1913, 10,086 vessels of 1,668,865 tons entered the port. (See Madagascar.) A railroad at present connects Tamatave with the neighboring Ivandro. Pop., 1911, 8761. There are a number of Europeans.

TAMAULIPAS, tä'mou-lē'päs. A maritime state of Mexico (Map: Mexico, K 6). Area, 30,826 square miles. The coast is flat, sandy, lined with lagoons and marshes, and but sparsely inhabited. The northern part is occupied by plains, while the southern and central portions are mountainous. Tamaulipas is watered by several large rivers, of which the largest are the Río Grande and Pánuco, forming respectively the north and south boundaries. The climate is temperate and healthful in the interior and hot and unhealthful on the coast. Agriculture is the principal industry, but is hindered by lack of irrigation facilities. Grazing is carried on extensively. The chief exports are hides and skins, live stock, some fruits, and rubber. There are three railroad lines in the state. The Mexican Free Zone, in which imports are liable to only 10 per cent of ordinary duties, was first established by Tamaulipas in 1858. Pop., 1910, 249,641. Capital, Victoria (q.v.).

TAMAYO Y BAUS, tȧ-mä'yō ē bous', Manuel (1829–98). A Spanish dramatist. He was born in Madrid of parents both of whose families were distinguished in the annals of the stage, and his early life was passed in traveling about the provinces with the company of which his parents were members. He was a lifelong friend of Manuel Cañete (q.v.). He was elected (1858) to the Spanish Royal Academy, of which he became permanent secretary in 1874. From 1884 till his death he was director of the National Library and chief of the board of archivists, librarians, and antiquarians. When Tamayo y Baus was only 11 years old, he made a translation or adaptation of *Geneviève de Brabant* which was successfully staged, with his mother in the title rôle, at Granada. His dramaturgic manifesto, *Truth as the Fountain of Beauty in Dramatic Literature* (1858), was widely influential. His most important plays are: *La Locura de Amor* (1855), dealing with the madness of Juana la Loca, the daughter of Ferdinand and Isabella; *Lances de Honor* (1863), treating of the evil of dueling; *Un Drama Nuevo* (1867), a perfect example of the incorporation of a play within a play. By most critics *Un Drama Nuevo* is considered not only Tamayo's masterpiece, but also one of the great plays of all literature. It was translated into English by J. D. Fitz-Gerald and T. H. Guild as *A New Drama* (New York, 1915). Consult: Manuel Tamayo y Baus, *Obras* (4 vols., Madrid, 1898–1900); Emilio Cotarelo y Mori, *Historia literaria*, vol. i (ib., 1901); Boris de Tannenberg, *L'Espagne littéraire, première série* (Paris, 1903); Narciso Sicars y Salvadó, *D. Manuel Tamayo y Baus* (Barcelona, 1906).

TAMBÓBONG, tȧm-bō'bông. A suburb of Manila, Philippines, situated about 3 miles north of the capital, in the Province of Rizal. Pop., 1903, 20,136.

TAMBOUR, tăm'bōōr (Fr., drum). In fortification a small traverse to prevent the enfilade of a trench, or in other words, a small work projecting from the main line of a fortification, often in the form of a redan or a lunette with a salient angle of about 60°. In older schemes of fortification the tambour usually consisted of a timber structure or stockade with loopholes which could protect the gateway of an approaching road, or afford a flanking fire on a bridge. In formal schemes of fortification, the tambour on the covered way would be used to close the entrance from the glacis. See Fortification.

TAMBOURIN, tăN'bōō'răN' (Fr. *tambourine*, dim. of *tambour*, drum, tabor). An ancient, lively dance of Provence, in ¾ time. It was originally accompanied by a flute and a tambour (drum); hence the name.

TAMBOURINE, tăm'bụ-rēn'. An ancient instrument of the drum type. It is composed of a piece of parchment, stretched on the top of a hoop furnished with pairs of small metal plates, and is sounded by the hands, fingers, or elbow.

TAMBOV, tăm-bôf'. A government of central Russia (Map: Russia, F 4). Area, 25,710 square miles. Its surface is mostly flat, in the basins of the Oka and the Don, and intersected by numerous river valleys. The region is watered principally by the Voronezh and the Khoper (tributaries of the Don) and by the Moksha and the Tsna (tributaries of the Oka). Iron is found near Lipetsk, but it is little exploited. Tambov is one of the most fertile governments of Russia, and its southern and larger part is covered with a thick layer of black soil. Rye and oats are the principal cereals. Flax, tobacco, and sugar beets are also produced on an increasing scale. The principal manufactured products are spirits, cloth, beet sugar, flour, and tobacco. The annual value of the output often exceeds $12,000,000. Pop., 1912, 3,473,000.

TAMBOV. The capital of the Government of Tambov, Russia, in a low region on the Tsna River, about 300 miles southeast of Moscow (Map: Russia, F 4). Pop., 1910, 60,729. The city was founded in 1636 as a fortress against the inroads of the Tatars from the south.

TAM'BURLAINE, The Great. A tragedy in blank verse, by Christopher Marlowe, acted in 1587 and licensed for publication on Aug. 14, 1590. Its principal source is a translation of Petro Mexia's *Silva de Varia Leoion*, made by Thomas Fortesque, and published under the title of *The Foreste* in 1571.

TAM'ERLANE. See Timur.

TAMERLANE. 1. A tragedy by Rowe, produced at Lincoln's Inn Fields in 1702 and adapted (1724) for the operatic stage to the music of Handel. Owing to its political significance, the play came to be produced annually at the Drury Lane on November 5. 2. A poem by Edgar Allan Poe which gave its name to his volume of verse published in 1827.

TAMETOMO, tä'me-tō'mô. Japan's most famous archer. He belonged to the great Minamoto family and shared its misfortunes in the middle of the twelfth century. He is credited with many feats of strength and skill. He sent an arrow through the body of one man and wounded a second who stood behind him. He shot an arrow through the helmet of his own brother without hurting him. Being taken prisoner and a sinew of his arm having been extracted by his foes, he came nevertheless to shoot a stronger bow and sank a boat by shooting an arrow through its bows. The accounts of his end are contradictory. After sinking the boat he fired his house and committed suicide, or he fled to Ryukyu (Luchu) and became its King, the first of the historic line.

TAM′ILS. A Dravidian people of southern Hindustan and northern Ceylon, who number more than 18,000,000. They are, perhaps, the most important of the civilized Dravidian people of India. The Klings of the seaports of Farther India and certain parts of Malaysia are Tamils, who have emigrated temporarily or permanently from their native land.

The Tamil language is the most important and archaic of the Dravidian languages. It is spoken in the northern half of Ceylon, and the territory between Cape Comorin and Pulicat, north of Madras, extending inland about halfway across India. Tamil is divided into the widely different Old or Son Tamil and Modern or Kodun Tamil. It has nine cases, two numbers, and in gender distinguishes between high caste (men, gods, spirits, etc.) and low caste (animals, inanimate things, and abstract ideas). The verb is formed by suffixing the personal pronouns to a predicative verb stem. The same base, therefore, when case suffixes are added, serves as a noun and, when the pronouns are affixed, as a verb. Moods are altogether lacking. In its vocabulary Tamil is exceedingly rich, especially in compounds and synonyms. The alphabet is based on one of the old forms of the Sanskrit Devanagari (q.v.) script. Tamil literature is abundant and important. An outline is given under DRAVIDIANS.

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TAMING OF THE SHREW, THE. A comedy by Shakespeare, written before 1596, produced in 1603. It is adapted from an earlier play entitled *The Taming of a Shrew*, of questionable authorship, produced in 1594. The story of Bianca is taken from Ariosto's *I suppositi* through Gascoigne's *Supposes*, a play of 1566. The "taming" comes from an old and widespread story found in the *Arabian Nights* and in Straparola.

TAMISE, tȧ′mēz′. A town in the Province of East Flanders, Belgium, 11 miles southwest of Antwerp, on the Scheldt and on the railway from Mechlin to St. Nicholas. Its chief manufactures are cotton and woolen fabrics, laces, soap, and wooden shoes; boat building and jute and flax spinning are carried on. Pop., 1900, 12,463; 1910, 13,306.

TAM′MANY HALL. The name applied (1) to a powerful political organization in New York City, (2) to the building which serves as that organization's headquarters, and (3) sometimes incorrectly to the society from which the organization leases the building. The name is adapted from that of an Indian chief, Tamanend, of the Lenni Lenape or Delaware tribe, who was famous for his virtues and his wisdom, but about whom little is definitely known. His name appears on deeds for tracts of land, dated June 23, 1683, and July 5, 1697; and according to tradition he died about 1740 and was buried in New Britain Township, Bucks Co., Pa. Before and during the Revolutionary War patriotic societies, akin in spirit to the Sons of Liberty, with Tamanend as their patron saint were organized in imitation of and opposition to such Tory societies as St. Andrew's Society, St. David's Society, St. George's Society, and the Friendly Sons of St. Patrick. In Philadelphia the Sons of King (later St.) Tammany met almost every year from 1772 to 1791, and later, in 1795, a short-lived branch of the New York society was established there. Similar societies of St. Tammany had a brief existence in Providence, Brooklyn, and Lexington. See SECRET SOCIETIES.

On May 12, 1789, William Mooney, an upholsterer and ex-soldier, who previously had been active as one of the Sons of Liberty, founded in New York, ostensibly as a patriotic and social organization, the secret Society of St. Tammany or Columbian Order, which in 1805 was regularly incorporated as a fraternal aid association. The ritual and organization of an Iroquois lodge were followed more or less closely by the founders, the society being divided into 13 tribes, each of which had its separate totem, the year being divided into four seasons, each month, or rather moon, being called by some distinguishing characteristic, and the officers, annually elected, being known as the grand sachem, sachems, the sagamore, or master of ceremonies, scribe or secretary, and the wiskinskie or doorkeeper. The place of meeting was called the Wigwam, a name often used to mean Tammany Hall itself. It was the custom to confer the honorary title of Great Grand Sachem upon the Presidents of the United States, and, from Washington to Jackson, all accepted. Until their abandonment in 1813, it was the practice of Tammany Society to have picturesque ceremonies according to Indian custom. In 1811 the society built its first hall, at the corner of Frankfort Street and Park Row, in 1867 moved to Fourteenth Street, and in 1915 it decided again to change locations, selecting a site farther uptown. The political organization is nominally distinct from the society.

Though the society was ostensibly organized for patriotic, social, and benevolent purposes, it early took an active interest in politics and soon came to stand distinctively for democracy and decentralization, identifying itself definitely (in 1798) with the Democratic-Republicans as opposed to the Federalists. Though never an officer, Aaron Burr is supposed to have given the society its first training in the devious ways of practical politics. He was assisted by Matthew L. Davis, who carried out his orders. The remarkable organization as a political machine was effected or at least perfected under Martin Van Buren during the contest within Tammany Hall between the friends of Jackson and those of Adams. In 1800 the society first took an active part in a political campaign, being instrumental in carrying New York for Jefferson. From that time to the present Tammany has generally professed to be the local representative of the National Democratic party and has exerted a powerful influence on the political history of the State and a preponderating influence on the political history of the city. Generally the organization has been bitterly assailed by rival factions of the Democratic party, and on at least one occasion, in 1878, under Kelley, it bolted the party's regular State ticket, but for the most part it has controlled a vast majority of the Democratic voters of the city. After 1834, when the mayoralty first became elective, it devoted its attention primarily to securing control of the city government and from 1834 to 1913 succeeded in electing fully two-thirds of the mayors. Gradually its organization became more and more perfected, and the inrush of immigrants after about 1840 added enormously to its strength, for Tammany succeeded in securing the adhesion of an immense majority of the foreign-born citizens. In order to secure proper compactness and discipline within the organization, great power was necessarily thrown into the hands of a few individuals, and in the history of Tammany many of its officers are alleged to have succumbed to the temptations which such power has brought. From an early period charges of corruption, peculation, and blackmail were made against Tammany leaders by their political opponents, and Tammany often retaliated with similar charges against the opposition, as in 1839 against the Whigs. The climax was reached in 1869–71, when Tweed and his associates were proved to have robbed the city of untold millions. (See TWEED, WILLIAM M.) Damaging disclosures concerning the methods of Tammany were also made during the investigations conducted respectively by the State Committee on Cities, headed by J. Sloat Fassett, in 1890, the special committee of the State Senate, headed by Clarence Lexow, in 1894, and the special committee of the State Assembly, headed by Robert Mazet, in 1899.

Tweed was the first to exercise over Tammany the powers of the modern boss. After the exposure of his colossal frauds Tammany was severely criticized. On a platform of reform and regeneration it was reorganized by John Kelly (q.v.), who caused some of the most prominent of Tweed's prosecutors—men like Tilden, Charles O'Conor, Horatio Seymour, and August Belmont—to be chosen as officers, while he, by perfecting the machinery of the organization, gained almost entire control. At his death, in 1886, he was succeeded by Richard Croker (q.v.), who, however, did not exercise the powers of a boss until 1888, and who in 1901 retired. Lewis Nixon (q.v.) was then nominally the leader for several months. Tweed, Kelly, Croker, and Nixon had each been chairman of the finance committee; this committee was reorganized in 1903, after the policy of Tammany had been shaped for a time by a triumvirate, and Charles F. Murphy (q.v.) was chosen leader. A man of remarkable political talents, Murphy soon gained for himself virtually absolute power. In 1912, after he had secured the elections of McClellan and Gaynor, he was made one of the issues in the national campaign. The whole Tammany system was sharply criticized. The control of Tammany in State Democratic politics, despite occasional rebuffs, has been well-nigh absolute.

In organization Tammany is highly centralized, the power resting ultimately in the hands of one man or of a relatively small number of men. There is a captain for each election district in the city, and a district leader for each Assembly district. The executive committee of the organization is generally made up of these various district leaders; while in addition each district elects a certain number of men to the so-called General Committee, in which ostensibly the power rests, and in whose name the lease of the building known as Tammany Hall is held. The men elected by each district to the General Committee, whose membership is somewhat in excess of 5000, form the General Committee for that district and are presided over by the district leader. The General Committee has standing subcommittees on finance, printing, naturalization, correspondence, and organization.

The power of Tammany is traceable, however, to something more than mere machine organization. It makes a systematic appeal for the votes of the lower classes and accomplishes its purpose by numerous acts of real charity; by gratifying the social instincts of the tenement dweller, the district leaders giving at their own expense frequent dances, chowder parties, picnics, and excursions; by bailing unfortunates out of jail; by systematically ingratiating itself with the vast numbers of immigrants; by securing work for the unemployed; by an extensive and generally astute use of patronage (when Tammany is in power); and apparently by the application of pressure and various acts of virtual intimidation. It also gains votes by virtue of its position as the representative in New York of the Democratic party, and, by the lax enforcement of sumptuary laws when in power, it wins the support of those voters who on principle or through motives of self-interest oppose such laws. In the midst of revelations of fraud and corruption such as in the case of Tweed, and of defeat, as in 1913 by the Fusionists, Tammany has evinced a wonderful vitality. By nominating for mayor such men as Havemeyer, Hoffman, Hewitt, and Gaynor, and by denouncing the corruption and aristocratic tendencies of the opposition, it has recovered power. According to its own standards Tammany Hall has been an efficient organ for government. Arrayed against it are the members of the Republican party, a large majority of the cultured and well-to-do classes, and large numbers, representing various classes, who are convinced that Tammany government means a government of blackmail, of fostered vice, of police corruption, and, if not of outright dishonesty in all respects, at least of general wastefulness and inefficiency.

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TAMMANY SOCIETIES. See TAMMANY HALL; SECRET SOCIETIES.

TAMMERFORS, tăm′mĕr-fôrs′ (Finnish

Tampere). The principal manufacturing city of Finland, Russia, situated in the Government of Tavastehus, close to the falls of Tampereenkoski and 125 miles northwest of Helsingfors by rail (Map: Russia, B 2). It is a modern town with extensive cotton, paper, saw and iron mills, and various other manufacturing establishments (including locomotive works and shipyards), whose motor power is supplied chiefly by the near-by rapids. Its principal import is cotton, of which 7,687,100 pounds were imported in 1913. The town was founded in 1779, while its industrial development dates from the beginning of the nineteenth century. Pop., 1912, 45,791.

TAM′MUZ. A deity of Sumerian origin worshiped in Babylonia and also, according to Ezekiel viii. 14, in the temple at Jerusalem, where women wept for Tammuz. The meaning of the Sumerian name, Tamuzu, or Duuzi-Duzi, seems to be *aplu kenu*, true son. He is represented as a son of Ea, and probably had his original home at Eridu. At first he was apparently an agricultural deity. He is mentioned in the inscriptions of Gudea of Lagash, in the Adapa-myth and in the Gilgamesh Epic. In the developed Babylonian mythology he became the symbol of the decay of vegetation after the close of the summer season, pictured as slain by the goddess Ishtar after she has secured him as her husband. The death of Tammuz gave rise in Babylonia to the mourning ceremonies described by Ezekiel, and from Babylonia as a centre the cult spread to the West. There was a relation of Tammuz to the boar already in Babylonia. Among the Canaanites Tammuz was known as *Adoni*, the lord, and this name was given by the Greeks as Adonis (q.v.). Among the Phœnicians the chief temple and worship of Adonis was at Byblus (or Gebal), and from Phœnicia the Adonis cult was carried to Cyprus and Greece, where he was connected with Aphrodite. His festivals were partly the expressions of joy, partly of mourning. In the latter the women gave themselves up to the most unmitigated grief over the lost Adonis, shaved off their hair, and sacrificed their chastity in his temples. The days of mourning were completed by a solemn burial of an image of the god. This period was followed by a succession of festive and joyful days in honor of the resurrection of Adonis. The river Adonis (Nahr Ibrahim), which once a year ran purple to the sea from the Lebanon, was supposed to be tinged by the blood of the god; and a vessel sent off from Alexandria, and carried by the tide to Byblus, used to inform the mourners by letter that he had been found again. These feasts were celebrated during the summer solstice. The fourth month in the Babylonian calendar, known as Tammuz and adopted by the Hebrews, preserves the name of the god and furnishes a valuable testimony as to the time when his festival was celebrated, since the Babylonian year began in the spring. Adonis of Byblus was identified with Osiris, Athtar, Dusares, Attis, and other gods. This was no doubt facilitated by the similarity of mythopoetic thought in different peoples. Our information concerning the Tammuz Adonis cult comes partly from Lucian's *De dea Syra*, partly from the monuments on the Adonis River in the Lebanon. Consult: W. R. Smith, *Religion of the Semites* (London, 1894); H. Zimmern in E. Schrader, *Die Keilinschriften und das Alte Testament* (3d ed., Berlin, 1902); Alfred Jeremias, *Das Alte Testament in Lichte des Alten Orients* (Leipzig, 1906); M. Jastrow, *Die Religion Babyloniens und Assyriens* (Giessen, 1902–12); W. Baudissin, *Adonis und Eshmun* (Leipzig, 1911); S. Langdon, *Tammuz and Ishtar* (Oxford, 1914); J. E. Frazer, *Adonis, Attis, Osiris* (3d ed., London, 1914); G. A. Boston, "Tammuz and Osiris" in *Journal of The American Oriental Society* (New Haven, 1915).

TAM O' SHANTER. One of the best-known poems of Robert Burns, based on the popular belief that no evil spirit can pass the middle of a running stream. The hero is pursued by witches for disturbing their dance at Alloway Kirk, and succeeds in crossing the river Doon in safety.

TAM′PA. A city, port of entry, and the county seat of Hillsboro Co., Fla., 212 miles south by west of Jacksonville, at the mouth of the Hillsboro River, on Tampa Bay, and on the Atlantic Coast, the Seaboard Air Line, the Tampa and Gulf Coast, and the Tampa Northern railroads (Map: Florida, D 4). There is also steamship connection with the principal Atlantic and Gulf ports and Cuba, the West Indies, and Central America. Tampa has become a famous winter resort. Noteworthy are the Tampa Bay Hotel, De Soto Park, the scene of the encampment of the United States Volunteers during the Spanish-American War; the old government reservation; the Carnegie Library, Sulphur Springs, Ballast Point Park, the county courthouse, Elk's Home, the Church of St. Louis, and the Federal building. Tampa is an important shipping point through Port Tampa for phosphate, fruits, vegetables, turpentine, rosin, lumber, fish, and cattle. In the year ending June 30, 1913, the total trade of the customs district amounted to $8,918,000, including exports to the value of $4,326,000. The 1914 census showed manufactured products to the value of $14,039,000, and an invested capital of $9,858,000. The chief industry is the manufacture of Havana cigars, a large part of the world's supply being made here. There are foundries and machine shops, a fertilizer factory, and manufactories of wagons, automobile tops, jewelry, furniture, lamps, mattresses, safes and locks, brick and tile, etc. Fishing also is largely carried on. Pop., 1890, 5532; 1900, 15,839; 1910, 37,782; 1915 (U. S. est.), 51,521.

TAMPA BAY. An inlet of the Gulf of Mexico on the west coast of Florida (Map: Florida, D 4). The bay proper is about 20 miles long, and has an average width of about 7 miles, the northern part being divided into Old Tampa Bay (about 12 miles long and 6 miles wide) and Hillsboro Bay (7½ miles long and about 4 miles wide). Its entrance is protected by a line of keys, or low islands, and it forms an excellent harbor with a depth of 22 feet in the main entrance, though the dredged channel to Port Tampa is 24 feet deep.

TAM′PAN. A tick (q.v.) of southern Africa, remarkable for its very poisonous bite, found in Angola and southward, and described by Livingstone in his *Travels*. It attacks by preference the parts between the fingers or toes, attains the size of a pea, and when filled with blood is dark blue, and so tough that it cannot be burst by squeezing with the fingers. The first effect of the bite is mingled pain and itching, which ascends until it reaches the abdomen, and causes either violent vomiting and purging, or fever. The tingling sensation lasts for a week.

TAMPICO, tȧm-pē'kō. A seaport in the state of Tamaulipas, Mexico, 206 miles northeast of the City of Mexico, on the Pánuco, near its mouth (Map; Mexico, K 6). The town is surrounded by lagoons, which make it very unhealthful. It has broad streets and squares, the largest of the latter, the Plaza Constitución, having a public garden in its centre. The most notable building is the parish church of the Jesuits. The town is connected by rail with the interior states of northern Mexico, of which it is the chief outlet. The city has experienced rapid development due to the exploitation of oil fields. In 1913 exports amounted to $81,030,261, and included ixtle, rubber, guayule, chicle, and asphalt. Imports, chiefly manufactured articles from the United States, were valued at $45,832,515. Pop. (est.), 35,000. Tampico was an Aztec city. In 1683 it was destroyed by the pirate Lorencillo and was not rebuilt till 1823. It received the name Santa Ana de Tamaulipas in 1834, and was the scene of a Mexican victory over the Spanish in 1827. In 1914 it was the scene of the Tampico incident (see MEXICO, *History*), and later was captured by the Constitutionalists.

TAMSUI, tăm'sōō'ē (Chin., Freshwater). A port on the north coast of Formosa, opened to foreign residence and trade by the Treaty of Tientsin (1858), and continued as such by the Japanese. It stands at the mouth of the Tamsui River, 13 miles from Jai-peh, or Daihoker (Map: Japan, D 8). The principal exports are tea, rice, sugar, camphor, coal, flax, hemp, jute, etc., chiefly to China, Hongkong, British India, and the United States, and the imports are salt, flour, kerosene oil, cotton and woolen goods, lead, and other metals, tobacco, joss sticks, etc. The population is estimated at over 6000.

TAM-TAM (Hind., drum, onomatopoetic in origin). An Indian or Chinese musical instrument. It consists of a metal disk concave in the middle and is suspended by a loop. The tone is produced by striking the disk with a stick having a soft knob made of felt or leather.

TAM'WORTH. A municipal borough and market town, on the borders of Staffordshire and Warwickshire, England, at the confluence of the Tame and Anker, 13 miles northeast of Birmingham (Map: England, E 4). Its chief buildings are the castle built on the site of a Saxon fort and the church of St. Editha, founded in the eighth century. It acquired in 1897 the historic castle which had descended through the female line of the Marmions to the Marquis Townshend. Market gardening, brickmaking, dyeing, wool stapling, and manufactures of tapes and small wares are carried on. From the beginning of the eighth century Tamworth was the chief Mercian royal residence. Burned by the Danes in 911, it was rebuilt by Ethelfleda, daughter of Alfred the Great. Pop., 1901, 7271; 1911, 7738. Consult Palmer, *History of Tamworth* (London, 1871–75).

TANA, tä'nȧ. A river in British East Africa (Map: Congo, G 3). It rises in numerous head streams in the southwest slope of Mount Kenia, and flows southeast after making a long detour to the north, emptying into the Indian Ocean. Its length is over 500 miles. Its upper course down to Balarti (Hameye) is that of a mountain stream, full of falls and cataracts. Its importance as a waterway into the interior of Africa is considerably diminished by the bar which obstructs its entrance.

TANA. See TZANA.

TAN'AGER (from Neo-Lat. *Tanagra*, from Brazilian *tangara*, the native name of the bird). The popular name for the Tanagridæ, a family of birds having a conical beak, triangular at the base, the upper mandible notched towards the tip, and its ridge arched. The family is closely related to the finches, and about 350 species are known, all American and nearly all tropical. Only five species occur as far north as the United States and only two of these reach Canada. They are all birds of moderate or small size, 6 to 8 inches long, or less, of surpassingly gaudy plumage, though the brilliancy is mostly confined to the males. They are arboreal, feeding on fruit and insects, and have little power of song, but a few species sing well. The best known of the three North American forms is the scarlet tanager (*Piranga erythromelas*), the most brilliant bird of the northern United States—the male bright scarlet with black wings and tail; the female light olive-green above, greenish yellow beneath. The immature males are like the females, but have the black wings and tail, and the adult male assumes this plumage in winter. The scarlet tanager breeds as far north as New Brunswick and as far west as Kansas, but winters in Central and South America. It builds its nest near the end of a horizontal limb; the nest is a loose, shallow structure of twigs, weeds, and rootlets. The eggs are pale bluish with numerous reddish-brown spots. The scarlet tanager has a pleasing song. From New Jersey southward there is found from April to September the summer tanager (*Piranga rubra*), rose-red, brighter below, the wings fuscous margined with rose. The female is orange olive-green above, buffy yellowish green below. In habits, nesting, and song it resembles the scarlet tanager. From the eastern foothills of the Rockies to the Pacific there is found in summer the Louisiana or Western tanager (*Piranga ludoviciana*). The male is bright yellow, with the whole head crimson or scarlet, and the back, wings, and tail black. The female is exactly like the female scarlet tanager, except for white or yellowish markings on the wings. In nesting and other habits this bird resembles the others. Consult Robert Ridgway, *Birds of North and Middle America*, part ii (Washington, 1902), and general ornithologies. See Colored Plate with THRUSH.

TAN'AGRA (Lat., from Gk. Τάναγρα, modern Grimadha). An ancient city in eastern Bœotia close to the Athenian border. It did not play any part in ancient history, but near it was fought an important battle between the Athenians and the Spartans in 457 B.C. Through the treacherous desertion of the Thessalian cavalry the Athenians were defeated, but later in the same year at Œnophyta in the same district they won a great victory which made them masters of Bœotia. During the Hellenistic and Roman periods Tanagra was a flourishing agricultural community, said to produce the best wine in Bœotia. It is now deserted, though the line of ancient walls is marked by mounds of rubbish, and there are remains of the theatre and other ancient buildings. The chief fame of the town is due to its extensive necropolis, first opened in 1874, and since then the scene of countless open and clandestine excavations. The tombs or graves have yielded the long series of graceful and charming terra-cotta statuettes, known as Tanagra figurines. In many cases these were broken before being cast into the grave, and their significance has caused much discussion, in which an occult symbolism has not been proved. The high value attached to these little figures has led to much modern forgery, and it is often hard even for an expert to detect the imitations. Consult Fowler, Wheeler, and Stevens, *A Handbook of Greek Archæology* (New York, 1909), and K. Baedeker, *Greece* (4th Eng. ed., Leipzig, 1909).

TA′NAIS. The ancient name of the Don.

TANANA, tȧ-nä′nȧ (South American name). One of the singing grasshoppers of the genus *Locusta*, common in Brazil, whose music is much admired by the natives, who keep it in little cages much as the Japanese keep crickets.

TANANA (tä′nȧ-nä′) RIVER. The longest and most important of the affluents of the Yukon River, Alaska (Map: Alaska, K 3). It is navigated from the middle of May to the middle of October as far as Fairbanks (q.v.), 200 miles. Of its tributaries the Chena, Tolovana, and Volkmar are practicable for very small steamers, while the Kantishna has been navigated 200 miles.

TANANARIVO, tȧ-nä′nȧ-rē′vō. The capital of Madagascar. See Antananarivo.

TANANA VALLEY. This region, watered by the Tanana and its tributaries, is the most important portion of the Yukon watershed. Area, about 25,000 square miles. Pop. (white), about 6,000, with some 30,000 acres under homestead. The native population, Tananas, decrease slowly in numbers. From 1903 to 1915 gold to the estimated value of $66,000,000 was mined, the products of the Fairbanks district alone exceeding $63,000,000. Coal beds, though low grade in quality, extend from the Delta River westward to the upper Nenana. In the Bonnefield district an area of 600 square miles of lignite coal outcrops, under favorable conditions for mining. Good grass, fertile soil, abundant timber (mostly spruce and birch) make portions of the Tanana valley the most desirable part of interior Alaska for permanent settlement.

TAN′AQUIL. The wife of Tarquinius Priscus.

TANAUAN, tȧ-nä′wȧn. A town of Leyte, Philippines, situated 10 miles from Tacloban. Pop., 1903, 18,256.

TANAUAN. A town of Luzon, Philippines, in the Province of Batangas. It is situated on the principal highway from Batangas to Manila, about 27 miles north of Batangas. The town was founded in 1584, on the shore of Lake Taal, but was destroyed in 1754 by an eruption of the volcano Taal (q.v.), and later rebuilt in its present position not far from the lake. Pop., 1903, 18,263.

TAN′CRED (c.1050–1112). Prince of Antioch, a hero of the First Crusade. The first authentic information respecting him is that he joined his cousin Bohemund in the First Crusade in 1096. They landed in Epirus, and took the oath of allegiance to the Greek Emperor, Alexius (q.v.). Tancred's exploits on the way to Syria; his quarrel with Baldwin for the possession of Tarsus; his valor before Antioch, where he took an oath that as long as he had 40 knights he would never withdraw from the expedition to Jerusalem; and the praises of his biographer, Radulph of Caen, have given him a fictitious importance. After the conquest of Jerusalem he became Prince of Galilee. A quarrel with Baldwin, after Godfrey's death, caused him to give up his possessions in the Kingdom of Jerusalem. While Bohemund was in captivity he ruled over Antioch. When Bohemund died in 1111, Tancred became Prince of Antioch, where he died in 1112. Tancred has been made famous by Tasso in his *Gerusalemme Liberata*. For the actual facts during the most important period of his life, consult Bernhard Kugler, *Boemund und Tankred* (Tübingen, 1862), and Reinhold Röhricht, *Geschichte des Königreichs Jerusalem* (Innsbruck, 1898).

TANCRED AND GISMUNDA. A tragedy played before Queen Elizabeth in 1586, published by Robert Wilmot in 1591. It was founded on a story by Boccaccio, the substance of which makes the plot of Tale 39 in Painter's *Palace of Pleasure* (London, 1566–67).

TANCRED DE HAUTEVILLE, ōt′vēl′. A Norman noble, father of several sons who established by force of arms the Norman power in southern Italy and Sicily. The most celebrated of the brothers were Robert Guiscard and Roger I (q.v.).

TAN′DY, James Napper (1740–1803). An Irish agitator, born in Dublin. During the American Revolution he took an active part in the effort to prevent the use of English goods in Ireland; was an enthusiast in the "volunteer movement"; on May 27, 1782, commanded the corps of artillery that guarded the approaches to the Irish Parliament when that body met to receive the answer of the ministry to the demand for legislative independence; and was one of the foremost in the volunteer convention of November, 1783. Ten years afterward when he was about to be tried for writing a seditious pamphlet called "Common Sense," he fled to the United States. In 1798 he went to Paris and was put in command of a vessel for an invasion of Ireland. He remained on Irish soil, however, but eight hours, and then went to Bergen, Norway, and from there by land to Hamburg. At the latter place he was seized and was delivered to the English, and upon his arrival in Ireland was condemned to death. Bonaparte, however, brought such pressure to bear in his favor that he was released. He soon after went to France and was made a general of division. He was the hero of the famous ballad, "The Wearing of the Green." Consult W. E. H. Lecky, *History of England in the Eighteenth Century* (new ed., 7 vols., New York, 1892–93).

TANEIEV, tä′nȧ-yĕf, Sergei Ivanovitch (1856–1915). A Russian composer. He was born in the Province of Vladimir and studied at the Moscow Conservatory under Nicholas Rubinstein, Hubert, and Tchaikovsky. After his graduation in 1875, when he received the gold medal in two departments, he toured in Russia with Leopold Auer (q.v.) and won high praise as a pianist. At the Moscow Conservatory he became professor of harmony (1878), professor of piano (1881), and was director (1885–89). After that, until his death, which occurred at Dindkovo, he taught higher composition with signal success. His career as a composer began in 1881 with a sacred cantata (in commemoration of Nicholas Rubinstein) entitled *St. John of Damascus*. The list of his compositions includes, besides four symphonies, the opera *Orestes* (1895), numerous songs of high lyric quality, and much chamber music that alone would have made the composer famous. His last great work, *On Reading a Psalm*, a cantata in the style of Bach, was successfully performed in 1915. He wrote also an elaborate treatise on *Imitative Counterpoint in Strict Style;* and among his papers was found an almost completed treatise on *Canon and Fugue*. As a composer Taneiev was neither a Nationalist nor an ultra-Modernist, but a true Classicist. Both as teacher and as composer he exercised a wide influence in Russia.

TANEY, ta̤′nĭ, ROGER BROOKE (1777–1864). An eminent American jurist, Chief Justice of the United States Supreme Court. He was born in Calvert Co., Md., graduated at Dickinson College, Pa., studied law at Annapolis, and in 1799 was admitted to the bar. In 1823 he removed to Baltimore, where he succeeded William Pinkney and Luther Martin as head of the Maryland bar. In 1827 he was elected Attorney-General of the State, and, having become a Democrat and a supporter of Andrew Jackson, was appointed Attorney-General of the United States in 1831. In this capacity he became one of Jackson's most trusted counselors, encouraged him to remove the United States Bank deposits, and upon the refusal of William J. Duane, then Secretary of the Treasury, to obey Jackson's orders to this effect, was appointed in Duane's stead, though his appointment was never confirmed by the Senate. Taney promptly removed the deposits and thus further won the confidence of his chief. In 1836 he succeeded John Marshall as Chief Justice of the United States Supreme Court. In this capacity he sustained in the main the high reputation of his distinguished predecessor for legal learning and acumen, though as a result of the passions engendered by the approaching civil strife some of his opinions were severely criticized. He wrote the opinion of the court in many important cases, the most notable being that of Dred Scott. (See DRED SCOTT CASE.) During the Civil War Chief Justice Taney gave opinion in the noted case of Ex parte Merryman in answer to an application for a writ of habeas corpus in behalf of a citizen of Baltimore who had been arrested by a United States officer on a charge of treason, denying in strong and vigorous language the right of the President to suspend the writ of habeas corpus and affirming that that power was vested in Congress alone. A memoir of Taney's life, in part an autobiography, was published in 1872 by Samuel Tyler.

T'ANG, tăng. One of the seven most celebrated dynasties of China. It lasted from 618 to 907 and was founded by Li Yuan, a soldier and a descendant of one of the princely houses, who, after a reign of eight years, during which many reforms were introduced, abdicated in favor of his second son, Li Shih-min, the real unifier of the Empire and the most illustrious of the T'ang rulers (627–649). With the twelfth Emperor decay began to set in and in 907 the line came to an end. In 923 a descendant of one of the T'ang emperors established the Posterior T'ang, which came to an end in 936 under its fourth Emperor.

The T'ang is undoubtedly one of the most brilliant periods of Chinese history. The Empire was extended to the Caspian Sea and China itself was divided into 15 provinces. In 628 a maternal uncle of Mohammed visited China and built the mosque at Canton, and a century and a half later 4000 Mohammedan soldiers, whose descendants now form an important element of the population, settled in the country. Learning and literature were fostered, the Hanlin Yuan (q.v.) had its beginning, and Buddhism, Taoism, and even Nestorian Christianity flourished under Imperial patronage. Paper money was then first used and the Peking *Gazette* was founded.

TANGANYIKA, tăn′gȧn-yē′kȧ. A large lake in Central Africa, extending from lat. 3° 16′ to 8° 48′ S., and from long. 29° 20′ to 31° 20′ E. (Map: Africa, H 5). It lies in the western branch of the Great Rift valley (q.v.), which is interrupted at the south end of the lake by a plateau, but continued farther to the southeast as the basin of Lake Nyassa. Tanganyika extends in a north-northwest and south-southeast direction, with a length of 400 miles and a breadth of 20 to 40 miles. Its area is estimated at over 12,000 square miles. Its drainage basin, which includes a narrow strip of fertile lowland along either shore, has the appearance of a vast chasm with precipitous rocky cliffs, reaching a height of 4200 feet above the level of the lake, which is 2700 feet above the sea. The depth is very great, ranging in the greater portion from 500 to over 2000 feet, and the lake has but a few shoals, reefs, or islands. There are, however, floating islands of vegetation, the shores being often very densely forested with palms. Navigation is also rendered dangerous by severe hurricanes and tornadoes to which the basin is subject. The lake is fed largely by the seasonal rain (October to March), and discharges into the Congo through the Lukuga, which leaves it near the middle of the western shore. This discharge, however, is intermittent, and the level of the lake is subject to periodic fluctuations, each of which may range over a series of years. The fall of the lake level in recent times has amounted to two feet annually. Though the water is, as a whole, fresh, it has in some portions a tendency to become brackish. Besides the usual fresh-water fish, crocodiles, and hippopotami, there are a number of peculiar isolated groups of deep-water mollusks and crabs which are asserted to be of marine origin, and which point to a connection with the sea, probably in Jurassic times.

The largest town is Ujiji, on the east shore. Lake Tanganyika was discovered in 1858 by Burton and Speke, and later explored by Livingstone, Cameron, Stanley, and others. Consult Peters, *Das deutsch-ostafrikanische Schutzgebiet* (Munich, 1895).

TANGELO, tăn′jē-lō. A name given to the fruits obtained from hybrids between the tangerine and pomelo. The tangelo has the loose skin of the tangerine and the sprightly acid flavor of the pomelo, with less bitterness. It is used principally as a breakfast fruit. Consult United States Department of Agriculture *Yearbook, 1904* (Washington, 1905).

TAN′GENT (Lat. *tangens*, pres. p. of *tangere*, to touch). In elementary work, an unlimited straight line which meets a curve in but one point without cutting it. This definition is, however, not general. If we have a point *P* on a curve, with chords drawn from *P* to one of the arcs terminated by *P*, then if a line can be drawn from *P* so that chords of unlimitedly short length make angles of unlimited smallness with this line, the line is called a tangent to the curve at *P*. This more general definition of tangent is illustrated in the figures (page 824).

In Fig. 1 we have the elementary idea of tangent. In Fig. 2 we see that a tangent at *P* may cut the curve at some other point. In Fig. 3 we see that a tangent at *P* may even cut the curve at that point. The point *P* in any of these cases is called the point of contact or point of tangency. A tangent may be thought of as the limiting position of a secant, the point of tangency being the point in which the points of intersection of the secant with the curve coincide. In the circle there is but one distinct tangent at any point in the circumference, and this is perpendicular to the radius at that point. The segments of two tangents to a circle from an external point, limited by the point and the points of contact, are equal. If the point moves up to the circumference the segments become zero and the tangents coincide; if the point moves inside the circumference the tangents become imaginary. (See CONTINUITY.) All conic sections being of the second class (see CURVE) admit of but two tangents from any point. Curves belonging to higher classes admit of a greater number, depending upon the class. Tangents are of different orders of contact (see CONTACT) according to the number of coincident points at the point of tangency, and thus serve to distinguish various singularities of curves. (See CURVE.) In coördinate geometry the projection, upon the X axis, of the segment of the tangent between the point of contact and the X axis is called the subtangent. An important class of tangents are known as asymptotes (q.v.). In the geometry of surfaces the tangent plane corresponds to the tangent line of curves. The extensive list of properties involving tangents is best obtained from works on analytic geometry.

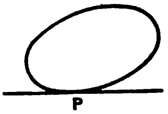


FIG. 1.

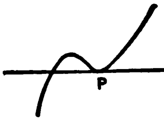


FIG. 2.

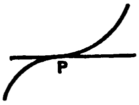


FIG. 3.

TANGERMANN, tăng′ẽr-män, WILHELM (1815–97). A German Old-Catholic theologian, known as an author by the pseudonym Victor Granella. He was born at Essen-on-the-Ruhr and studied theology at Münster and Munich. Ordained a Roman Catholic priest in 1845, he was appointed chaplain at Neuss in 1846 and at Unkel in 1862. In 1870 he was deprived of his office because of refusal to acknowledge the Vatican's decrees, and afterward he was identified with the Old-Catholic movement. From 1872 to 1888 he was in charge of the congregation at Cologne. His writings include: *Wahrheit, Schönheit, und Liebe, Philosophisch-ästhetische Studien* (1867); *Philosophie und Christentum in ihren Beziehungen zur Kultur und Religionsfrage* (1876); *Das liberale Princip* (1883; 2d ed., 1886); *Natur und Geist* (1894); *Erkenntnis und Liebe, die schönsten Leitsterne des Lebens* (1906).

TANGERMÜNDE, tăng′ẽr-mün′de. A town in the District of Magdeburg, Prussia, 63 miles west of Berlin, on the Elbe (Map: Germany, D 2). The town still retains its old walls, gates, and towers, its twelfth-century Church of St. Stephen, an ancient castle, now the district building, and the old council house. There are a large sugar refinery, mills for manufacturing rapeseed oil and bone meal, and boatbuilding establishments. Pop., 1900, 11,524; 1910, 14,001.

TANGHIN, täŋ′gĭn (Malagasy name), *Cerbera tanghin*. A tree of the family Apocynaceæ. The kernel of its fruit was formerly used in Madagascar, where the tree is native, to determine the guilt or innocence of persons charged with witchcraft and like odious crimes.

TANGIER, tăn-jēr′. The chief seaport of Morocco, on the Bay of Tangier, in the Strait of Gibraltar, eight miles east of Cape Spartel and 35 miles southwest of Gibraltar (Map: Africa, D 1). The climate is healthful and temperate and through European influence the sanitary conditions of the town have been greatly improved. Inland is the Spanish protectorate of Morocco, in which Tangier is not included, but, by the Franco-Spanish treaty of Nov. 27, 1912, constitutes, with a territory of some 600 square kilometers, a special international district. Tangier is surrounded by ancient ruins of walls and by gardened areas. It is picturesquely Oriental and its life is highly interesting. The white Moorish houses, amid towers and gates, rise above one another from the sea in the form of an amphitheatre, the highest point being crowned by a castle. The houses are of one story, the streets steep and too narrow for wagons or carriages. The main street leads from the harbor on the east to the new market and to the Socco de Barra on the southwest. It passes the Great Mosque, whose handsome gate and tower are noteworthy. Near by is the Small Socco with its interesting bazaars, the business centre of the town. For the accommodation of the numerous visitors and tourists there are a number of European shops and modern hotels. The Kasba, or castle, dating from the fifteenth century, stands on the plateau in the northern part of the city. The plateau extends from the lofty Marshan towards the sea and furnishes a superb view. The castle or citadel is a dilapidated mass of buildings. The adjacent palace of the Sultan and the residence of the Governor are imposing edifices. There are a Catholic chapel, several synagogues, and a hospital. Tangier is lighted by electricity. The harbor is the best in Morocco, although it is both small and shallow. Imports and exports in 1912–13, £848,952 and £200,171; in 1913–14, £978,173 and £136,331. Trade is largely in the hands of the Jews. Pop., from 40,000 to 50,000, including 6000 Christians and 7000 Jews.

Tangier is the Roman Tingis and was the capital of Mauretania Tingitana. It was held in turn by the Vandals, Byzantines, Arabs, and Portuguese, who obtained possession of it in 1471. After being held by the Spaniards and again by the Portuguese it came to the English in 1662 as part of the dowry of Catharine of Braganza, wife of Charles II, but was abandoned by them to the Moors in 1684. As a result of the Algeciras conference of 1906, a joint Franco-Spanish police force was organized. Details for the administration of Tangier as an international district were not completed in 1914.

TANGLE. A kind of seaweed. See CARRAGEEN; LAMINARIA.

TANGLEWOOD TALES, THE. A volume of stories for children by Nathaniel Hawthorne (1853).

TANGO, tăŋ′gō; Sp. täŋ′gō. See DANCING.

TANGUAY, tăN′gâ′, CYPRIEN (1819–1902).

A Canadian clergyman and genealogist. He was born in the city of Quebec, graduated at the Quebec Seminary in 1839, and was ordained a Catholic priest in 1843. He removed in 1860 to St. Germain, and founded Rimouski College and the convent of Notre Dame. In 1865 he entered the service of the Canadian government, and in 1867 was sent to Paris to examine the French archives in connection with Canadian history. He was one of the original fellows of the Royal Society of Canada (1882). In 1887 he was sent abroad to report upon the historical archives of Europe. He published the important *Dictionnaire généalogique des familles canadiennes* (7 vols., 1871–90) and *Le répertoire du clergé canadien par ordre chronologique* (2d ed., 1893).

TANIER. See Cocco.

TA′NIS. The Carthaginian moon goddess, called by the Phœnicians Astarte (q.v.).

TANIS (Lat., from Gk. *Τάνις*, Egyptian *Za'net*, Hebrew *Zo'an*). A city of ancient Egypt in the northeast corner of the Delta. It was situated on the right bank of the Tanitic branch of the Nile, near the site of the modern fishing village of San. Tanis was the capital of the fourteenth nome of Lower Egypt, and was a place of importance in very early times. The kings of the Sixth dynasty founded there a great temple which was subsequently restored and enlarged by their successors of the Twelfth and Thirteenth dynasties, and the city was for some time the capital of the Hyksos rulers. Under the Nineteenth dynasty it was strongly fortified as a base of military operations against Palestine and Syria, and Rameses II, who established his residence there, restored the ancient temples and greatly embellished the city. The Twenty-first dynasty, of Tanitic origin, made the city the capital of Egypt, and at the time of the Assyrian invasions in the seventh century B.C. it was the seat of a prince. Until the founding of Alexandria it was one of the chief commercial cities of Egypt, but the silting up of the Tanitic mouth of the Nile diverted its trade to the new capital of the Ptolemies, and it gradually fell into ruins. Excavations of the site, conducted by Mariette in 1860 and by Petrie in 1883–84, brought to light the remains of extensive temple buildings, many statues and sphinxes, and no less than 14 obelisks. Tanis is undoubtedly the biblical Zoan which in Numbers xiii. 22 is said to have been built seven years later than Hebron, and it is identified by many Egyptologists with the city of Raamses, which the Israelites were obliged to fortify (Ex. i. 11). Consult: W. M. Flinders Petrie, *Tanis* (London, 1885–88); E. A. T. Wallis Budge, *A History of Egypt* (New York, 1902); J. H. Breasted, *Ancient Records of Egypt* (Chicago, 1907).

TAN′ISTRY (from *tanist*, from Ir., Gael. *tánaiste*, OIr. *tanaise, tanaiste*, next heir to an estate). An ancient Celtic law of succession by which property or political power descended not to the children, but to the eldest and worthiest of the surviving kinsmen of the deceased lord. The rights thus transferred were felt to be vested rather in the tribe than in the individual.

TANJAY, tän-hī′. A town on the east coast of Negros, Philippines, in the Province of Negros Oriental, situated 19 miles from Dumaguete, 1½ miles inland on a river of the same name. Pop., 1903, 11,894.

TANJORE, tän-jōr′. The capital of a district of Tanjore, in the Province of Madras, British India, 48 miles west of Negapatam, in the valley of the Kaveri River, one of the richest agricultural sections in India (Map: India, D 7). The large temple, dating from the eleventh century, is one of the finest examples of the pagoda style of architecture in existence. There are several concentric rectangles, the outer measuring 415 by 800 feet. The leading architectural features are the great gopura, a pyramidal tower 200 feet high, and the handsome embellished shrine of Kartikeya. Another striking edifice is the palace of the Raja, constructed in 1550. It has many sculptures and pictures, together with a library containing valuable Sanskrit manuscripts. Schwarz's Church, the English Church, St. Peter's College, the Prince of Wales Medical School, and People's Park are also of interest. Tanjore has manufactures of jewelry, carpets, copper utensils, and objects in repoussé work. Pop., 1901, 57,870; 1911, 60,341. Tanjore was the capital of a Hindu principality until the overthrow of the Chola dynasty by the Mahrattas in 1678. During its early history it was one of the most important cities in southern India. The English obtained control in 1799.

TANKAGE. A name applied to a product, used mainly for fertilizing purposes, which is prepared from the residue resulting from the treatment of abattoir and slaughterhouse refuse with steam and hot water in closed tanks for the removal of fat; a process commonly known as tanking. Tankage is variable in composition, depending upon the materials used in its preparation and the process of manufacture, but is generally rich in nitrogen, and it is this element which mainly determines its value as a fertilizer. According to Voorhees, two distinct kinds of tankage are ordinarily prepared: (1) concentrated tankage, containing from 10 to 12 per cent of nitrogen with very small percentages of phosphoric acid; and (2) crushed tankage, of which there are several grades, containing from 4 to 9 per cent of nitrogen and 3 to 12 per cent of phosphoric acid. Products containing more than 12 per cent of phosphoric acid are known as bone tankage, and are properly classed with bone fertilizers (q.v.). The term tankage is also sometimes applied to the product obtained by drying, and in some cases partially charring, city garbage. This garbage tankage is more variable in composition and less valuable as a fertilizer than true tankage, although, like the latter, its value as a fertilizer depends mainly upon the amount and availability of its nitrogen. The nitrogen of meat and bone tankage of good quality has been found to be about 60 per cent as effective as plant food as that of nitrate of soda, which is taken as the standard. Tankage is therefore one of the most valuable sources of organic nitrogen for fertilizing purposes. Tankage is also used with good results as a concentrated feeding stuff, especially for feeding hogs. When used in combination with corn it supplies the deficiencies, from a feeding standpoint, of that grain in protein and ash constituents and thus furnishes a better-balanced ration.

TAN′NAHILL, Robert (1774–1810). A Scottish poet. He was the son of a silk weaver of Paisley. He was apprenticed to his father and passed most of his life in Paisley at the loom. As a song writer he possessed a spontaneity akin to that of Burns. Among his best songs are "Bonnie Wood o' Craigilee," "Sleepin' Maggie," "Braes o' Gleniffer," "Gloomy Winter's noo awa'," and "Jessie the Flower o' Dunblane."

Suffering from melancholia, Tannahill drowned himself in a canal near Paisley. In 1874 the centenary of his birth was observed; and in 1883 a bronze statue was erected to his memory in the Paisley Abbey burying ground. Consult the complete edition of *Poems*, ed. by Semple (Glasgow, 1873), which includes a full biography; selections in Miles's *Poets and Poetry of the Century* (London, 1891 et seq.).

TANNEGUY, Charles Marie. See Duchatel, Count.

TANNENBERG. A village in the District of Allenstein, Prussia, with a population of about 500. On July 15, 1410, the Poles and Lithuanians inflicted a crushing defeat on the Teutonic Knights here. In August, 1914, Tannenberg was the scene of a great German victory over the Russians. The battle lasted seven days and was fought over several villages, the most important of which were Mühlen, Gilgenheim, Hohenstein, Allenstein, Soldau, Nerdenburg, Willenburg, and Ortelsberg. The Germans held the centre of their line near Tannenberg and turned both flanks of the Russian army. Though outnumbered by the Russians 230,000 to 135,000 they inflicted such a severe defeat that it broke the Russian offensive against Königsberg. It is estimated that the Russians lost 70,000 killed and wounded, besides 95,000 prisoners. See War in Europe.

TAN′NER, Henry Ossawa (1859–). An American historical painter, the son of a bishop of the African Methodist Episcopal church. He was born at Pittsburgh, Pa., and studied at the Pennsylvania Academy of Fine Arts under Thomas Eakins, and under Jean Paul Laurens and Benjamin Constant in Paris, where he thenceforth resided. His paintings are landscapes and especially biblical subjects, which he renders in a naturalistic manner, yet with deep religious sentiment. Good examples include the "Raising of Lazarus" (Luxembourg, Paris); "Christ at the Home of Mary and Martha" (Carnegie Institute, Pittsburgh); "Christ and Nicodemus" (Pennsylvania Academy, Philadelphia); "The Two Disciples at the Tomb" (Art Institute, Chicago), and the "Annunciation" (Wilstach collection, Philadelphia). He was elected an associate of the National Academy in 1909, and received the Lippincott prize, Pennsylvania Academy (1900), and medals at Paris (1900), Buffalo (1901), St. Louis (1904), and San Francisco (1915).

TANNER, Henry S. (1786–1858). An American geographer, born in New York City. He studied engraving and settled in Philadelphia, where, with his brother, he established a business in publishing maps, atlases, and geographical works. In 1850 he removed to New York City, where he died. His publications included many maps of different sections of North America.

TANNER, Thomas (1674–1735). An English antiquary, born at Market Lavington, in Wiltshire, where his father was vicar, and educated at Queen's College, Oxford. He was ordained deacon in 1694 and was appointed chaplain of All Souls' College in 1695. He became canon of Ely (1713), canon of Christ Church, Oxford (1724), and Bishop of St. Asaph (1732). He is known chiefly for *Notitia Monastica, or a Short History of the Religious Houses in England and Wales* (1695) and the *Bibliotheca Britannico-Hibernica*, a valuable account of the authors that flourished in the three kingdoms up to the seventeenth century (posthumous, 1748). With him Antony à Wood (q.v.) left additional "lives," which appeared in the second edition of *Athenæ Oxonienses* (1721). Tanner bequeathed a large body of manuscripts to the Bodleian Library at Oxford.

TANNERY, tȧ′ne-rē′, Paul (1843–1904). A French scholar, born at Nantes. He was educated in the Paris Polytechnic School. For two years he gave a course in the Sorbonne on the history of arithmetic, and for five years filled Professor Lévêcque's chair in the history of Greek and Latin philosophy in the Collège de France. Aside from articles in periodicals he published: *Pour l'histoire de la science hellène* (1887); *La géométrie grecque* (1887); *La correspondance de Descartes dans les inédits des fonds Libri* (1893); and *Recherches sur l'histoire de l'astronomie ancienne*. Consult *Biographisches Jahrbuch* for 1906 (Berlin).

TANNHÄUSER, tăn′hoi-zẽr. A German knight and minnesinger of the thirteenth century, probably a Bavarian by birth, who enjoyed the favor of Duke Frederick II of Austria. Little is known historically of his career, and he disappears entirely after the death of Conradin (1268). His lyrics are in the main mocking and sensuous. One of the latest of them, a penitential song, may have led to his identification with the hero of the old Teutonic legend of the Venusberg or Hill of Venus. This was a region within a mountain near the Wartburg, in the Thuringian Forest, where Venus reigned, and whence no one save Tannhäuser ever escaped. Here Tannhäuser, in the legend, lived with her until conscience smote him. He escaped, with the aid of the Blessed Virgin, and set out on a pilgrimage to Rome, to obtain pardon for his grievous sin. According to the story, Pope Urban IV refused to pardon the sin until the staff in the Pope's hand should sprout. Tannhäuser returned to the Venusberg, but the wand meantime put forth green leaves by a miracle, to show the extent of the divine mercy. Modern versions of the legend were made by Tieck, Heine, Geibel, and others; and in Swinburne's *Laus Veneris* Tannhäuser is conceived as having returned irredeemably to the Venusberg. But better known than any is the famous dramatic treatment by Richard Wagner in his opera *Tannhäuser* (1845), whose libretto follows E. T. A. Hoffmann in identifying Tannhäuser with Heinrich von Ofterdingen and introducing him into the contest of the minstrels on the Wartburg. The works of the historic Tannhäuser were first edited by Von der Hagen on his *Minnesinger* (1848). For these consult: Oehlke (Königsberg, 1890) and Siebert (Berlin, 1894); for the legend; Sabine Baring-Gould, *Curious Myths of the Middle Ages* (London, 1884), Grässe, *Der Tannhäuser und der ewige Jude* (2d ed., Dresden, 1890), and E. Elster, *Tannhäuser in Geschichte, Sage, und Dichtung* (Bromberg, 1908); and for the opera, *Tannhäuser, Translated into Poetic Narrative Form*, by Oliver Huckel (New York, 1906).

TANNHÄUSER. An opera by Richard Wagner (q.v.), first produced at Dresden, Oct. 21, 1845; in the United States, April 4, 1859 (New York).

TANNIN (from *tan*, OF., Fr. *tan*, oak bark for tanning, from Ger. *Tanne*, fir, oak), Tannic Acid, Gallotannic Acid, or Digallic Acid, $C_6H_2(OH)_3COOC_6H_2(OH)_2COOH$. An odorless and almost colorless powder as found in commerce, soluble in water, alcohol, acetone, glycerin, and various oils, occurring in Turkish and Chinese gallnuts and in other plants. It has a bitter, astringent taste, and becomes yellow if exposed to the action of light. It is used as an astringent in medicine and as a mordant in dyeing, and also in the manufacture of ink and of gallic and pyrogallic acids. Solutions of tannin reduce silver carbonate to metallic silver; they also reduce Fehling's solution (q.v.) and certain other substances, and precipitate gelatin and albumin from their solutions. On the other hand, solutions of tannin may be precipitated by the addition of various salts and acids, including common salt, sal ammoniac, the acetate as well as the sulphate of potassium, hydrochloric and sulphuric acids, etc. According to one method, tannin is procured by extracting the powdered gallnuts, which contain it in large quantities, with a mixture of alcohol, ether, and water; the layer of water then contains practically all the tannin; it is separated, purified by shaking with an excess of ether, and evaporated at a gentle heat. The residue obtained may be purified by dissolving in a dilute solution of common salt, and reprecipitating from this by adding an excess of salt in the solid state. With ferric salts tannin produces the well-known precipitate which is the coloring substance of ordinary black ink. The names "tannin" and "tannic acid" are also applied to a variety of other substances of vegetable origin and having properties more or less similar to those of gallitannic acid: they are all astringent, transform hide into leather, give blue or green coloration with salts of iron, etc. Some of the more important of these may be noticed here.

Alder Tannin, $C_{27}H_{28}O_{11}$. A reddish-brown substance soluble in dilute alcohol and quite soluble in hot water; its solutions give a green precipitate with ferric salts. It may be prepared by extracting sawdust from *Alnus glutinosa* with boiling water, precipitating the extract with lead acetate, and decomposing with sulphureted hydrogen; the precipitate, which now contains both the tannin and lead sulphide, is extracted with alcohol; thus the tannin is isolated.

Caffetannic Acid, $C_{15}H_{18}O_9$. This is found in coffee berries and in other vegetable products. It is soluble in water and in alcohol, and its solutions give green coloration with ferric salts. It may be prepared by extracting coffee berries with alcohol, diluting with water, filtering, boiling the filtrate, and precipitating it with lead acetate; the precipitate obtained is shaken with alcohol, in which it is caused to dissolve by decomposing with sulphureted hydrogen, and then the caffetannic acid is isolated by filtering and evaporating the solution to dryness.

Fraxitannic Acid, $C_{26}H_{32}O_{14}$. A substance found in the leaves of the ash tree. It may be obtained by extracting with water, precipitating the extract with lead acetate, and dissolving the precipitate in boiling aqueous acetic acid. The tannin is then isolated by a somewhat elaborate process, involving fractional precipitation with ammonia, treatment of the purest fractions with sulphureted hydrogen, etc. (Consult *Monatshefte für Chemie*, vol. iii, p. 745.) Pure fraxitannic acid is a golden-yellow powder, whose solutions give dark-green coloration and precipitate with ferric salts.

Quercitannic Acid. A substance, or perhaps several very similar substances, of uncertain composition, found in the leaves and bark, but not the wood, of the oak. It is also probably contained in tea. Extracts containing quercitannic acid are largely used in tanning. From these extracts the acid may be isolated by diluting with water, allowing to settle, filtering, precipitating the filtrate with hydrochloric acid, washing and drying the precipitate, dissolving it in strong alcohol, and mixing the alcoholic solution with somewhat more than an equal volume of water; the precipitate thus produced is rejected; on filtering, the liquid is evaporated to dryness, the reddish-white residue being practically pure quercitannic acid—a substance soluble in dilute alcohol and sparingly in cold water. Quercitannic acid gives a green coloration with ferric salts.

Quercinic Acid. A light brownish-yellow substance found in oak wood, and distinguished from quercitannic acid in that its aqueous solution gives blue coloration with ferric salts.

Quinotannic Acid, $C_{14}H_{16}O_9$. A light-yellow substance found in cinchona bark. It is soluble in water, alcohol, and ether, and its solutions give a green precipitate with ferric salts. It may be prepared by extracting cinchona bark with water, adding burnt magnesia, filtering, precipitating the filtrate with lead acetate, decomposing the precipitate with aqueous sulphureted hydrogen, again filtering, precipitating this filtrate with basic lead acetate, dissolving the precipitate in dilute acetic acid, adding ammonia, treating this last precipitate with sulphureted hydrogen, and, finally, evaporating the resulting solution to dryness in vacuo.

Artificial Tannin. A number of substances similar in composition and properties to the natural tannins have been obtained synthetically by Löwe, Schiff, Böttinger, and others.

Consult Trimble, *The Tannins: A Monograph on their History, Preparation, etc., with an Index to the Literature of the Subject* (Philadelphia, 1892–94), and Sir T. E. Thorpe, *Dictionary of Applied Chemistry* (rev. ed., 5 vols., New York, 1912–13).

TANNING. See LEATHER.

TANN-RATHSAMHAUSEN, tän-rät′sȧm-hou′*zen*, LUDWIG SAMSON, BARON VON UND ZU DER (1815–81). A German general, born at Darmstadt. He entered a Bavarian regiment of artillery in 1833, was transferred to the general staff in 1840, and, becoming aid-de-camp to Crown Prince Maximilian in 1840, was soon afterward promoted to the rank of major. In 1849–50 he took a conspicuous part in the Schleswig-Holstein campaign, and after his return to Bavaria was again aid-de-camp to King Maximilian, was made major general in 1855 and commanding general at Augsburg in 1861 and subsequently at Munich. In 1866 he was chief of staff of Field Marshal Prince Charles, commander in chief of the South German contingents, and having been appointed general of infantry and commander of the First Army Corps in 1869, led it with distinction in the campaign of 1870, at Wörth, Beaumont, and Sedan. Given command over the combined forces operating on the Loire, he reduced Orléans, afterward fought victoriously under the Grand Duke of Mecklenburg in several bloody engagements, and rejoined the besieging forces before Paris. For his biography, consult Hugo von Helvig (Berlin, 1882) and Gebhardt Zernin (Darmstadt, 1883).

TANOAN (tä′nȯ-*a*n) **STOCK** (from *Taháno*, the native name of Tano pueblo). A family of languages spoken in a group of pueblo villages in the upper Rio Grande valley, New Mexico. The most important modern villages are Jemez, Taos, Isleta, Picuris, Pojoaque, San Juan, Santa Clara, Sandia, and San Ildefonso. A number of villages occupied during the Spanish period are now in ruins. At that time they were grouped under the names Tewa and Tigua. In culture these villages are very much what they were when first visited by Spanish explorers some 300 years ago. They are regarded as the most typical pueblo group and probably the oldest from which the others derived their culture. See INDIANS, AMERICAN; ISLETA; PUEBLO. Consult Bandelier, *Papers of the Archæological Institute of America*, vol. i (Boston, 1881).

TAN'REC. See TENREC.

TANSILLO, tän-sil'lō, LUIGI (1510–68). An Italian poet of the Petrarchistic group, born at Venosa, Province of Potenza. He early entered court service and in 1535 joined the bodyguard, formed of one hundred nobles, of Don Pedro de Toledo, the Spanish Viceroy of Naples, with whom and with whose son, Don García, he stood in great favor. He accompanied them on their expedition against the Turks and fought with conspicuous bravery. Subsequently he was capitano di giustizia at Gaeta and died at Teano. His ingenious and sensuous poem *Il vendemmiatore* (1534; trans. by Mercier as *Jardin d'amour*, 1798) established his literary reputation, but caused his writings to be placed on the Index by Paul IV. To atone for it, Tansillo resumed a religious epic *Le lagrime di San Pietro*, begun in 1539, but left it unfinished. His two didactic poems *La balia* (trans. by William Roscoe) and *Il podere* are among the best in Italian literature. His lyrics, inspired by impassioned love for a high-born lady, are replete with fervor and fine descriptions of nature. They were turned to philosophical meanings in the *Heroic Furies* of Giordano Bruno, whence some were translated by J. A. Symonds. In the *Stanze a Don Pedro di Toledo* (1547) he depicts with consummate art the luxurious gardens of the Viceroy by the sea. Consult: *Poesie liriche edite ed inedite* of Tansillo (ed. by Fiorentino, Naples, 1882); *Capitoli giocosi e satirici* (ed. by Volpicella, ib., 1870); Fiorentino, *Aneddoti tansilliani e danteschi* (ib., 1883); Flamini, *L' egloga e poemetti di L. T.* (ib., 1893).

TANSY (OF. *tanasie*, Fr. *tanaisie*, from ML. *athanasia*, tansy, from Gk. *ἀθανασία*, *athanasia*, immortality), *Tanacetum*. A genus of plants of the family Compositæ, natives of the temperate parts of the Old World. Common tansy (*Tanacetum vulgare*), a perennial, has long been cultivated in gardens and is naturalized in many parts of North America. The deep-green leaves and yellow flowers have a strong aromatic smell and a bitter taste. The leaves contain a volatile oil, and the younger ones have been used for flavoring puddings, cakes, omelets, etc., and were formerly used in medicine, but are now rarely used even in domestic practice. Some curious Easter customs linger in many parts of England connected with the use of tansy cakes and puddings which were originally intended to represent the use of bitter herbs at the paschal feast. See Chambers, *Book of Days* (new ed., 2 vols., Philadelphia, 1911).

TANTA, tän'tå, or **TANTAH.** The capital of the Province of Gharbieh, Lower Egypt, situated in the Delta, about 60 miles north of Cairo (Map: Egypt, C 1). It has a palace of the Khedive and a fine mosque and is noted for its fairs and festivals, which are visited by thousands of Moslem pilgrims and traders. Pop., 1907, 54,437.

TAN'TALITE (from Neo-Lat. *tantalum*, tantalum). An iron and manganese tantalate which merges chemically by insensible gradations into the iron and manganese niobate, columbite (q.v.). An intermediate product between these two is a niobate and tantalate of iron and manganese. The columbite-tantalite series crystallizes in the orthorhombic system. Tantalite has a submetallic and often brilliant lustre and is brown to iron black in color. It occurs in granitic and feldspathic veins in the form of crystalline granules and cleavable masses. The iron in this mineral is frequently replaced by manganese, giving rise to a variety known as *manganotantalite*.

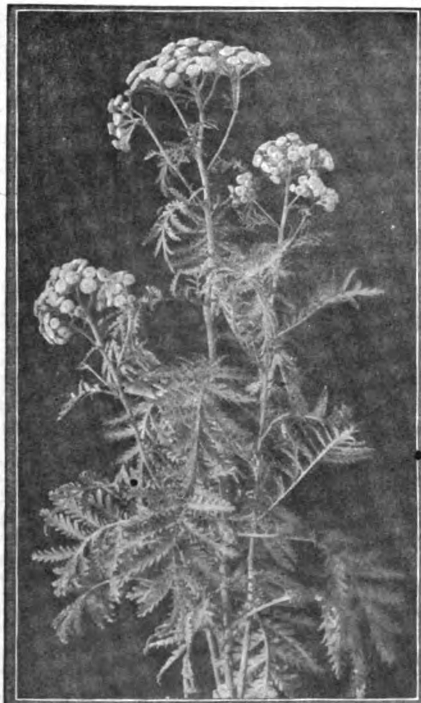
TAN'TALUM (Neo-Lat., from Lat. *Tantalus*, father of Niobe; so called from its close resemblance to the metal niobium). A metallic element discovered by Ekeberg in 1802. It occurs associated with the element columbium in the minerals tantalite, yttrotantalite, columbite, and other heavy rare minerals. It is obtained chiefly from tantalite. Its separation from columbium, on account of the extremely close similarity of the two elements, is a long and complicated operation. Tantalum (symbol, Ta; atomic weight, 181.5) is a black powder that assumes an iron-gray metallic lustre under a burnisher, and when gently heated ignites in the air, forming the pentoxide, Ta_2O_5, which in turn combines with bases to form a series of salts called tantalates. Metallic tantalum melts at 2798° C. (5068° F.). Wrought tantalum is exceedingly hard and tough and has been used in the manufacture of pen nibs. The metal, further, resists all ordinary acids, even aqua regia, whence its great usefulness for chemical purposes. Finally, tantalum is finding an increasing use in the manufacture of steel.

TANSY.

TANTALUM INCANDESCENT LAMPS. See ELECTRIC LIGHTING.

TAN'TALUS (Lat., from Gk. Τάνταλος). In

TANSY, ETC.



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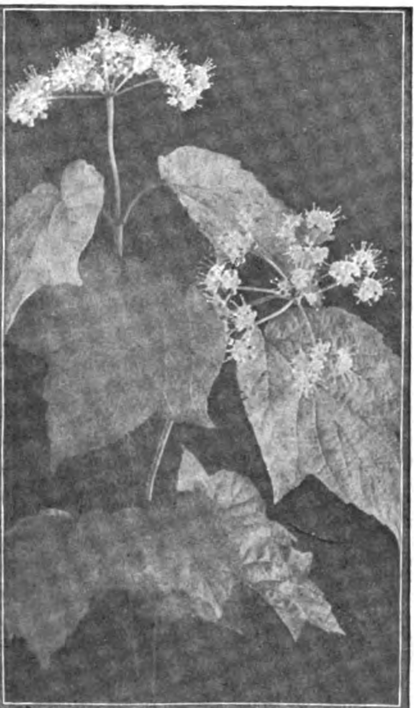

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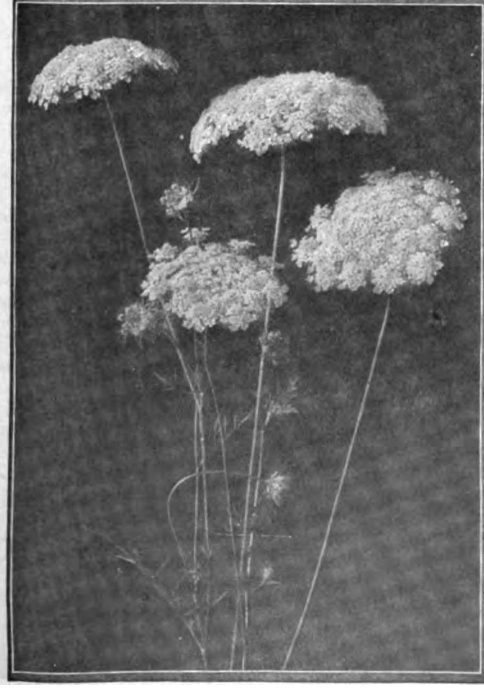

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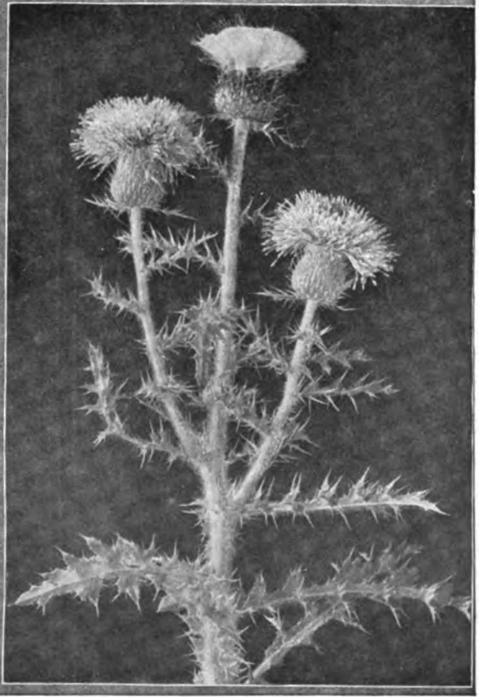

1. **TANSY** (Tanacetum vulgare).
2. **WILD CARROT** (Daucus Carota).
3. **ARROW-WOOD** (Viburnum acerifolium).
4. **THISTLE** (Cnicus lanceolatus).

Greek legend, King of the region about Mount Sipylus in Lydia, son of Zeus and father by Dione of Pelops (q.v.), Broteas, and Niobe (q.v.). As favorite of Zeus he was admitted to the gatherings of the gods, but, having offended grievously in some way, he was visited with extreme punishment, so that he became one of the typical figures in Tartarus. There Tantalus was plunged into a deep pool, whose waters receded whenever he stooped to drink, while over his head hung clusters of fruit which were ever kept just beyond his reach. Another version represented him as cowering beneath a huge rock which constantly threatened to fall and crush him.

TANTIA TOPI, tăn'tē-ȧ tō'pē (c.1819–59). An Indian insurrectionist commander, conspicuous in the Sepoy mutiny of 1857–58. He was born at Bithur, near Cawnpore. He became the chief lieutenant of Nana Sahib (q.v.) in 1857. After the defeat of Nana Sahib by Havelock, Tantia Topi conducted the campaign alone until the flight of his superior into Oudh and Nepal made communication impossible. He then acted under the orders of Rao Sahib, nephew of Nana Sahib. It was due to his generalship alone that the rebellion continued after the capture of Gwalior by Sir Hugh Rose and the death of the Rani of Jhansi, in June of 1858. For nine months he baffled the English in Central India, suffering his first serious reverse at Sikar in January, 1859. The rebels were finally dispersed in March, 1859, and Tantia Topi, who had taken refuge in the jungles of Paron, was betrayed (April 7) to Major Meade by his own friend and late associate Man Singh. He was tried by court-martial at Sipri and hanged there on April 18, 1859.

TANTRA, tăn'trȧ *or* tŭn'trȧ (Skt., system, woof, from *tan*, to stretch, weave). The Sanskrit term for a ceremonial or systematic treatise of any kind. In English, however, the word designates a late class of Sanskrit works which are related to the Puranas (see PURANA), and to the magic literature in general. (See *Atharvaveda* under VEDA.) The Tantras are in the main the sacred works of the worshipers of the androgynous Siva (q.v.), or of Sakti, the female principle itself. (See SAKTAS.) They deal with the creation and destruction of the world, the worship of the gods, the attainment of all objects, magical rites for the acquirement of six superhuman faculties, and four modes of union with spirit by meditation. Prayers to the gods, some few of great beauty, occur at rare intervals. Their place is taken by a condensed form of invocation of the divinity by means of a great variety of honorific epithets, one class, the "thousand-name prayers," forming a division by itself. Numerous other subjects are treated by the Tantras, as the mode of breathing in certain rites, or the language of birds and beasts. The form of the Tantras consists usually of a dialogue between Siva and his wife, the latter asking for information as to the mode of performing various ceremonies, and the *mantras* of prayers to be used in them. The followers of the Tantras consider them as a fifth Veda, and attribute to them corresponding antiquity. This claim is entirely imaginary; they are mentioned in some of the Puranas, and are probably later than the lexicographer Amarasinha (q.v.). No less than sixty-four Tantras are noted by the Hindu commentator Sankara (q.v.). Consult: E. W. Hopkins, *Religions of India* (Boston, 1895); Ewing, "The Cāradā-tilaka Tantra," in *Journal of the American Oriental Society*, vol. xxiii (New Haven, 1902); *The Tantra of the Great Liberator* (*Mahānirvāṇa Tantra*, translated with commentary by Avalon, London, 1913).

TAN'TUM ER'GO. The last two stanzas of the hymn *Pange lingua*, which are prescribed to be sung at benediction of the sacrament in the Roman Catholic Church.

TANZIMAT, tăn-zē'mȧt (Ar. *tanẓimat*, pl. of *tanẓim*, regulation, inf. of second form of *naẓama*, to arrange in order). The organic laws in accordance with which the administration of the Turkish Empire is in theory carried on. They were the result of the reform movement introduced by Mahmud II. The organic laws, known as the *hatti sherif* of Gulhane, were promulgated on Nov. 3, 1839, by Mahmud's son, Abdul Medjid (q.v.), soon after his accession. They established the equality of civil rights for all subjects, limited the power of the government officials, guaranteed the free practice of religion, and introduced radical reforms in the administration of finance, justice, and the army. In 1856 the Sultan found it necessary to publish a new ordinance, in which the complete carrying out of the Tanzimat in all respects was commanded. Other attempts in 1868 and 1876 to make the constitution effective were unsuccessful. Consult Engelhardt, *La Turqui et le Tanzimat* (Paris, 1882–84). See TURKEY.

TAOISM, tou'ĭz'm. A system of philosophy (also a sort of religion to-day) in China, the greatest exponent and practical founder of which, Lao-tse (q.v.), is venerated by the educated Chinese second only to Confucius. Just what the word Tao and the philosophy it embodies really mean is very difficult to explain. Lao-tse himself could present no adequate definition, and simply calls it "the way." Confucius acknowledged that he could make nothing of it. Broadly speaking, Tao may be defined as the proper way, the right road, a conduct of life designed to give the greatest individual happiness, contentment, and peace of mind. J. M. Kennedy presents the following definition: "Tao, a word which it is almost impossible to define fully and accurately, refers to 'the way' in which things first came into being out of primordial nothingness, and how, without struggling or striving, the phenomena of nature still continue."

The word Tao was not original with Lao-tse, for the name had been given to many principles of conduct since the time (some say) of Hwang-ti (2750 B.C.). At any event Tao, and also the combination Tao and Teh, were in use centuries before the great philosopher, and emperors were supposed to rule the people with regard to this principle. But it was Lao-tse (or Li-ehr, his proper name, for Lao-tse means "the Old One") who first connected these floating ideas into a very definite system of philosophy by his book, the *Tao-teh-king*, which he is supposed to have written shortly before going into retirement beyond the Pass (a little east of the modern Signanfu, and at that time the western boundary of the federated Chinese states) in 479 B.C., 35 years before the death of Confucius. Now the cultivation of Tao is what leads to the habit, or conduct, or philosophical reasoning, or rule of action, of Teh. Teh, in fact, is virtue. Professor Parker suggests the term "Providence" to signify Tao and "Grace" to explain Teh, and uses these exclusively in his translation of the

Tao-teh-king. This book is a very small one, consisting of only 5000 characters, but in it is included all of the philosophical mysticism of Taoism. The great Chinese historian, Sze-ma-tsien, writes of a meeting between Lao-tse and Confucius which was not a very happy one, for the "Old One" was not much impressed with China's greatest philosopher and distinctly reproved him. Confucius in return has nothing to say of Lao-tse's book except the discussion of one passage. It has been contended that the *Tao-teh-king* is not a genuine work of Lao-tse, especially because it is not mentioned by Mencius (q.v.). Professor Giles denounces it as spurious, and cites elaborate arguments in support of his view. Dr. Legge and Professor Parker regard it as genuine.

Lao-tse is opposed to the struggling and striving in human action. "Aim at extreme disinterestedness and maintain the utmost possible calm." Inaction is the secret of the highest human conduct. "Tao is entirely inactive, and yet it leaves nothing undone." Again: "Act with the least possible dwelling on action; employ means with the least possible ado; taste with the least possible dwelling on the savor; make the big as little and the many as few as possible." Also: "One may know the world without ever crossing the threshold; one may discern the Tao of Heaven without ever looking out of the window." In fact, Lao-tse was a recluse himself and meditated in seclusion; finally, like Timon of Athens, some of whose unamiable qualities he seems to have had, retiring from the active world altogether.

Some of his teachings are very Christian in spirit. "He who can overcome other men is strong, but he who overcomes himself is mighty." "It is by bending that we survive, by giving way that we assert. It is by lowliness that we exercise full force." Still more striking is the admonition to "recompense injury with kindness."

He has some curious ideas on the state. "When a great state is conciliatory and deferential to a small state it ends by taking the small state." Historically this is true enough, but the correlative idea that "when the small state is humble and respectful to the great state it captures the great state" is hardly compatible with the teachings of modern world politics. His idea of the size of the state is rather platonic. "My ideal is a series of small states with small populations. Let them possess an army machine of moderate size, but not be too ready to use it. . . . Each state would be within easy sight of the other; the sound of each other's hens cackling would be heard across." He has naturally no conception of the modern spirit of world trade and colonial expansion. "The people of each state would live to a good old age, and would have no movement of intercourse with neighboring states." Naturally, these views were determined by the China of Lao-tse's day. China was then in the feudal period of the Chou dynasty and divided into various powerful principalities frequently at war with one another.

Equally out of place and undemocratic are some of his views on government. "The more weapons of power are intrusted to the people, the more blundering is the government likely to be. The more cunning arts the people learn, the greater the flood of strange objects of luxury." But there is truth in his statement regarding the overabundance of laws. "The more legal enactments there are, the more thieves and robbers will abound." He is determined against popular government. "The difficulty of governing the people arises from their having too much knowledge." He cautions the autocratic ruler as follows: "He who tries to govern a state by wisdom is a scourge to it, while he who does not try to govern thereby is a blessing." But he gives the King some wholesome advice. "Do not confine the people within too narrow bounds; do not make their lives too weary. For if you do not weary them with life, then they will not grow weary of you." He is opposed to militarism. "Those who support and counsel the rulers of mankind under the principles of Tao do not make use of military force to compel the world."

In contrasting Taoism with Confucianism we find most marked the absence of Hsiao (filial piety) in Lao-tse's teachings. Taoism, moreover, condemns all interference with the natural order of things and thus all statecraft, especially any and every rule by force. It is the practical application of *laisser-faire*, more than that, it has no sympathy with the progress of society or the cultural arts. The doctrines of Confucius are more in the nature of service to society, to human intercourse; their spirit is communistic. Taoism, however, is individualistic, mystical, less adapted to human relationship and, in fact, somewhat aristocratic. Confucius wanted the ideal social order of service to the sovereign, state, and family. Lao-tse, as we have seen, had rather weak conceptions of individual duties to the state and to the community.

The two greatest disciples of Lao-tse and the ablest expounders of Taoism were Lieh-tse and Chwang-tse, the former of the fourth and the latter of the third century B.C. The first is more metaphysical and speculative, the other popular and witty. Especially Chwang-tse is very severe on the literati and even ridicules their great master Confucius. Taoist ethics are best represented in the *Kan-ying-pien* (Book of Rewards and Punishments) of the fifteenth century. In the sixteenth century it was incorporated in the *Tao-chang*, a collection of Taoist scriptures. It contains 212 moral maxims illustrated by stories and references to the history of China. The distribution of this book is deemed a religious duty, and innumerable editions are published at the expense of pious Taoists. Among the great men who were professed Taoists, Chang-liang (died 189 B.C.) deserves special mention for the important part he played in history as a councilor of Liu-pang, founder of the Han dynasty. Taoist legends attribute to him supernatural wisdom and tell of him many marvelous occurrences.

When Buddhism entered China Taoism borrowed from it various forms, ceremonies, and the idea of temples for worship. The "religion" fast degenerated into superstition and mysticism, until to-day it consists of a debased ritual composed of witchcraft, demonology, and hocus-pocus which has not the faintest resemblance to the teachings of Lao-tse. The Taoist priests of the present time claim to be in possession of magic powers, or are engaged in alchemy and other studies. Two thousand years ago one Chang Tao-ling became the recognized leader of the Taoist fraternity. He was said to have compounded and swallowed the elixir of life, whereupon he ascended visibly to Heaven. He bequeathed his secrets to his descendants, thereby establishing a hereditary Taoist papacy. The soul of each Pope is supposed to pass by transmission into the body of his successor, as with the Dalai Lamas of Tibet. The head of the fraternity is regarded as the vice regent of God on earth and bears the title of the Pearly Emperor of Heaven. His power is considerable among the Chinese masses.

Taoist priests to-day know practically nothing of Lao-tse, and merely attend to the spiritual needs of the people, which are not very high. They tell fortunes, determine lucky and unlucky days, and regulate popular feasts. For divination they use the Kwa, a system of trigrams of broken and unbroken lines which are determined with Shih sticks (see Pa-Kwa), and for the determination of days they use an astrological device called lo-pan, or table of the net, because it resembles a cobweb, in which certain symbols are arranged in concentric circles around a compass. The temples are ill kept, with cheap images and ornaments. Spiritual deities or patrons are provided for everything under the sun, for all the forms of nature, each organ of the human body, every sense, etc. Each locality has its favorite patrons.

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TAO-KWANG, tou′kwăng′ (1781–1850). The reign title of Mien-ning, the sixth Emperor of the present Manchu dynasty of China. He came to the throne in 1820. The first years of his reign were comparatively tranquil, but disturbances and insurrections soon occurred in Turkestan, in Hainan, in Formosa, and in Kwangtung. In 1834 the privileges of the British East India Company were abolished, and the misunderstandings which then arose, combined with the high-handed proceedings of Commissioner Lin, led in 1839–40 to war with Great Britain, the defeat of the Chinese, and the negotiation of the Treaty of Nanking in 1842. This treaty provided for the opening of Shanghai, Ningpo, Foochow, and Amoy besides Canton to foreign residence and trade, the cession of Hongkong to Great Britain, and the payment of an indemnity of 21,000,000 taels, equal at that time to about $35,000,000. This large payment in addition to the costs of the war, coming on an impoverished treasury, created much discontent among the people, the secret societies became active, and swarms of pirates harassed the government. Tao-kwang died in 1850 and was succeeded by his fourth son, who reigned as Hien-Fung (q.v.). See H. A. Giles, *China and the Manchus* (Cambridge, 1912).

TAORMINA, tä′ôr-mē′nȧ (Lat. *Tauromenium*). A town and popular winter resort in the Province of Messina, Sicily, 30 miles by rail southwest of the city of Messina (Map: Italy, E 6). It is majestically situated on a rocky terrace 390 feet above the Ionian Sea, but is overhung by the ruins of the castle (1300 feet above the sea), and again to the northwest by Mola (2080 feet) and by Mount Venere (2834 feet). The theatre, founded by the Greeks, rebuilt by the Romans, and wrecked by the Saracens, was partially restored in 1748, and is of great interest. The ancient city was named after Mount Toro (ancient Taurus), on whose slope it lay, and was founded by the Siculi in 396 B.C., after the destruction of Naxos, near by, which was the oldest Greek colony in Sicily, having been founded in 735 B.C. Under the Roman Empire it was a city of importance. On account of its strong position it was long able to keep out the Saracens, who finally captured it in 902 A.D., killed the people and burned the buildings. Being resettled, it was, in 962, again captured by the Saracens, from whom it was taken in 1078 by the Normans. Pop. (commune), 1901, 4351; 1911, 4941 (town, 4110). Consult Squillaci, *Taormina attraversi i secoli* (Catania, 1892), and R. H. Bell, *Taormina* (Philadelphia, 1916).

TAOS, tä′ōz. See Tanoan Stock.

TAOTAI, or **TAUTAI**, tou′tī′. A Chinese official who has the general supervision and control of the affairs, both civil and military, of a *tao*, or circuit, and is usually styled by foreigners the "Intendant of Circuit"—a circuit consisting of two or more fu or departments. A foreign commissioner of customs ranks with the taotai, and all foreign consuls have the rank of taotai. The taotai is the Chinese official of lowest rank to come in direct contact with foreigners.

TAPAJOS, tȧ-pä-zhôs′. A south tributary of the Amazon, flowing entirely within Brazil (Map: Brazil, F 5). It is formed by the Juruena and Arinos rivers in the northern part of the State of Matto Grosso, flows north and northeastward till it enters the Amazon at Santarem after a course of about 1200 miles. Its headwaters are on a low and flat divide which separates its basin from those of the Paraguay and the Guaporé. The upper course lies on the great Brazilian plateau, from which it descends to the forest plains of the Amazon in a series of falls and rapids which completely obstruct navigation. The last 200 miles only are navigable for large vessels. Near its mouth it expands into a large lake 70 miles long and 12 miles wide, but contracts again just before entering the Amazon.

TAPARELLO, Massimo. See Azeglio, Marchese d'.

TAPE GRASS, Eel Grass, Wild Celery. Popular names for *Vallisneria spiralis*, an aquatic grasslike plant which grows in slow waters, being common from New England to Minnesota and south to Florida and Texas. It is said to be the favorite food of wild ducks. See Vallisneria.

TAP′ESTRY (Fr. *tapisserie*, from *tapis; It. tappezzeria;* Sp. *tapiceria;* Ger. *Tapete*, once meaning tapestry, but wall paper now; Lat. *tapete;* Gk. *τάπης*). In its broad sense any fabric for upholstering furniture, wall, or floor. In another sense, heavy-weight upholstery goods, as distinguished from laces and prints. Specifically (1) primitive tapestries; (2) picture tapestries of the Arras, Brussels, Gobelin, or Aubusson type; (3) Jacquard tapestries that are machine imitations of and developments from Nos. 1 and 2; (4) tapestry carpets, and rugs that are machine woven with pile formed by an extra set of warp threads printed with colored patterns before weaving; (5) an imitation of No. 4 printed after weaving; (6) tapestry paintings that are painted imitations of No. 2 on canvas or rep; (7) tapestry embroideries that are embroidered imitations of No. 2; (8) tapestry wall paper, i.e., wall paper printed with crossed lines to give the tapestry effect, mostly in imitation of verdure tapestries of the No. 3 variety.

The only real tapestries are varieties 1 and 2. All of these are woven entirely by hand, without shuttle, or drawboy, or Jacquard attachment. All are in plain weave, with weft threads blocked in by colors, and with warp threads entirely concealed but making their position manifest in the form of ribs. Real tapestries are exactly alike on face and back, except for the loose threads on the back that mark the passage of bobbins from block to block of the same color, and except of course that the back is left handed as compared with the face. All are woven back to the weaver, who on most low-warp looms does not see any part of what he has done until the whole is completed. Where two colors appear parallel with the warp threads, open slits are left in the weaving, which are sewed up after the tapestry is completed, but which are an important part of tapestry texture, as they make the cloth less flat and regular than it would otherwise be.

Tapestry is the figured fabric easiest to weave on a primitive bobbin loom (i.e., a loom without a shuttle). Consequently tapestry is woven by most primitive peoples who can weave at all. Among the most interesting primitive tapestries woven to-day are the Oriental kelims which are imported and sold as Oriental rugs and properly regarded as a variety of Oriental rugs. (See RUGS, ORIENTAL.) Other primitive tapestries woven to-day are Navajo blankets and Mexican serapes. Some of these have weft threads that are so large and coarse and soft that the warp threads cannot make their presence felt as ribs, and the surface is flat. The most important ancient primitive tapestries that have been preserved are the Coptics (made in Egypt from the fourth to the eighth century A.D.), of which there are collections in the New York Metropolitan Museum and in several European museums; and the Peruvians (made in South America from the fourteenth to the seventeenth century A.D.), of which there are collections in the Boston Museum of Fine Arts and in the New York Museum of Natural History. There also survive a few examples of ancient Greek primitive tapestries dating from the fifth century B.C. and a few examples of ancient Egyptian primitive tapestries dating from 1500 B.C. In all of the primitive tapestries thus far enumerated, the weft is commonly of wool, the warp of cotton, linen, or wool.

China being the mother country of silk, one is not surprised to find that the weft of Chinese tapestries is of silk, and that Chinese tapestries are much thinner and lighter than all others. The designs of Chinese tapestries are largely decorative, and scenes and figures are usually introduced in such a manner as not to exalt the tapestries from the primitive into the picture class. Chinese tapestries, even those directly copied from the European Gobelin tapestries, do not possess the qualities of construction or expression that distinguish tapestries as an important separate form of art. Many Chinese tapestries have shadows and supplementary line effects painted on after weaving, somewhat in the manner of the brown enamel on early European stained-glass windows; many Chinese mandarin robes are made entirely of intricately woven and exceedingly beautiful tapestry. In texture, the Saracenic silk tapestries of the Middle Ages did not differ at all from those of China. One of the most important surviving examples is a stole, with Arabic lettering, that was one of the garments buried with the Bishop of Bayonne at the beginning of the thirteenth century, and exhumed about the middle of the nineteenth century. It is now in the Cluny Museum.

Picture tapestries are a higher form of primitive tapestries, and developed from them. We know that the ancient Greeks and Romans had picture tapestries as well as primitive tapestries. In the Odyssey, Homer describes the famous picture tapestry that Penelope wove. Andromache, too, wove a tapestry, the shroud that was to envelop the body of Hector. Most wonderful of all was the tapestry in which Helen wove the story of her own tragic life.

About the picture tapestries of ancient Rome we know from the spirited weaving contest described by Ovid in his *Metamorphoses*. Unfortunately, of the elaborate picture tapestries of ancient Greece and Rome, none have survived.

The art of weaving picture tapestries was undoubtedly brought to a higher degree of elaboration, and to greater perfection, in France and in Flanders, in the fifteenth and sixteenth centuries than it had ever attained previously. The revival of the art almost paralleled the development of pictures in stained-glass windows, and the general effect of some of the earliest pieces of tapestry is like that of stained glass of the period, the outlines being accentuated in brown, much as the stained-glass outlines are accentuated by the leads. Examples of this are the three thirteenth-century tapestries preserved in the cathedral at Halberstadt, Germany, perhaps of local manufacture. Two of these tapestries are 3 feet, 7 inches high by about 30 feet long—narrow bands intended to hang above the choir stalls. The first pictures Christ and the Apostles. The second pictures the story of Abraham and Isaac. The third is nearly square, a little higher than wide, with Charlemagne in the centre, on his throne, crowned, sceptre in hand, a rich cushion beneath his feet. In the corners of the tapestry are the four philosophers—Socrates, Plato, Cato, and Seneca. Others of these early tapestries show Byzantine or Saracenic influence, notably the three famous fragments from the church of St. Gereon, Cologne, now shared by the museums of Lyons, Nuremberg, and South Kensington. Large circular medallions on a brownish-blue ground represent, in tones of light ivory, a winged griffin with eagle above and bull below.

Of tapestries made in the fourteenth century, but few have survived. There is only one in the New York Metropolitan Museum, a small Crucifixion, with stars patterning the background. In the Brussels Museum, there is the Presentation of Jesus at the Temple, which attracted great attention at the Tapestry Exhibition in Paris in 1876, and at the Exposition of French Primitives in 1904. It is made entirely of wool, with no silk or metal. The only set of tapestries surviving from the fourteenth century is the famous Apocalypse at the cathedral of Angers. Originally there were seven pieces showing 90 separate and distinct scenes, 18 feet high with a combined width of 473 feet. Some of the 90 scenes contained more than 25 personages. To-day the height is only 14 feet, and the total width 328 feet. The floriated bands at the top and bottom and the inscriptions with each scene have worn away during the course of 500 years. Of the 90 scenes, 70 remain intact, and there are fragments of eight others, while 12 have entirely disappeared. These tapestries were made for the Duke of Anjou to hang in the chapel of his château at Angers. The cartoonist was Hennequin de Bruges, the court painter of Charles V, brother of the Duke of Anjou. The source of the design was an illustrated manuscript of the Apocalypse, which is now in the public library of the city of Cambrai. The painter followed the manuscript illustrations closely, executing the cartoons on large pieces of canvas the size that the tapestries were to be. The manufacturer of the tapestries was Nicolas Bataille of Paris, who received 1000 francs a piece for them.

From the fifteenth, sixteenth, seventeenth, and eighteenth centuries, hundreds, even thousands, of large tapestries still survive. These divide themselves rather obviously into Gothic of the fifteenth century, Renaissance of the sixteenth century, baroque of the seventeenth century, rococo or classic of the eighteenth century. Only it must be remembered that Gothic overlapped the sixteenth century 15 or 20 years, just as Renaissance overlapped the seventeenth century, and baroque overlapped the eighteenth century. Most of these tapestries were French, or Flemish, or French-Flemish; comparatively few were woven in Italy, or Spain, or England. Up to the last quarter of the fifteenth century Flanders was French; while Flemish was the language of many of the common people, the polite language was French, and the inscriptions for tapestries are always in either Latin or French. After the death and defeat of Charles the Bold in 1477, and the consequent downfall of the Burgundian power, Flanders ceased to be French. By the marriage of Charles the Bold's daughter, Mary of Burgundy, to the Emperor Maximilian, Flanders came under the power of the Hapsburgs; after that tapestries were no longer French-Flemish but French or Flemish. During the whole of the sixteenth century they were nearly all Flemish; after the beginning of the seventeenth century they were either Flemish or French, with the scales constantly inclining more and more in favor of France, until at the end of the eighteenth century tapestry weaving in Flanders was given up altogether.

The first great centre of tapestry weaving in Flanders was Arras, that gave the name of *arras* to tapestries in England, of *arazzi* to tapestries in Italy, of *paños de ras* to tapestries in Spain. During the fifteenth century, however, Arras lost its preëminence in the art of tapestry weaving to Brussels, which remained the chief centre of tapestry weaving as long as the weaving of tapestries continued to be practiced in Flanders. Of tapestries woven at Arras, only one set can be positively identified, the Story of St. Piat and St. Eleuthère at the cathedral of Tournai, Belgium; but as if to make up for our lack of information about other ancient tapestries that may have been woven at Arras, we not only know that the St. Piat and St. Eleuthère tapestries were woven there, but we also know the exact month and year of their completion, the name of the maker, and the name of the donor. One of the pieces now lost bore the following inscription, which was fortunately copied and preserved in the eighteenth century: "These cloths were made and completed in Arras by Pierrot Fere in the year 1402 in December, gracious month. Will all the Saints kindly pray to God for the soul of Toussaint Prier." This Toussaint Prier, who gave the tapestries to the cathedral of Tournai, was a canon there in 1402, but later became chaplain to the Duke of Burgundy, Philip the Good. As documents in tapestry history, these tapestries are second in importance to the Angers Apocalypse only. The material is wool, without silk or gold. Of the 18 scenes that there were originally, only 15 survive, in four pieces 6 feet, 10 inches high, with a combined width of 71 feet, 8 inches.

The most important early fifteenth-century tapestry in the United States is the Burgundian Sacraments presented to the New York Metropolitan Museum. Of the original 14 scenes, only seven remain, in five fragments, with inscription misplaced. An unusual feature of this tapestry is the brick-wall border with floriation outside. The tapestry was originally about 17 feet high by 38 feet wide, and was fully illustrated and described in the *Burlington Magazine* for December, 1907. Two of the pieces are mounted wrong side out, which illustrates very clearly and obviously the fact that tapestries are exactly alike on both sides. Originally this tapestry contained 14 scenes, an upper row of seven illustrating the seven sacraments in their origin; a lower row of seven illustrating the seven sacraments as celebrated in the fifteenth century.

Of all the hunting tapestries, none surpass in importance and interest the set of four dating from the second quarter of the fifteenth century, and lent to the South Kensington Museum by the Duke of Devonshire. They were discovered some years ago in fragments in Hardwicke Hall, having been cut up for use as window draperies. They were in bad condition, and were restored under the direction of Sir Purdon Clarke. In making the restoration the colors that on the front had faded were copied from the still vivid back. One of the four tapestries is 14 feet by 37; the others are slightly smaller. The material is wool only.

Immensely popular with Gothic tapestry weavers was the story of the Trojan War. Of the original small color sketches, 15 by 22 inches, that served as models for the full-size cartoons, there still survive eight in the Louvre, all in good condition. These sketches were drawn with the pen and colored red, blue, and yellow with water colors. Of tapestries woven from these sketches, there survive three fragments in the South Kensington Museum, seven in the Court House of Issoire, France, one in the Spanish cathedral of Zamora, and one in America. In style these Trojan War tapestries resemble the huge Clovis tapestries at Rheims, and the splendid Capture of Jerusalem in the New York Metropolitan Museum.

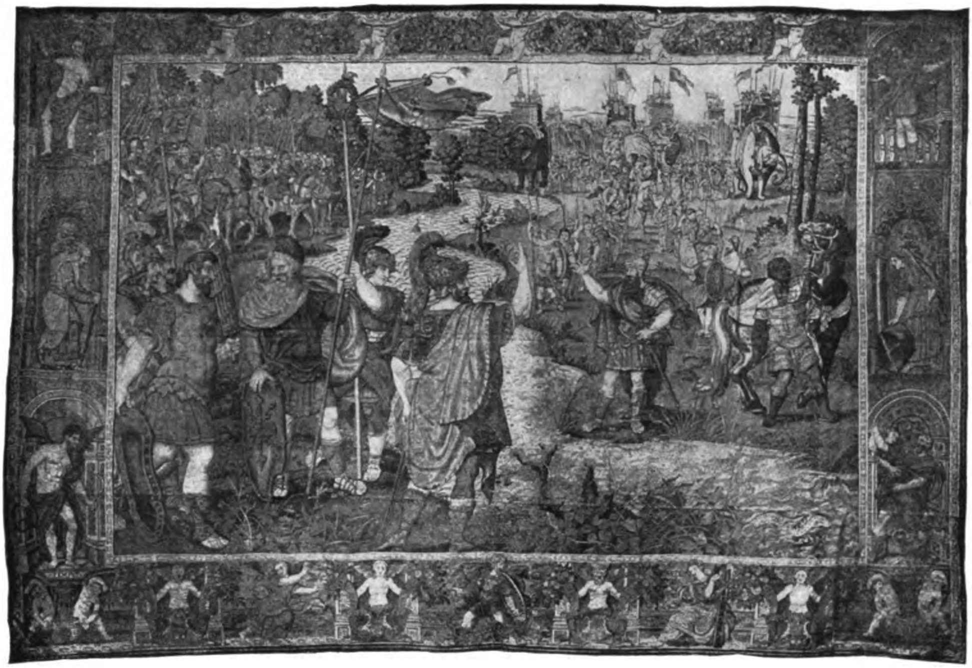
In the last quarter of the fifteenth century, the influence of the approaching Renaissance begins to make itself felt, although Gothic tapestries continue to be woven through the first quarter of the sixteenth century. Gradually horizontal effects begin to replace some of the vertical effects that were dominant in earlier tapestries. Hats began to be wider and flatter and lower; shoes to have round instead of pointed toes; a definite sky line appears at the top of tapestries. Most significant of all, tapestries begin to have borders on four sides, instead of none, or at top and bottom only. These late Gothic borders are from 5 to 6 inches wide, usually with flower-fruit motifs. The masterpieces of the late Gothic period are the Mazarin tapestry lent to the Metropolitan Museum by Mr. Morgan, and the pieces that resemble it in the Royal Spanish collection. Especially noteworthy are the Story of the Virgin tapestries that formerly belonged to Philip the Handsome, father of the Emperor Charles V. The Mazarin tapestry, so called because it formerly belonged to the famous Cardinal, represents the best that can be done with gold and silver and silk and wool, to picture many figures elaborately gowned, with flesh and hair that are marvelous in texture and tone. The flesh tints are extraordinary, and represent an intricacy of interweaving that almost passes credibility. Compared with an ordinary tapestry, this one is like the most delicate cloisonné against a parquet floor. In plan the Mazarin tapestry is a triptych, with panels separated by Gothic jeweled columns, and with wings divided by Gothic jeweled arches. The subject is the Triumph of Christ and of the New Dispensation. In the middle panel is shown Christ seated on his throne, right hand upraised, Gospels in left hand, with richly illuminated pages open towards the two groups of worshipers below. One of these groups represents the Church and is headed by the Pope; the other group represents the state and is headed by the Emperor. The Old Empire is represented by Ahasuerus and Esther, in the right wing of the tapestry; the New Empire by Augustus and the Roman sibyl, in the left wing of the tapestry. The Triumph of the Roman church over the Jewish church is also symbolically represented. There are two Latin inscriptions in Gothic letters to help explain the story.

The most famous tapestries in the world are the Acts of the Apostles set at the Vatican, designed by Raphael for Pope Leo X to hang in the Sistine Chapel. These tapestries revolutionized style in tapestry designing and weaving. They not only substituted Renaissance for Gothic; they also substituted Italian for Flemish. Even Flemish painters began to work in the Italian style. By contemporaries and by posterity Raphael's Acts of the Apostles tapestries were praised without end. By engravers, by painters, and by weavers they were copied over and over again. The woven copies are to-day among the chief treasures of the Royal Spanish collection, the Imperial Austrian collection, the French National collection, the Berlin Museum, Hampton Court, the Bauvais Cathedral, the cathedral of Loretto, the Dresden Museum. Of the seven full-size cartoons that are in the South Kensington Museum, having been brought to England on the order of Charles I for the Mortlake Tapestry Works, the Duke d'Aumale said: "they are, together with the Parthenon marbles, England's most beautiful art possession," and "as examples of Raphael's work, unexcelled except perhaps by the Chambers of the Vatican."

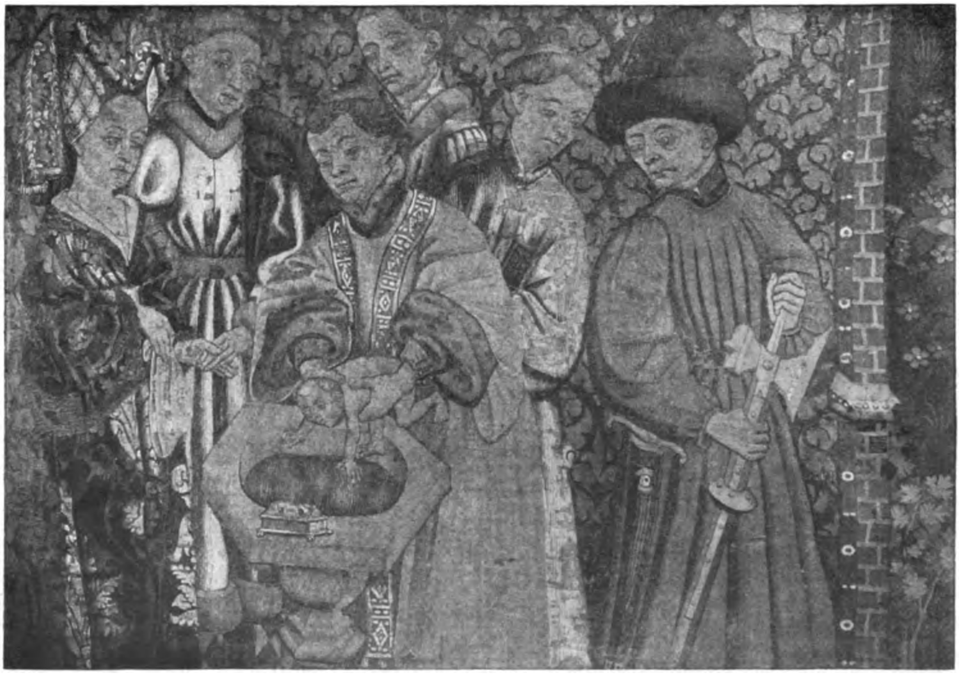
The most prolific designer of tapestries in the style of the Italian Renaissance was Raphael's famous pupil, Giulio Romano. His most famous sets were the Story of Scipio, the Fruits of War, the Story of Romulus and Remus, the Grotesque Months, Children Playing. The first and most important set of Scipio tapestries, woven from the designs of Giulio Romano, was for Francis I to hang in the château of Madrid. This set was made by Marc Cretif, of Brussels, and in 1797 was burned for the gold that it contained. Of the original small color sketches fifteen are still preserved in the Louvre. Of the Scipio tapestries now in America, woven in Brussels in the sixteenth and seventeenth centuries, some are based upon the designs of Giulio Romano, others upon designs created by other artists, to supplement the series, particularly stories of subordinate characters. Examples of the latter are Sophonisba at the Feet of Masinissa, after Rubens, and Scipio Upbraiding Masinissa. The Conference of Scipio and Hannibal, in the Boston Museum of Fine Arts, is reversed in direction and much modified in details from the designs of Giulio. Of one of the early sets from the original designs, there is an example in the Cincinnati Museum, the Assault on New Carthage, but cut down in size, and with applied and later side and bottom borders. Early Renaissance in every detail of design and execution, and luxuriantly rich with gold, that has been inserted with marvelous skill in plain, basket, and couched weave, is a set of which eight are still in Madrid, the other four in New York. This set has the wide and magnificent compartment borders inspired by the woven pilasters of the original Acts of the Apostles set. Those woven pilasters were not borders in the ordinary sense of the word, there being only seven of them for ten panels, but they were planned to hang between the tapestries and continue the vertical effect of the painted pilasters in the wall above them. The bottom borders of the ten panels were of an entirely different type, being woven imitations of bas-relief. The Acts of the Apostles set, woven a little later for the King of Spain, and still preserved in the Royal Spanish collection, has full side and bottom borders of the compartment type, designed by Giulio Romano, who had helped to create the original seven woven pilasters.

Characteristic of Renaissance tapestries are the very wide borders, 17 to 22 inches, due to the influence of the Italian Renaissance compartment borders. About the middle of the seventeenth century borders began to decrease in width, and towards the end of the eighteenth century disappeared altogether, thus completing the cycle of style in borders, and ending where the fifteenth century began.

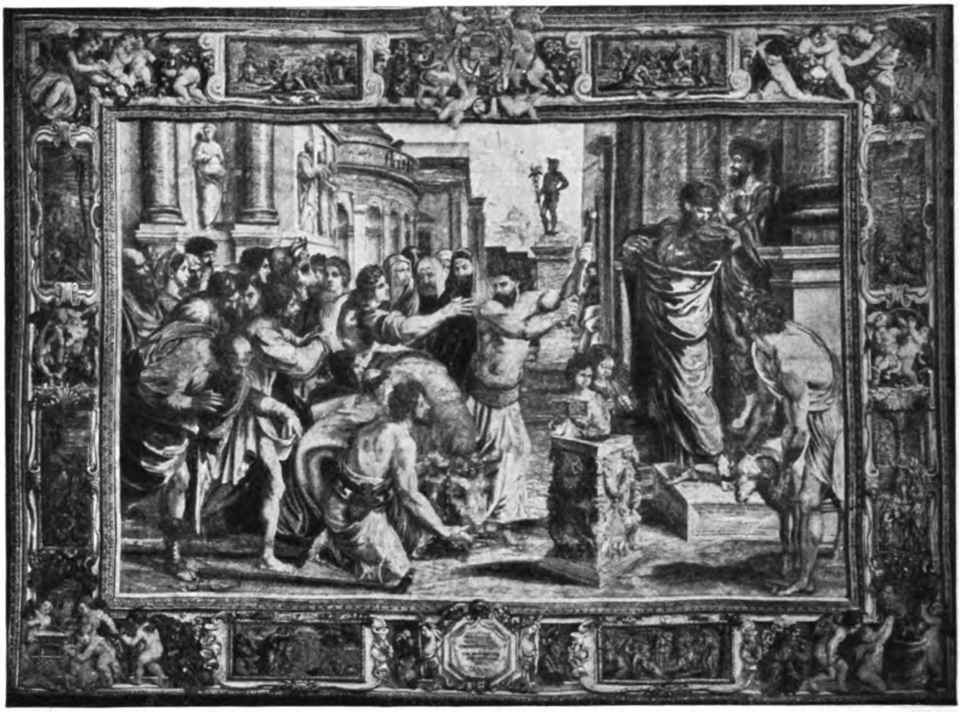
The greatest Flemish designer of tapestries in the style of the Renaissance was Bernard van Orley. Among famous sets designed by him were the Hunts of Maximilian, in 12 pieces, now in the Louvre; the Battle of Pavia, presented by the Netherlands to Charles V in 1531 and now in the Museum of Naples; the Life of Christ that was once in the famous Berwick and Alba collection. To this Life of Christ belongs the Dollfus Crucifixion, now in the Metropolitan Museum. Most of Van Orley's tapestry borders are in width transitional, from 10 to 12 inches, wider than late Gothic borders, but narrower than those of the full Renaissance.



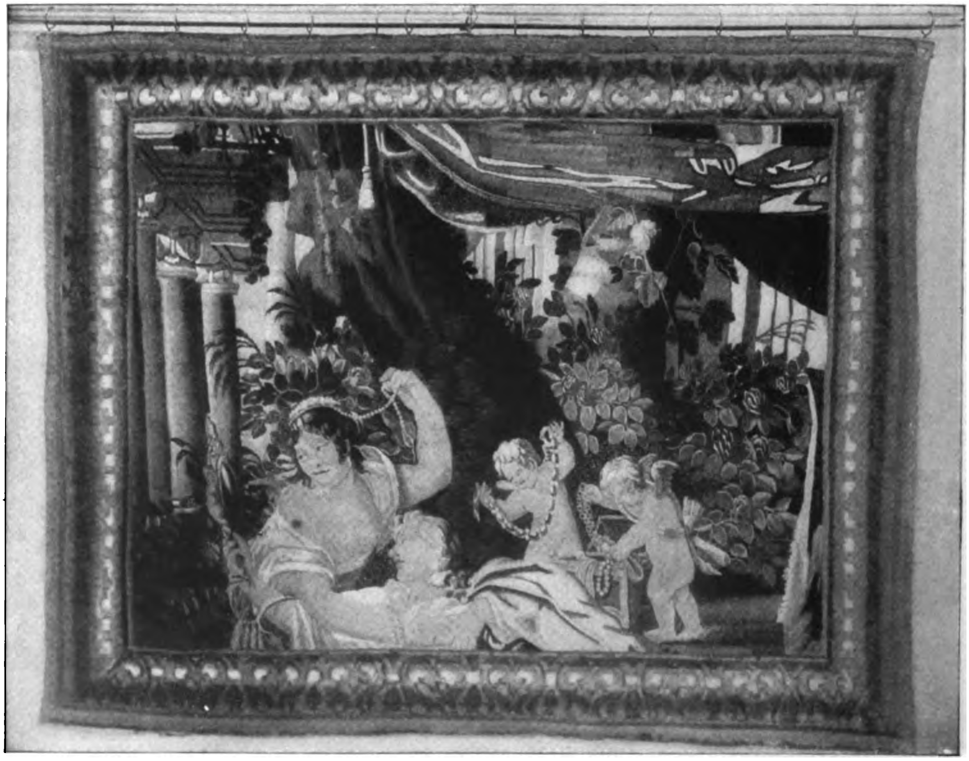
INTERVIEW OF SCIPIO AND HANNIBAL. A RENAISSANCE TAPESTRY AFTER GIULIO ROMANO, WOVEN IN BRUSSELS



BAPTISM. ONE SCENE, MOUNTED WRONG SIDE OUT, FROM THE GOTHIC EARLY FIFTEENTH CENTURY "SEVEN SACRAMENTS," GIVEN TO THE METROPOLITAN MUSEUM OF ART, NEW YORK, BY THE LATE J. PIERPONT MORGAN



THE SACRIFICE AT LYSTRA. AN ENGLISH MORTLAKE SEVENTEENTH CENTURY TAPESTRY, IN THE FRENCH NATIONAL COLLECTION. REPRODUCED FROM ONE OF THE FAMOUS "ACTS OF THE APOSTLES" TAPESTRIES DESIGNED BY RAPHAEL FOR POPE LEO X.



RINALDO AND ARMIDA. FRAGMENT OF ONE OF THE FAMOUS RINALDO AND ARMIDA SERIES WOVEN IN PARIS IN THE FIRST HALF OF THE SEVENTEENTH CENTURY.

The baroque tapestries of the seventeenth century, like the paintings and the architecture, were sculptural in style. All objects represented on a flat surface were backgrounded with deep shadows in order to make them project or stand out from the picture. Characteristic of the period is the style of Rubens, in whose studio were made many designs for tapestries, notably the Constantine set for the Gobelins at Paris. During the last quarter of the sixteenth century the tapestry industry at Brussels had been almost exterminated by religious wars; and though it was revived again in the first quarter of the seventeenth century by the protecting care of the archdukes Albert and Isabella, it never regained its former glories. Many of the best weavers went to France and to England, attracted by the invitations of Henri IV and James I.

There had been tapestry weaving in Italy in the fifteenth century at Mantua and at Ferrara and in the sixteenth century at Ferrara and Florence. But not until the seventeenth century was there any real transplanting of the industry on a large scale from its Flemish home.

The tapestry works of the Gobelins were established, as the inscription over the entrance says: "April, 1601, Marc de Comans and François de la Planche, Flemish tapestry weavers, install their workrooms on the bank of the Bièvre." The works retained the name of Gobelins from the dye works established there in 1440 by Jean Gobelin. Both manufacturers came from Flanders—Planche from Oudenarde, Comans from Brussels. Among important sets woven at the Early Gobelins were the Story of Artemisia; the Story of Diana; the Story of Constantine, designed by Rubens; the Story of Clorinda and the Story of Theagenes and Chariclea, designed by Dubois; the Story of Gombaut and Mace. In 1662 Louis XIV bought the Gobelin plant, and in 1667 the Furniture Factory of the Crown at the Gobelins was formally organized as a state institution. To the Gobelins were also transferred the other tapestry works at that time active in the city of Paris, as well as the works that had been established at Maincy by Fouquet, the unfortunate Minister of Louis XIV. From Maincy also came Charles Lebrun to head the Gobelins, and to act as dictator and creator of the style of Louis XIV.

At the Gobelins high-warp and low-warp looms were operated side by side until the nineteenth century. Since then high-warp looms only have been employed at the Gobelins. The high-warp loom is so called because the warp threads are stretched vertically, in contrast to the horizontal plane that they occupy in the low-warp looms. In the high-warp looms it is necessary to pull by hand the lisses or loops of cord that shift the position of the warp threads to form the new shed; in the low-warp looms this is done more rapidly and easily by treadles. In other words, the high-warp is handwork exclusively, while the low-warp is hand-and-foot work. The principal reason for using the slower and more expensive high-warp process at the Gobelins is that it enables the artist director to watch the work of the weaver more closely.

The most important set of tapestries created at the Gobelins during the reign of Louis XIV was the Story of the King, in 14 huge tapestries, picturing and celebrating the more important events of the early part of the reign of Louis XIV, among them his coronation, his marriage, and his victories in war. Especially interesting is the one that pictures Louis XIV visiting the Gobelins. The set most often woven at the Gobelins during this period was the Royal Residences, picturing the 12 palaces that the King liked best. The Story of Alexander was in special favor on account of the allusions found in it to the glories of Louis XIV. About the only set with much everyday human interest was the Child Gardeners. All of these sets were designed by Lebrun, although the details were worked out by the numerous artists employed under him in the royal studios. As the King grew older, the opportunities for glorification became fewer. So, instead of the Story of the King, we have the Story of Moses; the Indies; the Triumphs of the Gods; the Portières of the Gods; the Old Testament; the New Testament; the Metamorphoses of Ovid; together with numerous reproductions of sixteenth-century designs, such as the Story of Scipio, the Fruits of War, the Hunts of Maximilian, the Months of Lucas.

Of Louis XV Gobelin tapestries the Don Quixote series in 28 scenes, designed by Charles Coypel, were the most celebrated. Other important Louis XV sets were: Coypel's Opera Fragments; the Story of Esther, designed by De Troy; the Hunts of Louis XV, designed by Oudry. During the reign of Louis XV many of the old designs were reproduced, and many furniture coverings and portrait tapestries were executed.

In 1664 the tapestry works at Beauvais were established as a private institution, under royal protection and encouragement. Among important pieces woven at Beauvais in the reign of Louis XIV were: Children Playing; the Conquests of Louis the Great; a reproduction of Raphael's famous Acts of the Apostles, signed by the proprietor of the Beauvais Works, Béhagle, now in the Beauvais Cathedral; numerous Chinese and other grotesques, designed by Bérain. In the reign of Louis XV the selection of Oudry as artistic director of the Beauvais Works quickly brought great commercial success. Oudry not only supplied important original designs of his own, but also supplemented his own efforts by those of Boucher. It was for Beauvais and not for the Gobelins that Boucher did his best work and the majority of his work. Among the sets designed by Boucher for Beauvais were the Italian Fêtes; the Story of Psyche; the Chinese set; the Loves of the Gods; Opera Fragments; the Noble Pastorale. One result of the success of Oudry at Beauvais was that the painter Dumons was sent to Aubusson to try to revive and develop the industry there. Aubusson is a small town in the mountains of Auvergne, 250 miles south of Paris, where tapestries had been woven since the sixteenth century in designs that were crude, texture that was the coarsest, with dyes that were bad. As a result of the efforts of Dumons and his successor Juliard at Aubusson, many exceedingly attractive tapestries were woven there during the latter two-thirds of the eighteenth century. Today the commercial centre of tapestry production—rugs and furniture, coverings as well as wall panels—is Aubusson.

The establishment of the Gobelins inspired the English to activity at Mortlake, near London. Here in 1619, in the reign of James I and with the special encouragement of the then Prince of Wales, who later became King as Charles I, were set up looms to be operated by weavers imported from Flanders. In planning the enterprise the French example was closely followed, and one of the shop managers at the Early Gobelins, Philip de Maecht, was imported to act as superintendent of the new works. While the Mortlake Works continued in existence until 1703, they were successfully active for only about 15 years. Among the most important sets woven there were: the Story of Venus and Vulcan; the Acts of the Apostles from the Raphael cartoons that are preserved to-day in the South Kensington Museum; the Story of Hero and Leander, designed by Francis Clein, who was the artistic director. The tapestry works founded at Merton, near London, in 1881 by William Morris are still operated and in 1915 produced a large historical tapestry commemorating the coronation of King George V, entitled "The Arming of the King." The most important tapestries produced at Merton were from the designs of Burne-Jones, with foliage, flowers, and borders designed by Morris. The Royal Windsor Tapestry Works, established in 1876, lasted only 10 years, but sent their superintendent to become the head of the first tapestry works established in America. The looms were set up in New York City on Fifth Avenue in 1893, but were soon moved to Williamsbridge. The most important tapestries woven there are in the style of the French eighteenth century. Since then three other tapestry plants have been established in New York City.

The most important collections of ancient tapestries in the world are the Royal Spanish collection, the Imperial Austrian collection, the Royal Swedish collection, the French National collection, the Royal Belgian collection. The most important public collections in England are those at the South Kensington Museum and at Hampton Court. The English private collections are very rich. The most important public collections in the United States are those at the New York Metropolitan Museum and the Boston Museum of Fine Arts. The private collections of New York and Boston are very rich. See EMBROIDERY.

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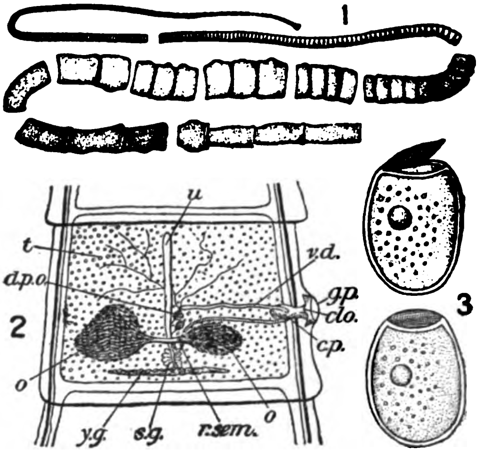
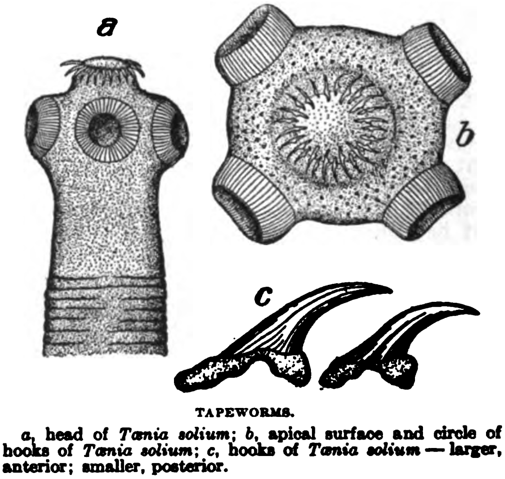
TAPE'WORM'. A name for any worm of the group *Cestoda*, but popularly used for the Tæniidæ or the Bothriocephalidæ. Nearly 200 species of cestoid worms have been described, of which the majority fall into one of the two families just named. (See CESTODA.) These worms have no intestine and are without cilia, but have testes and ovaries in each segment, together with frequent yolk glands. They belong to the order Polyzoa or segmented individuals. They are all endoparasites and secure nutrition from the digestive tract of the host in which they live, absorbing digested food through their body walls.

Tænia. A tænia consists of a scolex or head and detachable segments or proglottids. Within the scolex is the brain; on the outer surface of the scolex are four sucking disks as well as a ring of hooks. Fixation is secured through the suckers and hooks. In each proglottid is an albumin gland, and a uterus and a vas deferens end in openings on the side of the proglottid. New proglottids grow behind the head, by division of its posterior part. The farther from the head, the larger is the proglottid. The distal proglottids separate from time to time and are excreted with the fæces of the host. But the head must be removed to secure freedom from the parasite.



TAPEWORMS.

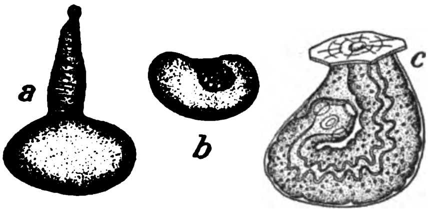
1, *Tænia saginata;* 2, segment of *Tænia solium* (showing generative organs): *u*, uterus; *t*, testes; *o*, ovary; *d.p.o.*, detached portions of ovary; *y.g.*, yolk gland; *s.g.*, shell gland; *r.sem.*, receptaculum seminis; *v.d.*, vas deferens; *g.p.* genital papilla; *clo.*, cloaca; *c.p.*, cirrhus pouch; 3, lidded ova of *Bothriocephalus latus*.



TAPEWORMS.

a, head of *Tænia solium*; *b*, apical surface and circle of hooks of *Tænia solium*; *c*, hooks of *Tænia solium* — larger, anterior; smaller, posterior.

The embryonic stages of tapeworm are hydatids (measles, cysticerci) or *cysticercoidi*. When a *Tænia ovium* with mature embryo is swallowed and reaches the human intestine, it migrates through the blood vessels or lymphatics into the tissues and develops into a hydatid. Both in man and in the pig the embryo of *Tænia solium* becomes a measle; while the embryo of *Tænia saginata* becomes, similarly, a measle in the cow. When a cysticercus is ingested by a man, it develops in his intestine into a complete tænia. In the human digestive tract a *Cysticercus cellulosæ*, or bladder worm, obtained from measly pork, becomes a *Tænia solium* in six to ten weeks. The *Tænia canina* develops in man from a cysticercoid of the cutaneous parasites of the dog. *Tænia solium* was so named by Linnæus because it is generally found alone; but in many instances two or three are found together, and in rare instances as many as 30 or 40 have been expelled from one patient. The full-grown tænia or strobila is from 10 to 35 feet in length, and may consist of from 800 to 1000 proglottids. The sexually mature proglottids begin at about the four hundred and fiftieth segment. The breadth of the worm is about ⅛ of an inch at the widest. The head is very small and globular or pear-shaped, is about the size of a small pinhead, and is dark with pigment. The crown of hooks numbers about 22 to 28 in each double row. The neck is very narrow and about ½ of an inch in length, and merges into the wider, segmented part. The impregnated eggs, when discharged into the intestine, do not mature there. They require the second host; such as, e.g., the pig, who eats the expelled proglottids or the ova. The exception to this general rule is met when a cysticercus is found together with a tapeworm in a human digestive tract. This is necessarily a source of grave danger, for the cysticercus may traverse the body as it does in the hog and cause similar lesions; hence the imperative necessity of securing the expulsion of the entozoa as soon as their presence is known. When fully mature the measle resembles a pea or a small kidney bean, being about ⅛ of an inch in diameter. Its great vesicular portion consists of a caudal extremity, inflated like a bladder, while the head, neck, and body may be drawn out in vermiform style.



BLADDER WORMS OF PIG.

a, *Tænia solium* (evaginated head); *b*, *Tænia solium* (invaginated head); *c*, *Cysticercus cellulosæ* (head formation completed).

The great source of tapeworm is measly pork, eaten uncooked or but partly cooked. Pork, ham, bacon, and sausage should always be very thoroughly cooked. It is also possible to ingest the embryo of the tapeworm with lettuce or other uncooked green food which has grown where a filthy stream flows over it, or which has been watered with liquid manure. Thorough washing will prevent danger from these vegetables.

Tænia saginata (or *mediocanellata*) has no circle of hooklets and is about 25 feet in length. In its case cattle instead of hogs are the intermediary hosts. It is transmitted through imperfectly cooked veal or beef. *Tænia echinococcus* is, in its larval condition, probably more fatally injurious to the human race than all the other species of entozoa put together. In its mature (strobila) condition, in which it is found only in the dog and wolf, it seldom exceeds ¼ of an inch in length, and develops only four segments, including that of the head. The final segment, when sexually mature, equals in length the three anterior ones, and contains as many as 5000 eggs. The proscolex or embryo forms large proliferous vesicles, in which the scolices or larvæ (known also as acephalocysts, echinococci, echinococcus heads or vesicles, pill-box hydatids, etc.) are developed by gemmation internally. The eggs develop in their interior a six-hooked embryo, and these embryos are introduced into our bodies with food or water into which the eggs have been carried. It finds its way into the liver, and later is carried by the blood current to other organs, including the lungs, the kidneys, the brain, and the bones. It grows slowly, many months elapsing after the ingestion of tapeworm eggs or embryos before the echinococci appear.

In some countries in Europe hydatids are very prevalent. It is said that the disease is endemic in Iceland to such an extent that one-sixth of the population suffer from it. The cause may be found in the great number of dogs harbored by the Icelanders. *Tænia saginata* is common all over the world.

The presence of a tapeworm in the intestines is made certain only by finding pieces of the entozoön in the dejecta, resembling flat segments of macaroni. But in most cases it gives rise to a series of anomalous symptoms, including vertigo, noises in the ears, itching of the nose and anus, ravenous appetite, dyspepsia, colic, palpitation, syncope, and emaciation. In the treatment of tænia prophylaxis is important. All meat must be so thoroughly cooked that the centre of each piece is subjected to great heat. Beef is the principal host of the entozoön. Rare beef must therefore be avoided. The medicinal treatment consists in causing the patient to fast for 24 hours and then administering the oleoresin of *Filix mas* (male fern), which must be followed by a brisk calomel purge. Santonin is also a reliable anthelmintic. The head must be sought in the excrement of the patient and medication must be repeated till the head is evacuated.

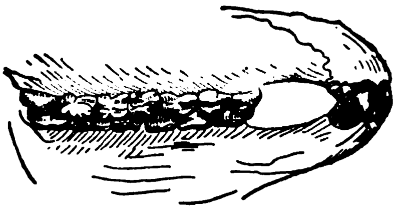
Tapeworms, although rare among horses and cattle, are common in dogs and sheep, causing irritability of the bowels and an unthrifty appearance. For dogs no remedy answers so well as powdered areca nut, of which 30 grains suffice for a dog weighing about 20 pounds. It is best given after 10 or 12 hours' fasting, in a little soup or milk, and should be followed in a few hours by a dose of castor oil. Neither areca nor any of the approved remedies used in men prove effectual in sheep; and one of the best prescriptions for them consists of 40 drops of oil of turpentine, a dram of powdered green vitriol, and an ounce of common salt, given mixed in a little milk or gruel, or, where their bowels are confined, in linseed oil. A daily allowance of linseed cake and sound dry food should likewise be given with the grass or roots, and pieces of rock salt left within the animal's reach.

Among other varieties of tæniæ are *Tænia cucumerina*, which infests the dog and cat, and whose cysticercus is harbored by the flea; *Tænia nana*, which is the smallest tapeworm found in man, and which is frequent in Egypt and Sicily; and *Tænia diminuta*, first seen in Italy, rarely found in man. The last named infests rats and mice, and its cysticercus inhabits caterpillars and certain of the Coleoptera. The largest tapeworm, rare in America, but common in central and eastern Europe, is *Bothriocephalus latus*. It is sometimes 25 feet long, nearly an inch broad, and may have 4000 joints. See Parasite.

Consult M. G. C. Braun, *Animal Parasites of Man* (3d ed., trans. by Pauline Falcke, New York, 1908), and "Worms," in Gould and Pyle, *Cyclopedia of Practical Medicine and Surgery* (Philadelphia, 1912).

TAPIOCA, tăp'ĭ-ō'kȧ. See Cassava.

TAPIR, tā'pẽr (Sp. *tapiro*, from Tupi Brazilian *tapyra*, tapir). A tropical ungulate mammal of the family Tapiridæ, allied to the horses and rhinoceroses. It has a bulky form, with moderately long legs—the front feet four-toed, the hind feet three-toed. The tapir has thick skin, short hair, small tail, thick neck, short ears, small eyes, elongated muzzle; the nose is prolonged into a short, flexible proboscis; it has 6 incisors, 2 canine teeth, and 14 molars in each jaw. The family includes only five living species, with a peculiar geographical distribution, as two species are found in South America, two in Central America, and one in the Malayan region. The best known is the American tapir (*Tapirus americanus* or *terrestris*), about the size of a donkey, and common throughout the wooded parts of South America east of the Andes. Its color is uniform deep brown, but the young (as with the other species) are beautifully marked with yellowish fawn-colored stripes and spots. The skin of the neck forms a thick rounded crest on the nape, with a short mane of stiff hair. The tapir inhabits deep forests, and delights in plunging and swimming in water. It feeds chiefly on young shoots of trees, fruits, and other vegetable substances, and sometimes commits great ravages in cultivated grounds. It is inoffensive, never attacking man; but when hard pressed by dogs, shows great cunning, and if brought to bay makes a violent resistance and inflicts severe bites. It is easily tamed. Its hide is useful and its flesh is eaten.



DENTITION OF A TAPIR.

The hairy tapir (*Tapirus roulini*) occurs only on high levels on the Andes, up to 7000 or 8000 feet. The skin is uniformly covered with hairs an inch long. There are white marks on the head and the sides are bluish hazel instead of brown. The hog tapirs of Central America (*Tapirus bairdi* and *Tapirus dowi*) are smaller than the other species, and differ from them in having the nasal septum ossified. They are brownish black above, dirty white on the throat and chest, and somewhat rufous on the head.

The Malayan tapir (*Tapirus indicus*) is found in the Malay Peninsula, Java, Sumatra, and other large islands. It is larger than the American tapir, and its proboscis is rather longer in proportion. The neck has no mane. The color is glossy black, except the back, rump, and sides of the belly, which are white. The colors do not pass gradually one into the other, but the line of separation is marked, giving the animal a very peculiar appearance. The habits of this species are similar to those of the American tapir, and it is equally capable of domestication. The young are striped and spotted as in that species.

Fossil tapir-like forms are known from the Eocene onward, and most of them have been placed in the family Lophiodontidæ; but many species are hardly separable from the modern family Tapiridæ.

Consult: Alston, "Mammals," in *Biologia Centrali-Americana* (London, 1879–82); W. T. Blanford, *Fauna of British India: Mammals* (ib., 1889); Ridley, in *Natural Science*, vol. vi (ib., 1895); F. E. Beddard, "Mammalia," in *Cambridge Natural History*, vol. x (New York, 1902); and general works. See Plate of Tapirs and Hippopotamus.

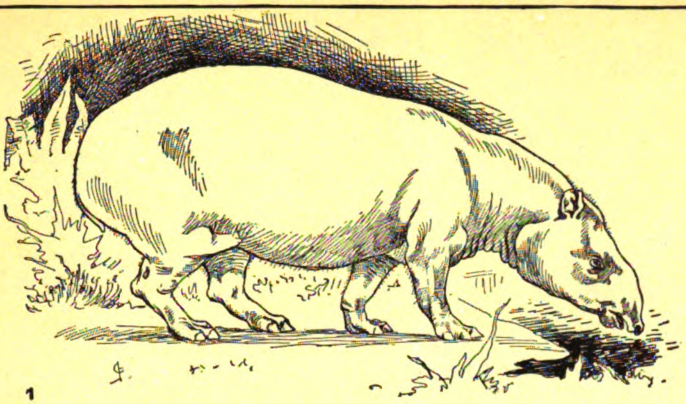
TAPIR TIGER. See Jaguar.

TAPOTEMENT, tȧ'pōt'mäN'. See Massage.

TAP'PAN, Arthur (1786–1865). An American merchant, philanthropist, and reformer, the brother of Benjamin and Lewis Tappan, born at Northampton, Mass. He entered business in Portland, Me., removed to Montreal, Canada, and after the War of 1812 established himself in the importing business in New York City. In 1827 he associated with himself his brother Lewis in the publication of the *Journal of Commerce*. He was largely interested in various religious, educational, and philanthropic institutions. It is as an Abolitionist, however, that he will be longest remembered. He became interested in the American Colonization Society at its organization, but having become convinced that the society was being used by the proslavery party to rid the country of free negroes, in order to establish slavery more firmly, he withdrew from it. In 1830 he paid a fine which secured the liberation of William Lloyd Garrison from imprisonment in Baltimore, and the acquaintance which followed led to Tappan's identifying himself completely with the Abolition cause. In 1833 he was one of the organizers of the New York Antislavery Society and of the American Antislavery Society, of both of which organizations he became the first president. In 1840 he became president of the New American and Foreign Antislavery Society, which was organized by those antislavery men who disagreed with the Garrison party, and believed in carrying the slavery question into politics and forming a political party for that purpose. He was therefore much interested in the Liberty, Free Soil, and Republican parties. He spent the latter years of his life in retirement in New Haven. Consult Lewis Tappan, *The Life of Arthur Tappan* (Boston, 1871).

TAPPAN, Lewis (1788–1873). An American merchant and reformer, brother of Arthur and Benjamin Tappan, born in Northampton, Mass. He became largely interested in cotton manufacturing and calico-print works in Boston, but in 1827 he removed to New York City. Thereafter his career was closely identified with that of his brother Arthur. In 1827 they established together the *Journal of Commerce*, of which Lewis Tappan became the sole proprietor in 1829. In 1833 he was one of the organizers

TAPIRS AND HIPPOPOTAMUS



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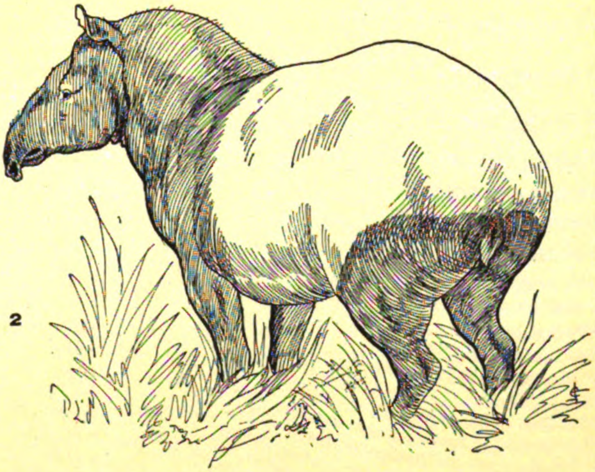

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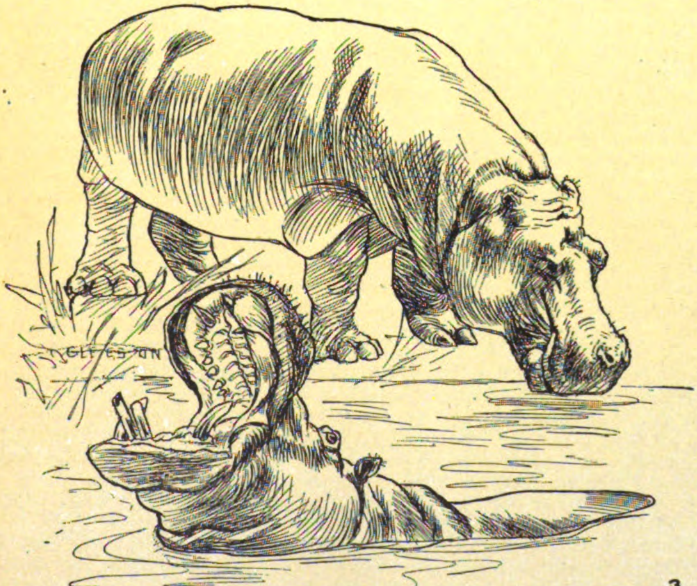

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1. AMERICAN TAPIR (Tapirus Americanus). 2. MALAYAN TAPIR (Tapirus Indicus).
3. HIPPOPOTAMUS (Hippopotamus amphibius).

of the New York (City) Antislavery Society. The firm of Tappan & Co. failed for upward of $1,000,000 in the financial crisis of 1837, and although they afterward paid their indebtedness, Lewis Tappan retired from the firm and in 1841 established Tappan's Mercantile Agency, one of the earliest and best-known organizations of this kind in the country. With his brother he was one of the organizers of the American and Foreign Antislavery Society, and wrote and spoke in favor of a more rational and conservative attitude on the part of the reformers. He published a *Life of Arthur Tappan* (1871).

TAPPAN BAY, or Tappan Zee. An expansion of the Hudson River, in New York, lying immediately north of Irvington. It is about 11 miles long, and over 3 miles wide at the widest point.

TAP′PEN, Frederick D. (1829–1902). An American financier, born in New York City. He graduated at New York University in 1849, and in 1850 became a clerk of the National Bank of New York, of which in 1857 he became cashier and in 1868 president and director. During the great loans in 1873 and 1874 he was chairman of the loan committee. In 1896 he induced the New York banks to loan $20,000,000 in gold to the United States. In May, 1901, he formed a pool of $20,000,000 for loans and broke the 60 per cent and 75 per cent rate for call money. Again in the last week of June his efforts to preserve the credit of a tottering clearing-house bank succeeded in calming the market, although the bank, as he had predicted, failed.

TAPPERT, tăp′ĕrt, Wilhelm (1830–1907). A German writer on music, born at Ober-Thomaswaldau, near Bunzlau, Silesia. After teaching for several years, he studied music (1856–58) under Kullak and Dehn in Berlin, where he settled permanently in 1866, and became professor of the history of music at the new academy. His name is favorably known in the musical world through numerous contributions to periodicals and the following publications: *Musik und musikalische Erziehung* (1867); *Musikalische Studien* (1868); *Das Verbot der Quintenparallelen* (1869); *Wagner-Lexikon* (1877); *Richard Wagner, sein Leben und seine Werke* (1883); *Wandernde Melodien* (1890); *Sang und Klang aus alter Zeit* (1906).

TAPS. See Bugle and Trumpet Calls.

TAPTI, tăp′tė. A river of the Bombay Province, British India (Map: India, C 5). It rises in the mountains of the western part of the central provinces, and flows westward, emptying into the Gulf of Cambay, 160 miles north of Bombay, after a course of about 450 miles. The greater part of its course is followed by a railroad, but the river is unnavigable above Surat, a few miles from its mouth.

TAPUYA, tȧ-pōō′yȧ (alien). A collective designation for a group of tribes holding an extensive area in eastern Brazil, constituting a distinct stock, and apparently more ancient in occupancy than any of the surrounding tribes. Their general territory extends from lat. 5° to 20° S., and from the Atlantic coast inland to the Xingu River. They are sometimes also known as *Cren* or *Gueren*, the Ancient People. The Tucano (q.v.) and several other tribes upon the Uaupes and Yapurá on the Brazil-Colombia border are also thought to be of the same connection. The Tapuya tribes, among which the Botocudo (q.v.) are the most noted and typical, have every characteristic of an ancient primitive race. They are believed to have raised the numerous shell mounds along the adjacent Atlantic coast, and it is held that skulls and other human bones found in caves within their territory, in connection with bones of extinct animals, are of the peculiar type belonging to this people. In physique they are of middle stature, with long arms and short legs, broad faces, small deep-set eyes, retreating foreheads, and projecting lower jaws. Their features are frequently disfigured by labrets in the lower lip. Their culture is low. In their native forests they go naked and have only brushwood shelters. They have no tribal organization, do not possess dogs, build no canoes, make no pottery. Before interfered with by the Brazilian government they were cannibals. But they are skillful hunters with the bow and arrow, make polished stone axes, and weave baskets of rushes. The men have but one wife at a time. Their language, of which specimens have been published by Ehrenreich, is difficult in its phonetics, with a marked tendency to simple word forms rather than agglutination. The Indians of Tupi descent about Pará and on the lower Amazon are incorrectly called Tapuya. Consult J. J. von Tschudi, *Reisen durch Südamerika*, vol. ii (Leipzig, 1867), and D. G. Brinton, *The American Race* (New York, 1891).

TAR (AS. *tearo, tearu*, Icel. *tjara*, Ger. *Teer*). A term applied to the oily, dark-colored products obtained in the destructive distillation of peat, wood, coal, bones, and other materials of organic origin. Bone tar is described under Dippel's Animal Oil (q.v.). Coal tar is likewise described in a special article. (See Coal Tar.) Wood tar is commonly made from the roots and wood of various trees such as the beech and pine. Tars from these sources are not identical, hence it is necessary to refer to them as pine and beech tar. In the old process wood was heaped into a conical stack depressed at the centre, covered with earth, and fired. The tar condensed and ran to the centre of the pile. The operation is now more economically conducted in retorts. By distillation the crude tar is separated into a number of light oils used as solvents for varnishes; creosote oil containing cresols and guiacol and used as a preservative; and a residue of pitch employed as a waterproofing compound. In doses of one or two grains pine tar is considered a good remedy in diseases of the mucous membrane of the respiratory passages. Tar soap consists of a good grade of tallow soap heavily impregnated with tar and containing sufficient alkali to make the combination soluble in water. See Acetic Acid; Acetone; Methyl Alcohol; Naval Stores; Wood Distillation.

TARA, tä′rȧ. A hill in County Meath, Ireland, about six miles east of Trim and nearly the same distance southeast of Navan. It is about 500 feet in height and is noted as the site of the palace of the ancient kings of Ireland. It was here that St. Patrick began his great apostolate by preaching to King Laoghaire or Leary in 432. The site was finally abandoned in 565 on account of a curse pronounced against the reigning King by St. Ruadhan. The lines of the ancient palace may still be traced in the mounds and earthworks which crown the summit of the hill. The place is the theme of one of Thomas Moore's popular ballads and remains a focus and rallying point for Irish national aspiration. Here O'Connell, the liberator, held the greatest of his monster meetings during the Repeal agitation, and here also some 40 years later Parnell erected the monument, which now stands out prominently above the landscape, to the memory of the Croppy insurgents who fell in an engagement near by during the rebellion of 1798.

TARA. See TABO.

TARABULUS, tȧ-rä′bōō-lōōs. A town of Syria. See TRIPOLI.

TARAFA, tä-rä′fȧ (Ar. *Tarafa 'Amr ibn al Abd al Bakri*) (c.560). An early Arabian poet. He lived at the court of the King of Hira in northeastern Arabia. In consequence of his satires on royalty, the King had him put to death. He ranks as one of the six great pre-Islamic poets of Arabia, and is the author of one of the seven *Mu'allakāt* (q.v.), or exalted poems, of that period, which remain the classic models of Arabic poetry. The Arabic text is in Ahlwardt, *Divans of the Six Ancient Arabic Poets* (London, 1870); there are translations by Rückert, in *Sieben Bücher der morgenländischen Sagen und Geschichten* (Stuttgart, 1837), and by Vandenhoff, *Nonnulla Tarafæ Carmina* (Berlin, 1895).

TARA (tä′rȧ) **FERN** (*Pteridium aquilina esculenta*). A species of bracken (q.v.), the rhizome of which was one of the principal articles of food of the Maoris before the British settlement of New Zealand. This fern is also distributed in Australia, Japan, and the Hawaiian Islands. In Japan the cut rhizomes are macerated to remove the starch.

TARAHUMARI. See TARUMARI.

TARAI, tȧ-rī′, or **TERAI.** A low, moist forest belt stretching along the southern base of the Himalaya nearly throughout their length, from Assam in the east to the Punjab in the northwest. In spite of its unhealthful nature, it is densely populated by tribes who seem to be immune from malarial diseases.

TARANTELLA, tä′răn-tĕl′ȧ (It., tarantula). An Italian dance, written in $\frac{3}{8}$ time, constantly increasing in speed, and alternating between the major and minor modes. It is accompanied by castanets and a tambourine. During the Middle Ages the dancing of the tarantella was thought to cure a form of insanity induced by the bite of the largest of European spiders, the *Lycosa tarantula*. From the fifteenth to the seventeenth century a peculiar nervous disease called tarantism existed in Italy, said to have been cured by this music. Of the many songs used for this but few exist. Specimens are given in Jones, *Maltese Melodies* (London, 1805); Smith, *Musica Antiqua* (ib., 1812); Mendel, *Lexicon* (Berlin, 1870–83). The tarantellas written by modern composers bear little resemblance to their prototypes in form or rhythm. They are written in $\frac{3}{8}$ or $\frac{6}{8}$ time and, owing to their rapidity, became favorites for solos. See DANCING MANIA.

TARANTISM, tăr′an-tĭz′m. A dancing mania supposed to be due to the bite of a spider, the tarantula (q.v.), and especially prevalent at Taranto in Apulia, Italy. The disease was a form of contagious emotional or hysterical excitation. The gesticulations, contortions, and cries somewhat resembled those of St. Vitus's dance and other epidemic nervous diseases of the Middle Ages. The victims were supposed to have a passion for bright colors, music, and the dance, and tunes called *tarantella* were composed for their cure. To these the patient danced until exhausted, and although sufferers were subjected to other methods of treatment, such as burial up to the neck in earth, none was so successful as the tarantella (q.v.). Not only dancing but catalepsy was a symptom, and all classes, ages, and both sexes appeared to be affected. The disease spread over Italy and southern Europe, and affected large numbers of people.

TARANTO, tȧ-rän′tō (Lat. *Tarentum;* from Gk. *Τάρας*, *Taras*). A town of south Italy, in the Province of Lecce, at the northern end of the Gulf of Taranto (Map: Italy, F 4). It is situated on a rocky islet, formerly an isthmus, between the Mare Piccolo (little sea), an extensive harbor on the east or landward side of the town, and the Mare Grande (great sea), or open gulf, on the west. The harbor, one of the finest in Italy, can be entered safely by the largest vessels. The principal buildings are a cathedral, dedicated to St. Cataldo; a fine episcopal palace; a castle and fortifications, erected by Charles V; and two hospitals. The streets are as narrow and dark as those of an Oriental city. Taranto has manufactures of velvets, linens, and cottons, and carries on some commerce in wheat, oats, and olive oil. The Mare Piccolo is famous for its shell fish, and a considerable portion of the population derives its subsistence from the oyster and mussel fisheries. Pop., 1912, according to Baedeker about 50,000.

Ancient Tarentum was one of the most splendid cities of Magna Græcia. It was founded, according to tradition, about 707 B.C. by the Parthenians, a body of Laconian youth. It rapidly grew in wealth and power, extending its trade even to the Po, and supplying much of southern Italy with pottery. It steadily reduced its Messapian neighbors till 473 B.C., when a bloody defeat was followed by the fall of the aristocratic government and the establishment of a pure democracy. About 400 B.C. Tarentum appears as the leading Greek city in Italy. When in 281 B.C. the Tarentines came into collision with Rome, they invited to Italy Pyrrhus (q.v.) of Epirus. After his departure his general, Milo, surrendered the town to the Romans, 272 B.C., who treated it leniently. During the Second Punic War it was captured by Hannibal, with the exception of the Acropolis. When in 209 B.C. it was retaken by the Romans, it was sacked, and 30,000 of the inhabitants were sold into slavery. Later it was the seat of a prosperous Roman colony. Under the Empire it was quite overshadowed by Brundusium, on the Adriatic, but rose again during the Gothic wars, which left it in the hands of the Byzantine Empire. It was captured in 661 A.D. by the Lombards, and later passed into the hands of the Saracens, who sacked it in 927, and of the Greeks, from the latter of whom it was wrested by Robert Guiscard, the Norman, in 1063. Later it shared the fortunes of the Kingdom of Naples. Few relics of the classic Tarentum are extant, the chief being bits of an amphitheatre and traces of a Doric temple, which from its form must be one of the early monuments of that style. Consult K. Baedeker, *Southern Italy* (16th Eng. ed., Leipzig, 1912), and the article "Tarentum" in Friedrich Lübker, *Reallexikon des klassischen Altertums*, vol. ii (8th ed., Leipzig, 1914).

TARANTO, DUKE OF. See MACDONALD, E. J. J. A.

TARANTULA, tȧ-răn′tū-lȧ (from It. *taran-*

tola, *tarantella*, from *Taranto*, Lat. *Tarentum*, a city in southern Italy, where the spider is common). A famous species (*Tarantula fasciventris*) of European wolf spiders (Lycosidæ); its bite was supposed to be fatal or to be followed by serious symptoms. As a fact the bite of this spider is not dangerous. The name "tarantula" is generally applied in the United States and elsewhere to certain of the large bird spiders, or so-called American tarantulas of the family Theraphosidæ. These are large, hairy spiders occurring in the southwestern United States, Central America, and South America, which possess large, hard polished fangs which move vertically and are thus used to pin down their prey. They feed upon insects and all sorts of small animals. *Aname hentzii* is a large species of this group which has the most northern distribution of all of the so-called American tarantulas. It has a bite which is painful but not dangerous, and never fatal, so far as accurate records go. These creatures are nocturnal, hiding during the day in long silken tubes in underground crevices, etc. Some Central American species are occasionally brought north on board vessels containing tropical fruit.

TRUE TARANTULA.

TARANTULA KILLER. A large and conspicuous wasp (*Pepsis formosa*), common in the southwestern United States and in Central America, which preys especially on tarantulas (q.v.). It is more than 2 inches long. The head, thorax, abdomen, and long, spiny legs are black, while the wings are bright reddish brown with black spots at the tips. It stings the spider, the result of the stinging being complete paralysis, deposits an egg upon it, then buries it in a hole 5 inches deep after the manner of other mud wasps (q.v.).

TARAPACÁ, tä'rà-pà-kä'. A province of north Chile, bounded by Tacna on the north, from which it is separated by the Camarones River, Antofagasta on the south with the Loa River as the dividing line, Bolivia on the east, and the Pacific on the west (Map: Peru, D 8). Its area is 18,125 square miles. The coast land is occupied by a mountain range rising to 6000 feet, and the eastern part belongs to the region of the Bolivian Andes. The interior is an elevated arid plain known as Pampa de Tamarugal. The wealth of the province consists chiefly in the immense deposits of nitrate, which are worked on a very extensive scale. Agriculture is carried on to some extent along the rivers, and there are silver mines near the capital, Iquique (q.v.). There is a railway line connecting the capital with Pisagua, the chief seaport, and the interior. Pop., 1912, 119,714. Tarapacá was taken by Chile from Peru in 1880 and was formally ceded in 1884.

TARARE, tà'rär'. A manufacturing town in the Department of Rhône, France, at the foot of Mont Tarare, 20 miles northwest of Lyons (Map: France, S., J 3). In 1756 the manufacture of muslins, for which it has since become famous, was introduced from Switzerland. The chief products of its mills are muslins, tarletans, silks, silk plush, and velvets. Pop., 1901, 12,334; 1911, 12,532.

TARASCO, tà-räs'kô. An ancient nation of Michoacan, Mexico, constituting a distinct linguistic stock. The early history of the Tarascans is preserved in a very curious Spanish document the translated title of which is "Relation of the Ceremonies and Rites, Population and Government of the Province of Mechuacan." According to their traditions they migrated from the north about the same time as the Aztec tribes (see NAHUATLAN STOCK), and about the year 1200 established their Kingdom in Michoacan, maintaining their independence against the Aztec, whom they excelled in many culture characteristics. Their principal buildings, especially in their capital city of Tzintzuntzan, were of cut stone laid in mortar. Many of the ruins are still unexplored. Their calendar was nearly the same as that of the Aztec, and they had also a pictograph system. Their principal god was Curicaberis, the sun. The dead were cremated, and both their funerals and their religious ceremonials were accompanied by human sacrifices. They were famous for their beautiful and durable fabrics of woven feathers as well as of cotton, and were skillful in the working of gold and silver. They surpassed all other native tribes in their defensive armor, which consisted of helmet, cuirass, and limb protectors, all of wood covered with plates of copper or gold. In physique they were considered the tallest and handsomest people of Mexico. They still constitute the bulk of the population of central Michoacan, and number about 200,000, and although they have lost the art of feather weaving, they maintain their reputation for the weaving of beautiful rebosos and belts with figures of birds and animals, and for their lacquer work. The language is vocalic and euphonious. Despite the fact that they offered no resistance to the Spanish invasion of Mexico, their last King, Tangaxoan, was tortured to death by Nuño de Guzmán. In 1810 they were the first to revolt against the Spaniards, and thus, under Hidalgo, began the Mexican War for Independence. Consult K. S. Lumholtz, *Unknown Mexico* (New York, 1902).

TARASCON, tà'rà'skôɴ'. A town in the Department of Bouches-du-Rhône, France, 13 miles southwest of Avignon, on the Rhone River (Map: France, S., J 5). It is connected with Beaucaire on the opposite bank by a suspension bridge. The twelfth-century church of St. Martha, a composite of the Romanesque and Gothic, occupies the site of an old Roman temple. It was rebuilt during the fourteenth and fifteenth centuries. It has a tenth-century crypt and the tombs of St. Martha and Louis II of Provence. Other objects of interest include the old Gothic castle completed in the fifteenth century, now a prison, and the town hall. The leading industries are silk spinning and the manufacture of hats. Pop., 1901, 8885; 1911, 8631. Tarascon is the ancient Tarasco. (See

Tarasque.) Daudet received here the inspiration for his *Tartarin de Tarascon.*

TARASP, tȧ′räsp′. A village of Switzerland, in the Lower Engadine, Canton of Grisons, situated on the Inn, at an altitude of 3910 feet, 36 miles from Chur and 28 miles from St. Moritz (Map: Switzerland, E 2). It is a health resort, frequented for its mineral baths. Pop., 1900, 275; 1910, 312.

TARASQUE, tȧ-räsk′. A monster prominent in the local folklore of Tarascon, France, said to have been subdued by St. Martha in early Christian days. On the fête "La Tarasque" an effigy of the beast is carried in procession about the streets of Tarascon.

TARAX′ACUM. See Dandelion.

TAR′BELL, Edmund C. (1862–). An American figure and landscape painter. He was born at West Groton, Mass., and studied at the Boston Museum School and with Boulanger and Lefebvre in Paris, but was most influenced by the Impressionists. Upon his return to the United States he settled near Boston and soon attracted favorable attention with his interesting and characteristic New England interiors. His technique is consistently impressionistic, displaying a subtle treatment of color tones, luminous light and shade effects, and clever handling of textures. Among his best-known paintings are: "Josephine and Mercié" (Corcoran Art Gallery, Washington); "Woman in Pink and Green" and "Girl Reading" (Cincinnati Museum); "The Venetian Blind" (Worcester Museum); "The Golden Screen" (Pennsylvania Academy of Fine Arts, Philadelphia); "Girl Reading" and "My Children in the Woods," among others in the Boston Museum; and "Afternoon Tea" (Wilstach collection, Philadelphia). Tarbell became a member of the National Academy (1906), of the "Ten American Painters," and of the National Institute of Arts and Letters, and from 1889 was instructor in drawing and painting in the Boston Museum School. His many prizes include gold medals at the Pennsylvania Academy of Fine Arts, Philadelphia (1895 and 1911), Carnegie Institute, Pittsburgh (1909), and the National Academy of Design (1909).

TARBELL, Ida Minerva (1857–). An American author, born in Erie Co., Pa. She graduated at Allegheny College in 1880 (A.M., 1883) and from 1883 until 1891 was associate editor of the *Chautauquan.* From 1891 until 1894 she studied at the Sorbonne and at the Collège de France. On her return she became an associate editor of *McClure's Magazine,* and in 1906 assumed a similar position upon the *American Magazine.* Allegheny and Knox colleges honored her with the degree of L.H.D. Her writings, direct, vigorous, and notably informative, include: *Life of Napoleon Bonaparte* (1895; 2d ed., 1901); *Madame Roland: A Biographical Study* (1896); *Early Life of Abraham Lincoln* (1896), with J. McCan Davis; *Life of Abraham Lincoln* (1900); *History of the Standard Oil Company* (2 vols., 1904); *The Tariff in our Times* (1911); *The Business of Being a Woman* (1912); *The Ways of Woman* (1915)—all this in addition to much miscellaneous work for the magazines.

TARBES, tärb. The capital of the Department of Hautes-Pyrénées, France, on the left bank of the Adour, 32 miles by rail east by south of Pau (Map: France, S., E 5). The cathedral, dating from the twelfth century, with a fine octagonal lantern tower, is the most noteworthy building. It has manufactures of woolens, machinery, and cannon. The town became a bishopric in 420 and in mediæval times was the capital of the County of Bigorre. It was occupied for 40 years by the English during the fourteenth century. Pop., 1901, 26,055; 1911, 28,615.

TARBORO, tär′bŭr-ō. A city and the county seat of Edgecombe Co., N. C., 65 miles (direct) east of Raleigh on Tar River, and on the Atlantic Coast Line and the East Carolina railroad (Map: North Carolina, E 2). Cotton, knit goods, cottonseed oil, fertilizers, carriages, foundry and machine-shop products, and lumber are manufactured. Pop., 1900, 2499; 1910, 4129.

TARDE, tärd, Gabriel (1843–1904). A French sociologist and criminologist, born at Sarlat (Dordogne). In 1880 he began to contribute to the *Revue Philosophique,* and gradually won his way to reputation, which was assured after the publication of his *Lois de l'imitation* in 1890 (Eng. trans., *The Laws of Imitation,* 1903). He later became professor of modern philosophy at the Collège de France in Paris. In a large number of books and articles, Tarde elaborated a complete and original theory of society. It is essentially a psychological theory. In Tarde's view, to study society is to study how the minds of men act, and how they influence one another. The essence of society, he held, is that one man should be so affected by another that the two should be brought to greater similarity of thought or action. Social life is a round of invention and imitation; an "invention" being a new thought or act of any kind, and "imitation" any thought or act of copying or making after a model. Imitation obeys certain laws which Tarde began to investigate. Thus it is usually the inferior who copies the superior, the lower class the upper class—a new idea having prestige because of its novelty, though if taken up as a permanent institution it will come to prestige by lapse of time. Circles of imitation spread from different inventions as ripples around stones thrown on a pond; the circles interfere, oppose, combine, in complicated ways which Tarde sought to analyze. The essentials of his theory were presented in the *Lois de l'imitation,* and were elaborated five years later in his *Logique sociale,* in which extensive illustrations were given from the whole range of social development. Along with his sociological theory, Tarde gradually developed a philosophical system, best summarized in his *Lois sociales* (1898; Eng. trans., *Social Laws,* 1898). His psychological point of view is carried over into his criminological work. *La criminalité comparée* (1886; 5th ed., 1902), his first book, emphasized the purely social influences upon crime, with much criticism of the anthropological school of Lombroso (q.v.). *La philosophie pénale* (1890; Eng. trans., *Penal Philosophy,* 1912) is a more systematic presentation of his ideas. Tarde's other works include: *Etudes pénales et sociales* (1892); *Les transformations du droit* (1893); *Essais et mélanges sociologiques* (1895); *L'Opposition universelle* (1897); *Etudes de psychologie sociale* (1898); *Les transformations du pouvoir* (1899); *L'Opinion et la foule* (1901); *Psychologie économique* (2 vols., 1901). A volume called *Underground Man* appeared in 1905. Consult *Gabriel Tarde: Introduction et pages choisies par ses fils, suivis de poésies inédites,* with preface by Henri Bergson (Paris, 1909).

TARDIEU, tär′dyē. A French family of engravers. Nicolas Henri (1674–1749), born in Paris, was a pupil of Gérard Audran and later became court engraver. His most important works include a series from the "History of Constantine," after Rubens, and plates after Rigaud and Watteau. His son and pupil, Jacques Nicolas (1716–91), made a specialty of portraits. He succeeded his father as court engraver, and was also appointed engraver to the electoral court of Cologne.—Jean Charles (called Cochin) (1765–1830), a son of the preceding, was an historical painter, and a pupil of Regnault. "The Queen of Prussia at Tilsit" and two other paintings at Versailles are by him.—Jean Baptiste Pierre (1746–1816), a grandnephew of Nicolas Henri, was the first to raise the art of geographical engraving to a high level, and was ably followed in its practice by his brother Antoine François (1757–1822), as well as the latter's son Ambroise (1788–1841). Pierre Alexandre, nephew and pupil of Jacques Nicolas, also studied under Wille. He engraved chiefly portraits, including the fine plate of Lord Arundel, after Van Dyke.

TARDIGRADA, tär′dĭ-grā′dȧ (Lat., slow-going). A group of animals of uncertain affinities, represented by the bear animalcules. They are minute, slowly moving, soft-skinned animals, not more than a millimeter in length, and are often referred to the class Arachnida, as distantly related to the mites. The body is short and thick, not divided into segments, the head slightly separated from the trunk. The mouth is provided with a sucking proboscis, and is surrounded by papillæ. The digestive canal opens by a muscular pharynx into a narrow œsophagus, which leads to a capacious stomach, succeeded by a short intestine. There are two eyelike spots, and the nervous system consists of a brain succeeded by a ventral nerve cord of four ganglia. There are no heart, blood vessels, nor any respiratory organs; and the animals are hermaphroditic. The segmentation of the egg (which is very large) is complete and regular. Tardigrades are not uncommon in bog moss (*Sphagnum*), or in fresh and salt water, and are capable of revivifying after being apparently dead and dried up, if placed in water.

TARDIGRADA. A subdivision of Edentata. See Sloth.

TAR′DIVEL, Jules Paul (1851–1905). A Canadian journalist and novelist. He was born at Covington, Ky., and went to Canada in 1868. He was educated at St. Hyacinthe College, took up newspaper work, and after serving on the staff of *La Minerve* and *Le Canadien* he founded in 1881 *La Vérité* (Quebec), of which he was for many years editor and proprietor. He was independent in politics, strongly pro-Catholic, and strove to make Catholic principles rule in the conduct of public affairs. He was a bitter enemy of liberalism and the Freemasons, and favored the secession of Quebec from Confederation and the eventual independence of the province. He published: *Vie du Pape Pie IX, ses œuvres et ses douleurs* (1878); *Notes de voyage* (1890); *Pour la patrie: roman du vingtième siècle* (1895), in which he attacks the influence of Freemasonry.

TARE (of uncertain etymology; possibly connected with ME. *tare*, brisk, eager). Various leguminous plants, especially species of *Vicia*, weak climbing plants, natives of the temperate parts of the Northern Hemisphere. One of these, the wild vetch (*Vicia hirsuta*), has very small flowers and pods, pinnate leaves, and small leaflets. It affords nourishing food for cattle, but the quantity is so small that it is seldom cultivated and is chiefly known as a weed. One species (*Vicia sativa*), with an upright branching habit, is cultivated in some parts of Europe for its herbage. The plant thrives well in poor sandy soils, where it is valuable for green manure. *Vicia villosa*, the hairy or winter vetch, is also a valuable forage and green manuring plant. (See Vetch.) The tare of the New Testament is supposed to be darnel (q.v.).

VETCH.

TAREN′TOLA (It., Tarentine, from *Taranto*, from Lat. *Tarantum*, from Gk. Τάρας, *Taras*, a city of southern Italy), or Tarente. One of the commonest geckos (q.v.), or lizards, of the Mediterranean region (*Tarentola mauritanica*), grayish brown with indefinite markings, and about 6 inches long. It has been introduced by ships into southern France, and when it takes up its abode inside a house becomes almost domesticated. Some other geckos are also mistakenly called by this name. An interesting account of their habits may be found in Hans Gadow, "Amphibia and Reptiles," in *Cambridge Natural History*, vol. viii (London, 1901).

TAREN′TUM. See Taranto.

TARENTUM. A borough in Allegheny Co., Pa., 22 miles northeast of Pittsburgh, on the Allegheny River, and on the Pennsylvania Railroad (Map: Pennsylvania, B 6). It is primarily an industrial centre, being interested largely in the manufacture of plate glass and bottles. Other products include brick, lumber, steel and iron novelties, steel billets and sheets, sack and wrapping paper, etc. Pop., 1900, 5472; 1910, 7414.

TARGE, François Henri René Allain-. See Allain-Targe, F. H. R.

TARGET AND TARGET PRACTICE. Target practice is the scheme of instruction and training designed to produce effective use of projectile weapons under war conditions. The word "target" is used to designate either the actual or simulated hostile personnel or material. There are, e.g., special systems of target practice for—1. Small arms: including the rifle, the pistol, and the machine gun. 2. Light and heavy field artillery: cannon from 3-inch to 6-inch. 3. Siege artillery: from 6-inch to 16-inch calibre. 4. Coast artillery:

guns, mortars, submarine mines. 5. Miscellaneous projectile weapons: hand and rifle grenades; army and navy balloon guns for use against aircraft; small arms and machine guns fired from aircraft against aircraft; bombs, torpedoes, and steel arrows launched from aircraft at land and water targets, etc. 6. Naval guns and torpedoes fired from a moving ship or submarine against other ships in motion.

The general scheme of any system of target practice includes a preliminary training of the individual and organization in principles and methods, followed by tactical fire problems (with service ammunition), simulating as far as possible the technical and tactical conditions of a definite phase of actual combat. The targets for these final or test exercises simulate in form, color, size, movement, etc., the actual targets to be expected in war.

Small Arms: Rifle and Pistol. The sole purpose of rifle training for the soldier is to make of him a good shot under war conditions, and a scheme of instruction will be effective in so far as it tends to produce that result. The soldier is therefore so trained at known distances in the various kinds of fire employed in actual service as to bring his skill as a rifleman up to the capabilities of his weapon, after which he should be so trained in firing as a part of tactical units as to utilize his individual skill to the best advantage in operations simulating those of the battlefield. By means of preliminary drills and gallery practice the soldier is trained in the fundamental principles of marksmanship; by means of range practice he is taught to apply these principles in firing at fixed distances, at clearly defined targets. This training is merely preparatory to combat firing in which individuals learn coöperation, and commanders and leaders learn how to obtain the maximum efficiency of fire by a judicious coördination of the skill and the efforts of all the individuals of the group or fire unit.

United States soldiers using the rifle are graded according to proficiency exhibited in the individual record practice. The test is a single course in slow and in rapid fire as given in the following table:

RANGE YARDS	Time	Shots	Targets	Value	Position
		SLOW FIRE			
300	No limit	10	A	50	5 sitting, 5 kneeling
500	No limit	10	B	50	Prone
600	No limit	10	D	50	Prone, sandbag rest
		RAPID FIRE			
200	1 min.	10	D	50	Kneeling from standing
300	1 min. 10 sec.	10	D	50	Prone from standing
500	1 min. 30 sec.	10	D	50	Prone

Total possible......................300 points

The grades of marksmanship, based on the above firing (the number of points being those made out of a possible 300), are as follows: expert rifleman, 253; sharpshooter, 238; marksman, 202; first class man, 177; second class man, 152. The targets A, B, and D used in this record firing are as illustrated in Figs. 1, 2, and 3. The value of a bull's-eye hit is 5 points, the other zones 4, 3, and 2 points respectively counting from the centre. Long-distance practice for sharpshooters and experts only is conducted at 800 and 1000 yards firing from the prone position at target C, Fig. 4. Value of zones in points as in A and B targets.

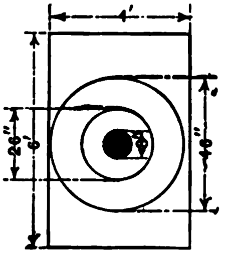

FIG. 1. TARGET A.

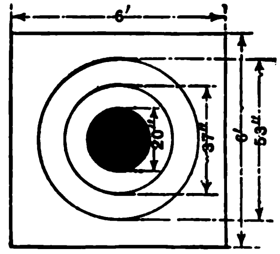

FIG. 2. TARGET B.

The course in pistol firing is both mounted and dismounted. The dismounted course is at 15 and 25 yards; for experts, 15, 25, and 50 yards. For the mounted course, at the halt and gallop, firing is at 10 yards. Expert test at 5 to 15 yards at the halt, gallop, and extended gallop.

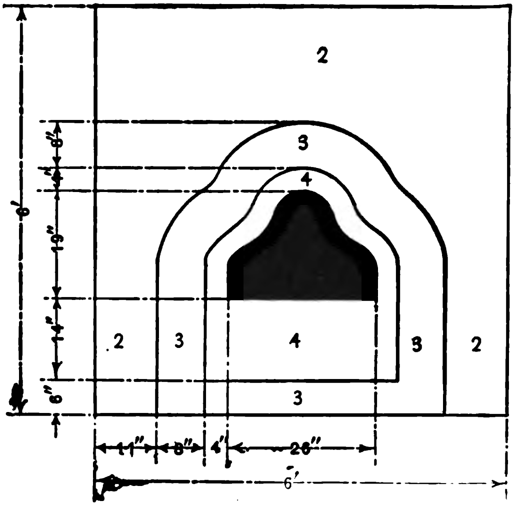

FIG. 3. UNITED STATES ARMY TARGET D.

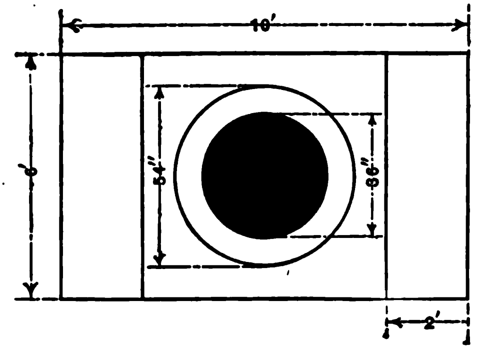

FIG. 4. UNITED STATES ARMY TARGET C.

Extra compensation in money and a badge are given to enlisted riflemen qualifying for the higher grades. Commissioned officers are given badges only. For the purpose of fostering interest in target practice, department competitions are held for the regular army in every alternate year, or when directed by the Secretary of War. Gold, silver, and bronze medals are awarded to department teams according to order of merit.

The National Board for the Promotion of Rifle Practice, with the approval of the Secretary of War, issues from time to time rules and regulations for national matches and other competitions. The national matches include rifle teams of 12 men each from the United States infantry, the United States cavalry, United States navy, United States marine corps, United States Military Academy, one team from the organized militia of each State, Territory, and the District of Columbia, one team from the university, college, military school or college whose members can present a certificate showing good scholastic standing and the amount of military duty required. There are also national individual rifle and pistol matches held at the same time and place.

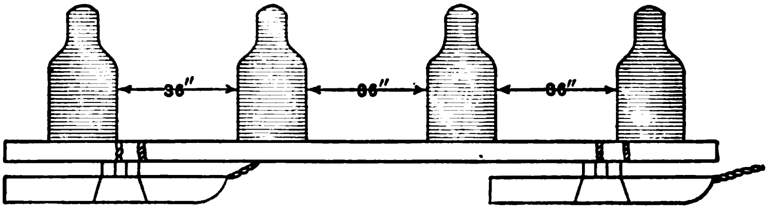

FIG. 5. MOVING TARGET.

After the individual target practice at known distances at well defined targets the training of the rifleman proceeds to collective firing of 20 to 25 rifles at unknown distances, against field targets which are groups of silhouettes, made of wood or fibre, painted olive drab, and in size and shape simulating enemy personnel and horses, which targets are so disposed over the natural terrain as to represent an actual episode in war. Companies, battalions, and regiments have similar exercises. Such field targets may be stationary, disappearing, moving, or a combination of two or more. Examples of such field targets are illustrated in Fig. 5 and Fig. 6.

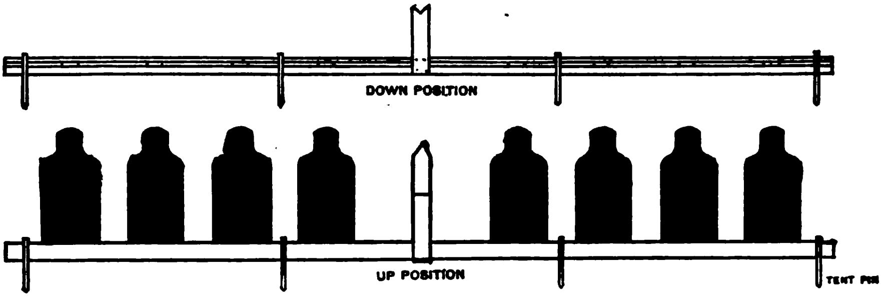

FIG. 6. DISAPPEARING TARGET.

The armies of all the great powers use similar methods and targets. The British and the United States soldier has more individual target practice, especially at the long ranges, than the rifleman of Germany and France, but the German and French infantry have more training in collective firing in tactical problems. As a marksman the American soldier ranks high among the soldiers of other armies. For further details consult *Small Arms Firing Manual United States Army* (Washington, 1913) and *Field Firing and the Proficiency Test, United States Army* (ib., 1911).

Machine Gun. For machine guns which played such an important part in the Great War, special target practice is provided. The squad handling a gun is practiced in directing the gun quickly upon a suddenly appearing target, in following its movements and in keeping up an effective fire against it. Field targets moving at various angles to the front and at different rates of speed are used. Such targets afford different and unknown ranges and different degrees of visibility. The method of instructions, nature of targets, etc., may be found in the *Combined Infantry and Cavalry Drill Regulations for the Automatic Machine Rifle, Calibre 30, United States Army* (1915).

Field Artillery Target Practice is essentially different from that for small arms. The accuracy of fire of the rifleman is obviously dependent upon one man, that of the field gun upon a squad of five or more men and the skill of the officer observing the fire. Normally the rifleman cannot bracket his target by the observation of the points of impact of his bullets, whereas the field artillery officer can observe and uses the bursts of his projectiles for that purpose during the ranging process. The rifleman uses direct fire, i.e., aligns his sights on the object attacked, whereas the artillery gunner, firing normally from behind cover, does not see his target but secures the correct laying of his gun by setting off on scales data computed by the officer observing the fire. The system involves team training at the guns, calculation of firing data by the officer and a sure communication system, verbal, telephone, or flag, from the officer's observing station to guns, and correction of range, height of burst and deflection errors, based on the observation of preceding bursts. In addition, in the exceptional cases when field guns use direct fire, the enlisted gunner must have a training in laying his gun similar to that of the rifleman.

The target practice of field artillery in the United States army includes pistol practice, subcalibre practice and service practice. Subcalibre practice is with a dummy cartridge whose axis is a tube the calibre of which is that of the small arm rifle ammunition, which is used for purposes of economy in training preliminary to service practice, in which service ammunition is used. Service practice problems, the culmination of the years' training, are always conducted as phases or episodes of combat, over the natural terrain, at unknown ranges, at field targets, fixed, disappearing, and moving, constructed usually of inch pine lumber simulating in form, size, color, disposition, and movement hostile personnel, animals, and material. Material objects, such as stone walls, earthworks, buildings, etc., when available, are also fired at to exhibit actual effect obtained. For the details of methods consult the annual training and target practice order published by the War Department. All ranges from the gun to about 5000 yards are used. The permanent artillery ranges in England, Germany, and other European countries are in general similar to the one which was being equipped at the School of Fire for Field Artillery at Fort Sill, Okla., in 1915. European equipment includes concrete and armored towers for observers near the targets, permanent protected power plants to move the targets at different speeds by means of long cables, permanent telephone lines to connect observers with firing points, etc. In the United States targets are drawn by six-horse limbers at the end of a 500-yard cable. One of the most realistic targets, adopted from the German, is illustrated in Fig. 7. It consists of a line of infantry skirmishes so arranged that it moves as a whole while appearing and disappearing at irregular intervals, thus representing an advancing infantry squad intermittently seeking cover. Fig. 8 is a gun team and carriage target, mounted on sleds and drawn by a six-horse limber. Consult: Bethell, *Modern Artillery in the Field* (London, 1911); *Index of Targets, School of Fire* (Fort Sill, Okla., 1915); *Mobile Artillery Targets* (Washington, 1914).

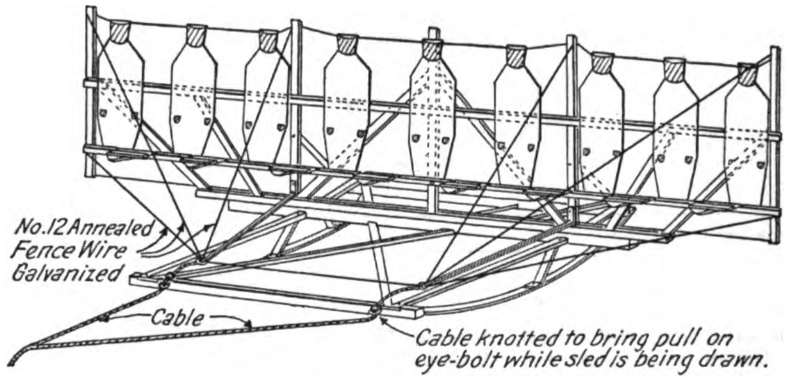
No. 12 Annealed Fence Wire Galvanized
Cable
Cable knotted to bring pull on eye-bolt while sled is being drawn.

FIG. 7. ADVANCING INFANTRY TARGET AND SLED.

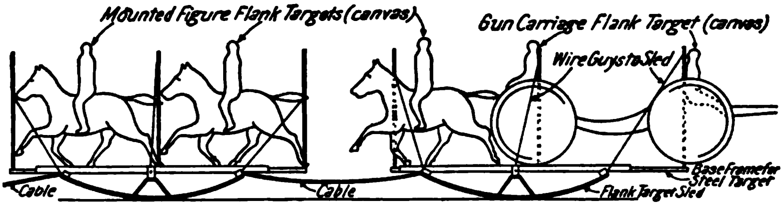
Mounted Figure Flank Targets (canvas)
Gun Carriage Flank Target (canvas)
Wire Guys to Sled
Base Frame for Steel Target
Cable
Cable
Flank Target Sled

FIG. 8. ARTILLERY TARGET. GUN TEAM AND CARRIAGE TARGET.

Siege Artillery. This target practice partakes of the character of both field and sea-coast artillery (see below), i.e., the means of reaching the target is based both on observation of bursts and on accurate trigonometrical data (obtained by instruments at the ends of a base line). The targets used simulate those for which the particular calibre was designed.

Coast Artillery. This target practice consists of practice with (1) 3, 4, 4.7, 5, and 6 inch guns; (2) 8, 10, 12, and 14 inch guns; (3) 12-inch mortars; (4) submarine mine practice. All service target practice with guns and mortars, except trial shots, is by battery at moving targets towed as fast as is practicable with the available vessels, the distance of the latter from the targets being 300 to 500 yards. For the record shots of the small guns, 3 to 6 inch, a material target 10 feet high by 24 feet long, mounted on towed rafts, is used. The practice is similar to that for field guns firing at moving targets, corrections being based on observation of splashes and direct hits only counting. For the large guns and mortars any form of towed target is used as an aiming point. The splashes are carefully plotted on a sheet with reference to the target. The centres of silhouettes of the vertical and horizontal projection of a battleship, drawn to scale, are placed on the plotted position of the aiming point and hits are allowed or rejected as they do or do not fall within the outlines of the silhouette. Minimum ranges are from 3000 yards to 10,000 yards, depending on the calibre of the gun. A figure of merit based principally on hits and time used is computed for each company, which is graded accordingly. The practice with the big guns and mortars is essentially different from that of the field artillery gun. For the coast artillery, gun range corrections are based on rapid instrumental plotting, since personal observations of shorts and overs have been found unreliable at the long range used. With the field artillery gun a target is included between two observed salvos and the fire for effect delivered between them.

Mines. Besides the gun practice mine companies have submarine mine practice annually, firing loaded mines under the conditions of war service. An improvised target is towed across the mine field at the end of a 300-yard tow line. The movement of the target is plotted instrumentally on a chart showing the mines, that mine judged to be under the target being fired electrically from the shore. The material target is assumed to be at the centre of a hypothetical circular target 75 feet in diameter. As in field artillery, subcalibre target practice is part of the training preliminary to practice with service ammunition. Consult: *Coast Artillery Instruction Order, U. S. A., 1916; Drill Regulations Coast Artillery, 1914;* Hines and Ward, *The Service of Coast Artillery* (New York, 1910).

Miscellaneous Projectile Weapons. To secure both efficiency and economy of material, practice with grenades thrown by hand is necessary. Practice with the various forms of rifle grenades, some of which have a range as great as 300 yards, is as necessary as target practice with trench mortars. The great value of such projectile arms was exemplified during the Great War.

Balloon gun is the name popularly given to the ground gun designed to attack aircraft. Their development and use during the Great War was notable. Target practice with such guns is against kites and balloons, both free and captive. The development of this armament is so recent that in 1916 there were no prescribed manuals for public information. The problem of vertical fire against aircraft moving in three dimensions is difficult and is not yet satisfactorily solved. Aircraft guns are the armament of aircraft whose targets are other aircraft. Target practice with such guns is in an embryonic stage owing to the fact that it is only within the last few years that such guns have been used. But it may be said that the hitting of one moving body from another moving body, both going at a high rate of speed, presents a difficult problem in exterior ballistics of three dimensions. Similarly, launching apparatus for dropping bombs and other projectiles from aircraft is in an experimental stage and up to 1916 little military success had been achieved. Lieutenant Scott, formerly of the United States army, devised such an apparatus, which met with considerable success in French experiments conducted before the Great War. Targets used for such practice include concentric circles of known diameter, or the outlines of a ship's deck, marked on the ground, silhouettes representing bodies of troops, etc. Two elements must be known, first, the ground speed, i.e., the speed at which the aircraft is passing over the ground (the resultant of the aircraft's speed, and the retarding or accelerating effect of the wind), and second, the height above the ground. For data on aeroplane observers in the conduct of the fire of artillery, consult *Extracts from Field Artillery Training* (British), *1914, relating to Aircraft* (Fort Sill, Okla., 1915). See MILITARY AËRONAUTICS; NAVAL AËRONAUTICS; TARGET PRACTICE, NAVAL; TORPEDO.

Civilian Rifle Practice. There was no organized effort to develop skill in rifle shooting in the United States before 1867, when Capt. George W. Wingate (q.v.), in command of Company A of the Twenty-second Regiment, New York National Guard, formulated instructions on the subject for that company. The elaboration of these instructions and their publication in the *Army and Navy Journal* led to the formation at New York, in 1871, of the National Rifle Association of America, which has ever since been the most active agency in encouraging both military and civilian rifle practice in the United States. Largely through the efforts of this association New York State, New York City, and Brooklyn gave $25,000 in 1872 for the establishing of the famous rifle range at Creedmore, Long Island, which was used for military matches continuously thereafter until 1909. Here was held in 1874 the first international rifle match in the United States, the contestants being a team of five men from the Amateur Rifle Club, representing the National Rifle Association, and a team of the same number of Irish rifle experts, representing the British National Rifle Association. This remarkable contest was won by the American team by a score of 934 to 931. American teams were also successful in Ireland in 1875; against Irish, Scottish, Australian, and Canadian teams at Creedmore in 1876; and once more in Ireland in 1880. The development of purely military rifle matches on the Creedmore and other ranges is discussed in the preceding part of this article.

Governmental efforts to encourage civilian rifle practice may be said to date from the formation, under an Act of Congress approved March 2, 1903, of the National Board for the Promotion of Rifle Practice. The board (which is affiliated with the War Department) is composed of the president and the seven directors of the National Rifle Association, eight members selected by the Secretary of War from the country at large, and five selected as representatives of the War Department, the army, the navy, and the Marine Corps. The board has no administrative force, and its work is carried on by the National Rifle Association, whose headquarters are in Washington. Further official support was expressed in 1912 when the Secretary of War asked all governors of States to request National Guard officers in their jurisdiction to put the State rifle ranges at the disposal of college and schoolboy rifle clubs and to assign militia officers as instructors for such organizations. Nearly all of the governors replied favorably to this request. Again, in 1914 Congress sanctioned the issue of a Krag-Jörgensen rifle and 120 rounds of ammunition to each member of a civilian rifle club affiliated with the National Rifle Association. In 1915 the Secretary of War approved the plan of that association for an annual competition between teams from civilian rifle clubs recognized by the association for the championship of the United States, these contests to be held simultaneously on military ranges, under military regulations, and with the regular service rifle.

Great impetus had been given to the movement in 1907 by the action of the National Rifle Association in amending its by-laws so as to admit to membership rifle clubs representing colleges which grant degrees, academies, preparatory schools, and public schools, the minimum membership age to be 14 years. The New York City Public School Athletic League (organized in 1903) had already introduced rifle practice for high-school boys by means of a "subtarget gun" machine, employing the service rifle without ammunition, but equipped with an electrical device which registers accurately the shooter's aim.

Under these various influences there was a rapid increase in the amount of civilian rifle practice throughout the United States during the decade 1905–15. According to the report of the secretary of the National Rifle Association covering the year 1915, there were affiliated with the association at the beginning of 1916, 639 civilian rifle clubs with 26,212 members, 64 college and university clubs with 3353 members, 87 high-school clubs with 2788 members, 10 private preparatory school clubs with 867 members, 32 military school clubs with 2106 members, and 9 boys' clubs with 139 members, making the total membership of these clubs 35,465. Similar interest was shown in this subject in Europe, and received due attention in the pamphlet, *Rifle Shooting in Educational Institutions* (2d ed., 1912), published by the National Board above mentioned. Consult "Shooting News," published monthly by that board, and its annual reports; also the annual reports of the National Rifle Association.

Trap Shooting. The obvious brutality of shooting pigeons released from a box within comparatively easy range of the shooter has caused the prohibition of that practice in all but a few of the United States and the substitution for the live birds of inanimate targets thrown from various forms of spring traps. Glass or tar-composition balls were the first of these targets to gain any vogue, but these were soon displaced by the clay pigeon, which was first made by George Ligowsky of Cincinnati, Ohio. Ligowsky used common clay, which he modeled into the form of a deep-bowled saucer and baked in an ordinary oven; but the cost of this target (about $30 a thousand) was almost prohibitive, while the crude method of manufacture caused great variation in its hardness, many, indeed, being practically unbreakable by ordinary bird shot. In 1882 the American clay bird, made of a composition of pitch and tar, was produced, but proved to be too fragile and prompted the invention by two brothers named Hebbard, of Memphis, Tenn., of a target composed in equal portions of pitch and finely ground, kiln-dried river clay. These targets are cast in various molds, but are generally 4⅛ inches in diameter and 1⅛ inches high, with a rim ¼ inch thick and ½ inch high, the body being raised ⅝ of an inch from the inside of the rim. The Hebbard target was named the Blue Rock and has remained the standard form. Such targets sell for from $5.50 to $6 a thousand. They are thrown from a trap with an arm propelled by a powerful spring, which gives the target a rotary motion and a steady and rapid flight.

It was estimated that there were about 500,000 trap shooters in the United States in 1916 and about 5000 gun clubs devoted chiefly to this sport. In that year these shooters were using targets at the rate of from 60,000,000 to 70,000,000 a year, while foreign clubs use about 10,000,000 annually. The various State gun clubs hold a State shoot every year, and the winners of these contests compete for the amateur championship of the world, which is held under the direction of the Interstate Association. In 1915 this contest engaged 853 shooters. Various other handicaps and straight shoots are also held under the management of the Interstate Association.

TARGET PRACTICE, Naval. Target practice is the culminating exercise in the preparation of ships and crews for war. The methods and details are constantly changing and to a certain extent both are confidential. After the men are thoroughly trained at the guns they are given practice with dotters and subcalibre tubes or similar apparatus. These are devices (attached to the guns) which fire at miniature moving targets or make pencil records on moving sheets. By this means the poorer marksmen are eliminated. The training is then advanced to subcalibre practice. One-pounder or other guns of small size are securely clamped to the chase (i.e., the forward barrel) of the heavy guns. The operator uses the sights and elevating mechanism of the big gun but fires a projectile from the small one, a suitable correction being made for the difference in range of the two pieces with a given elevation. The best marksmen are selected as gun pointers and record practice is then held. Large canvas targets are stretched on masts erected on a long wooden raft. This raft is towed at the end of a long hawser and the targets are fired at by the guns of the firing ship. The range is several thousand yards, the exact distance depending upon the calibre and characteristics of the guns used, and is frequently changed. As the secondary battery of ships is used for torpedo protection, its practice takes place at night, searchlights being used to illuminate the target. Several guns may fire at one target at the same time, but the hits are distinguished by freshly coating the points of the shells with different colored paints before firing and the color of the paint shows around the hole made in the target. Upon the results of record practice are based the rewards to the individual gun pointer, gun captain, guns' crews, ships' crews, etc., though they may be increased by battle practice records.

Battle target practice is intended to simulate war conditions. The exact regulations are different in each navy and are apt to change from year to year. The targets are towed at an unknown speed and on an unknown course. The firing squadron or division is given no information beyond what its commander or individual ships can ascertain while approaching it from a distance beyond the permitted range for firing. The manœuvres of the fleet while firing, the limits of range and time in which firing is permitted, and the number of shots to be fired are of course specified. Several targets are usually towed in the target group—one for each ship, one for each pair of ships, one for each division, as may be specified.

Night battle practices are rarely the same in any two navies or in the same navy in any two consecutive years. All are intended to simulate the conditions of night attack by torpedo boats. In addition to the regular target practices, special practices are undertaken by selected ships. These are devised to solve problems in gunnery, armor, tactics, or to obtain improved methods of target practice. The necessary expenditure for target practice is very great but, as it is the most valuable and necessary of all training for war, the expenditure is accepted as inevitable. All practicable means for reducing the cost are taken—such as the use of cheap cast-iron projectiles filled with sand and wood instead of a bursting charge, thereby effecting a saving in each discharge of nearly fifty per cent, as the steel projectile and bursting charge make up nearly two-thirds the cost of every shot. See Gunnery; Guns, Naval.

TARGOVITZA, tär′gô-vĭt′sȧ, Confederation of. A union of Polish nobles under the leadership of Felix Potocki, formed at Targovitza

(Russian Government of Kiev) on May 14, 1792, for the purpose of overthrowing the constitution adopted in the preceding year. The organizers of the confederation were entirely in the interests of the Russian Empire, and the adhesion of the Polish King to the confederation was followed by the second partition of Poland (q.v.).

TARGUM, tär′gŭm; *Heb. pron.* tär-gōōm′ (Aram. *targūm*, translation, explanation, from *targēm*, to interpret). The designation of the Aramaic paraphrases of the Old Testament used in the synagogues of Palestine and Babylonia. When Hebrew ceased to be generally spoken and gave way to the Aramaic, it became necessary to explain the meaning of what was read from the Scriptures. The first indication of this practice is to be found in Neh. viii. 8, where it is said that Ezra read the law to the people while his assistants "caused them to understand the reading." The custom grew and gradually there arose a class of meturgemans (mod. dragoman, interpreter) and finally the system was regulated by the rabbis. At first and indeed for many centuries the Targum from its very nature was not committed to writing, for the same reason that the oral law itself was never intended to become a definitely formulated written code. In the course of time, however, both yielded to circumstances and it was thought preferable to write them down rather than have them forgotten. Yet only a small portion of the immense mass of oral Targums that was produced survived. We possess the originally Judæan Targum Onkelos and three late and incomplete so-called Jerusalem Targums on the Pentateuch, the Judæan Targum ascribed to Jonathan ben Uzziel on the Prophets, as well as later fragments of another paraphrase of the Prophets, and Targums on the Hagiographa, viz. on Psalms, Job, Proverbs, the five Megilloth (Song of Songs, Ruth, Lamentations, Esther, Ecclesiastes), on Chronicles, and on the deuterocanonical pieces of Esther. There are no Targums on Daniel and Ezra and Nehemiah.

The Targums are seldom of much help for purposes of text criticism. Their main claim upon scholars rests upon the fact that in them there are to be found hints at the internal and external life of the people at the time when they were composed, and that they disclose the development of religious thought and of Scriptural interpretation from the first to the seventh century of our era. The text is in a very corrupt condition, as might indeed be expected, since no proper care was taken to secure the purity of the text when the Aramaic began to decline as the spoken tongue of the Jews. A translation of the Targums on the Pentateuch into English was made by Etheridge (London, 1862–65). The *Editio Princeps* of Onkelos (q.v.) is that of Bologna (1482), of the Targum on the Former Prophets that of Leira (1494), and on the Latter Prophets that of Venice (1517–18). Targums on the Hagiographa appeared in the Rabbinic Bibles, but the Targum on Chronicles was not published until 1680. Recent editions of the Targum are: Pentateuch (Targum Onkelos) by A. Berliner (Berlin, 1884); Prophets (Prophetæ Chaldaice) by Lagarde (Leipzig, 1872); Hagiographa Chaldaice by the same (ib., 1873); the Yemenite Targum of Onkelos was published in Jerusalem (1894–1901). Consult especially Gustaf Dalman, *Grammatik des jüdischpalästinischen Aramäisch* (2d ed., Leipzig, 1905).

TARGUVISHTEA. See Tergoviste.

TARIFA, tȧ-rē′fȧ. A seaport town of Spain, in the Province of Cadiz, on the coast, 21 miles west-southwest of Gibraltar (Map: Spain, C 4). It is the most southern town of Europe, is surrounded by tower-embattled walls, and communicates by a causeway with a small island, on which stand a fortress and lighthouse. The town is the most thoroughly Moorish in Andalusia; it is quadrangular in shape, and its streets are narrow and dark. Tunny and anchovy fisheries are actively carried on. Tarifa, the Carthaginian Josa, and the Roman Julia Traducta, received its present name from the Arabs, who are said to have called it after Tarif ibn Malik, who landed there to reconnoitre previous to the conquest of the country. It was successfully defended in 1812 by 2500 troops (mostly British) against a French force of 10,000 men, under Victor and Laval. Pop., 1900, 11,730; 1910, 12,522.

TARIFF (OF., Fr. *tariffe*, Fr. *tarif*, from Sp. *tarifa*, price list, rate book, from *Ar. ta'rīfa*, *ta'rīf*, notification, inventory, from *'arafa*, to know). A schedule of duties or imposts levied upon goods as they pass from one state to another. A tariff may be levied upon foreign goods: (1) simply as a means of augmenting the revenues of a government, in which case it is a form of taxation (see Tax; Free Trade); or (2) as a means of retaliating upon foreign governments for similar restrictions imposed by them, in which case it becomes an instrument of warfare serving a temporary purpose and designed in the end to secure commercial reciprocity; or (3) as a means of fostering artificially particular industries by protecting them wholly or in part against foreign competition. See Protection.

History. Tariffs for revenue seem to have been usual among the civilized nations of antiquity. Among the Greeks, especially the Athenians, a tariff was regularly resorted to for revenue. This was laid upon both exports and imports, and an additional tax collected from vessels engaged in foreign traffic using harbors for anchorage. The regular export and import duty at Athens was 2 per cent, though in time of war, when the state was in pressing need of large sums, it was considerably augmented.

Import and export duties were regularly levied by the Roman state for revenue. The name for this tax used by the Latin writers is portorium, a name applied likewise to transit duties and bridge tolls. In the provinces and in newly conquered countries, duties were collected by Roman officials known as portitores and publicani, and the sums transmitted to the Roman treasury. In some cases, however, the central government, as a favor, allowed the subject state to make its own customs laws, stipulating only that Roman citizens should be exempted from paying any duties imposed. In 60 B.C. all portoria were abolished by the Lex Cæcilia so far as concerned the ports of Italy; but Julius Cæsar soon after restored them. Augustus Cæsar still further increased the number of dutiable commodities, and a long list of those which under the later emperors were subject to the payment of a duty is given in the Digest of Justinian. The rate of duty at Rome seems generally to have been 5 per cent, but under the later emperors a duty of 12½ per cent (octava) is mentioned as the ordinary tax on imports.

In the Middle Ages the feudal lords individually claimed and exercised the right of imposing transit duties levied on all goods that passed by or through their possessions. Hence river ways and roads had many customhouses and tollgates. When feudalism gave away to monarchy and strong central government, the kings took the barons' rights. They erected customhouses at all their frontiers, and even on the boundaries of their different provinces. So universal did duties, local and national, become, that every continental nation was covered with a network of customs lines. Various cities also had their local customs duties, of which the octroi collected at the entrance to several cities on the Continent, notably Paris, is a survival.

In England we first hear of a tariff for revenue under King Ethelred about the year 980. At that time duties on ships and goods were levied and ordered to be paid at Billingsgate, London. They were first acknowledged as a part of the King's revenue in the reign of Edward I, who received them by regular grant from Parliament, if we may accept the assertion of Sir Edward Coke, quoted by Blackstone. But wool, skins, and leather were taxable at the royal pleasure, these being the hereditary customs of the crown, known in the law-Latin as *custuma antiqua*. Subsequently, under Edward, special duties to be paid by foreign merchants only were levied (*custuma nova*), which were protective in their nature and not merely for revenue. The duty on ordinary goods in this reign was sixpence in the pound; raised to one shilling (5 per cent) under Richard II, reduced to sixpence and again raised to eightpence, it was finally fixed at the shilling rate, where it remained till the reign of William III (1697). The King also had the right of prisage, i.e., of taking from every wine-importing vessel of twenty tuns two tuns for royal use. This duty was called tunnage to distinguish it from the other duties called poundage. Customs duties were originally granted for the defense of the realm, and especially for the protection of traffic on the high seas, and were at first given for a fixed period. To Henry VI, Edward IV, and their successors, they were given for life, until the reign of Charles I, whose unconstitutional levy of these duties without grant of Parliament formed one of the grievances against him. On the restoration of Charles II the duties were again granted for life, and under William and Mary they were made perpetual and assigned to the payment of the national debt.

From an early period it was the custom in England to base tariff duties upon official valuations of imports and exports. A book of rates containing such valuations is known to have been printed in 1545. The struggle between the first Stuarts and Parliament over questions of taxation was precipitated by the arbitrary action of James I in raising the official rates without the consent of Parliament. In 1642 the latter body itself issued a book of rates without the assent of the sovereign. After the Restoration a new book of rates was issued in 1668 with the assent of both authorities. This enumerated as many as 212 articles for taxation outward (i.e., export duties) and 1139 articles for import duties. Official valuations continued to be the basis for tariff purposes all through the eighteenth century, and this is one circumstance which makes it difficult to estimate correctly the value of England's exports and imports during that period. Another confusing practice which prevailed until about 1787 was that of assigning the proceeds from the duties on imports and exports to a variety of different purposes or funds. As a consequence it was often difficult even for customs officials to determine what was the aggregate rate to which a particular article was subject. Pitt's Customs Consolidation Act of 1787 did away with the separate funds by assigning all revenue from duties to the consolidated fund. In this Act some 1200 articles were rated for import duties and 50 for export duties. Another important achievement of Pitt's ministry was the negotiation of a commercial treaty with France (1786) which went far towards freeing trade between the two countries from hampering restrictions. The struggle against Napoleon caused the abrogation of this treaty, but it was the first definite step in the direction of that free-trade policy which England was to adopt some 60 years later. The next simplifications of the English tariff were those effected by Huskisson in 1824 and 1825, which consolidated some 450 trade and tariff acts into eleven and reduced the rates of duty on many articles, particularly exports. One of the most important results of the long struggle for the abolition of the Corn Laws (q.v.) was to simplify still further the English tariff. From 1842 to 1846, 390 duties, including all those on exports, were abolished and 503 were reduced; in 1846, 54 were abolished and 112 reduced; in 1853, 123 were abolished, and finally, in 1860, 371 more were abolished and virtual free trade was achieved. An important incident of the latter year was the negotiation with France of a new commercial treaty which lowered the duty on wine and placed such important French products as silks, gloves, etc., on the free list. For both countries the treaty marked a long step in the direction of free trade, but in the case of France the policy appears to have lacked the support of public opinion and was followed after the Franco-Prussian War by a reaction towards protection. The reduction and abolition of duties continued in England after 1860, the next important change being the placing of sugar on the free list at a sacrifice of some £6,000,000 revenue in 1872. On the outbreak of the Boer War the English tariff included only nine principal items, cocoa, coffee, chicory, dried fruit, tea, tobacco, wine, beer, and spirits. The extraordinary revenue required in connection with that struggle led to the restoration of the duty on sugar, to the imposition of an export duty on coal, and finally to the restoration of light registration duties on grain and flour (3d. and 5d. per cwt. respectively). These duties were repealed after the close of the war.

In the tariff history of France the two commercial treaties with Great Britain that have been referred to stand out as prominent features. Down to the time of the first (1786) the tariff policy of the country had been dictated by extreme mercantilist views of trade. The importation of many commodities was prohibited altogether, while others were admitted only on payment of high duties. Nor was the tariff confined to foreign trade. Each petty province of France had its system of duties, with the result that it was not unusual for the prices of even such common articles as the grains and salt to differ by 100 per cent or more on the same day in different parts of the country. It required nothing less than the Revolution (Decree of 1790) to free the land from these restrictions on internal trade. The bitter national hostilities which grew out of the Revolution and the brilliant years of Napoleon's ascendancy effectually stifled the aspirations for freer trade which ushered in the period. From 1815 until the negotiation of the second commercial treaty with Great Britain in 1860, the tariff policy of France was highly protectionist. The latter treaty was one of the fruits of the Anglomania of Napoleon III and was followed by treaties drafted on equally liberal lines with the more important continental states of Europe, including the German Zollverein (1865). These reduced the rates of duty on French imports to from 10 to 15 per cent *ad valorem*. The same liberal policy was continued substantially until 1881, when an Act was passed substituting specific for *ad valorem* duties and incidentally increasing somewhat the rates. Protectionist sentiment increased after 1881 and by 1892, when many of the commercial treaties negotiated at an earlier period expired, the country was ready for an out-and-out protectionist tariff, including not only high duties on agricultural products and manufactures, but also moderate bounties to producers of silk, flax, and hemp. At this time also the policy of providing maximum and minimum duties (see RECIPROCITY) was introduced. Since 1892 there has been no perceptible abatement in the demand for protection in France, and while French duties are moderate in comparison with those of the United States, she must be included among protectionist countries.

The tariff policy of the states now forming the German Empire first assumed definite form in the German Zollverein (q.v.). The importance of this early federation for tariff purposes in preparing the way for the German Empire is generally conceded. From the point of view of tariff history it is interesting because it enabled Prussia, which was inclined towards free trade during this period, to dominate the tariff policies of her smaller neighbors. A treaty negotiated with Austria in 1853 reduced the duties on trade between that country and the Zollverein, and the even more liberal treaty with France, already referred to, secured the same result for trade with that country in 1865. On the eve of the Franco-Prussian War the tariff of the Zollverein was practically a tariff for revenue only. After the war a reaction towards protection set in. This is clearly indicated in the tariff adopted in 1879, by which the duties on both agricultural and manufactured articles were increased. The policy continued to be only moderately protective until 1902, when an Act was passed which made very substantial concessions to the advocates of protection to agricultural interests. Among the most notable changes were an increase in the duties on grains (the duty on wheat was raised from 32 cents per cwt. to 90 cents) and on draft animals (the duty on horses valued at $250 or less was raised from $2.50 to $22.50).

The changes in the tariff policies of France and Germany that have been described have been paralleled pretty closely in the other countries of continental Europe. England's example and other influences caused a movement in favor of free trade to extend all over Europe in the decade from 1860 to 1870. This was followed by a reaction towards protection in the more important countries, which has gained in volume until in Germany and Russia, at least, the movement is comparable with the protectionist movement in the United States.

Outside of Europe England's free-trade example has been followed only by two or three of her own dependencies (e.g., India). Protective tariffs are found in Canada, in the Australian colonies, and in Cape Colony, and are well-nigh universal among the independent sovereignties. No country has, however, gone further in this direction than the United States.

History of Tariff Legislation in the United States. The earliest tariff in the history of the United States was that approved July 4, 1789. It is interesting to note that the preamble of the Act establishing it states that one of its objects is the encouragement and protection of manufactures, at this early period laying down a principle afterward adopted as the tenet of a political party. In 1817, at the beginning of President Monroe's administration, Congress abolished the internal taxes that had been made necessary by the cost of the War of 1812, and in his message the President recommended the imposition of a protective tariff pure and simple. A temporary protective duty had in 1816 been laid upon cottons and woolens, and in 1818 this was continued for a period of eight years. The rise of the party of Loose Construction, headed by Henry Clay, was favorable to the principle of protection, as the Strict Constructionists held that Congress could impose a tariff only for revenue. In 1819 a protective tariff bill passed the Lower House, but was rejected by the Senate. The election as Speaker, in 1820, of John W. Taylor, of New York, a declared high-tariff man, gave great encouragement to the Eastern manufacturers, and indicates the increasing influence of the protectionists, although in 1822 the Strict Constructionists were able again to defeat bills embodying the protective principle. In 1824, however, the friends of that principle secured a working majority in Congress, and after a prolonged debate adopted a bill whose essential principle was the exclusion from the American market of such foreign goods as competed with those manufactured in the United States.

In 1827 a convention held at Harrisburg, Pa. (July 30), discussed at length the principle of protection. Only four of the slave States sent delegates. The result of the convention was a petition to Congress praying for an increase of duties on certain articles then manufactured in the United States, a request which the Secretary of the Treasury made prominent in his report of the following December. By this time a strong party had been founded to support the protective system, or the American system, as it was popularly called. The famous Tariff of 1828, adopted by Congress after a debate of six weeks, was the immediate result of this party's propaganda. This went further than any act had previously done in the direction of prohibitive duties. The chief articles on which protective duties were laid were woolen and cotton fabrics. At that time the value of the cotton goods annually imported from Great Britain was fully $8,000,000, and that of woolen goods about the same. The exports to Great Britain, on the other hand, of rice, raw cotton, and tobacco (the chief products of the South), reached the sum of $24,000,000 per annum. The Southern producers naturally feared that if the United States should by a high tariff practically prohibit the importation of a large proportion of British goods, retaliatory measures might lead to a diminution of the Southern exports to Great Britain. It was dissatisfaction with the tariff that led to the famous nullification movement in the South in 1832, in which year Congress, while modifying the Act of 1828, distinctly recognized and retained the protective principle.

On March 3, 1833, the so-called Compromise Tariff, introduced by Henry Clay, was passed. It provided for the gradual reduction of the existing tariff until 1842, after which year the duties on all goods were to be 20 per cent. This measure for the time allayed the excitement in the South; but by the year 1842 it was seen that the financial consequences of the steady reduction of the tariff were extremely serious, since government revenues had decreased to an amount less than the expenses. A new tariff was manifestly necessary. Congress passed a bill continuing the duties imposed by the tariff of 1833, and provided for the division of any surplus revenue among the States. This was vetoed by President Tyler as being a violation of the compromise reached in 1833. A revenue tariff was also vetoed, because it contained the distribution clause, but on its being again passed, without this clause, the President signed it (Aug. 9, 1842). In 1846 a revenue tariff that eliminated altogether the principle of protection was passed, its aim being merely to provide an adequate revenue for government expenses. A still further reduction of duties was made by the tariff of 1857, which fixed them at the lowest figures shown since 1816.

In 1861 the Republican party passed the Morrill Tariff, intended primarily to protect American manufactures. Twice in the same year (August 5 and December 24) the duties were still further increased, less for protection, however, than in order to meet the expenses entailed by the Civil War.

It was not until 1880 that the tariff again became an important issue. The Republicans in nominating General Garfield embodied in their platform a strong declaration in favor of maintaining a scale of duties that should continue to protect American industries against foreign competition. The Democrats began to urge the expediency of modifying a tariff which had been framed to meet the conditions of a time of war, and which, they claimed, was hampering commerce, excluding the United States from the markets of the world, and fostering monopolies. They therefore declared for "a tariff for revenue only," which was afterward explained as a tariff that should give incidental protection. In 1882 provision was made by Congress for the appointment of a commission to report upon the expediency of a reduction of the tariff. This reduction became a question of pressing importance, since revenues had so increased over expenses as to accumulate a large and increasing surplus. The Tariff Commission made its report, and in accordance with its recommendations the Act of 1882, a distinctly protectionist measure, was passed. In 1884, the House being Democratic, the bill known as the Morrison Horizontal Reduction Bill for lowering the tariff was defeated. The campaign of that year turned to some extent upon the tariff question, for the Democratic platform, while evading the question of protection, demanded a real reduction of tariff duties, as well as legislation to check the aggression of great corporations. The election of Mr. Cleveland appeared to show that the cry of free trade had ceased to alarm the voters, and that they were willing to hear argument upon the questions at issue. The new President's first message (Dec. 16, 1885) recommended a reduction of the tariff, and his message in December, 1887, was devoted exclusively to this topic. In it he stated that the surplus in the treasury was nearly $140,000,000, demanded as a remedy the immediate abolition of the duties upon wool and other raw materials, and characterized the existing tariff laws as vicious, inequitable, and illogical. In accordance with the views of this message a new tariff measure, the Mills Bill, removing the duty on wool, and aiming at an estimated annual reduction of revenue of fully $50,000,000, passed the House. The Republican Senate offered a substitute repealing the tax upon tobacco and reducing the duty on sugar one-half, thus securing an estimated reduction of $65,000,000 per annum. Neither bill became a law.

The defeat of the Democrats in the presidential election of 1888 was possibly due to the prominence of the tariff question, but as the majority of the popular vote was on their side, it was seen that a reform or, at any rate, a revision of the tariff was sooner or later inevitable. Therefore, the Fifty-second Congress took up the matter in earnest, with the result that the famous McKinley Bill passed both Houses of Congress and was signed by President Harrison (September, 1890). By its provisions the annual reduction of revenue was estimated to be some $66,000,000, of which $6,000,000 was due to a reduction of internal revenue taxes, chiefly on tobacco. A bounty was provided to compensate producers of raw sugar for the abolition of the duty on that commodity.

One very important feature of the McKinley Act was the section added through the influence of James G. Blaine, then Secretary of State, and known as the reciprocity section. This provided that whenever the President shall be satisfied that the government of any country producing and exporting sugars, molasses, coffee, tea, and hides, or any such articles, imposes duties upon products of the United States which in view of the free introduction of such sugar, molasses, etc., into the United States, he may deem to be reciprocally unequal and unreasonable, he shall have the power to suspend by proclamation the free introduction into the United States of such sugars, etc., from the country in question. See CUSTOMS DUTIES; RECIPROCITY.

On the return of the Democratic party to power in 1893, an effort was made to carry out its promise of tariff reform. A bill framed by William L. Wilson passed the House, and after much amendment by the Senate became a law without the President's signature, Aug. 27, 1894. It made a considerable reduction in many duties, admitted wool free, and provided for an income tax. It was still in the main, however, a protective measure. As a revenue law this act was a failure, partly because the Supreme Court declared the income tax feature unconstitutional and partly because of the business depression which began in the summer of 1893 and caused a marked falling off in imports. The dominant issue in the next presidential campaign (1896) was the silver rather than the tariff question, but the election of the author of the McKinley Act was naturally construed as a popular verdict in favor of the policy with which his name was identified. A special session of Congress was called in March, 1897, and after prolonged debate the Dingley Act, copied closely in its leading provisions after the McKinley Act, became a law. Duties on wool, woolen goods, cutlery, pottery, and a few other articles were made even higher in this Act than in the Act of 1890. Lumber was still dutiable, and hides, heretofore admitted free, were taxed, out of deference to the wishes of the so-called "Silver Republicans" in the Senate, who made this concession a condition to their adhesion. The sugar bounty provision of the McKinley Act was not revived, but the reciprocity provisions were, in modified form.

In 1898 (June 13) the so-called "War Revenue Law" was passed to supply the revenue required in consequence of the war with Spain. An interesting feature of this law was that it relied upon increased internal revenue duties and a purely revenue duty of 10 cents a pound on imported tea rather than on changes in the general tariff to secure the additional revenue required. The war taxes were repealed by the Acts of March 2, 1901, and April 12, 1902 (except those on mixed flour). During the session of 1902 to 1903 earnest efforts were made in Congress by members of the Republican party representing some of the States of the Middle West (e.g., Wisconsin) to effect a revision of those clauses of the Dingley Act supposed to be favorable to the trusts, but without success. The sentiment for tariff reduction became sufficiently powerful in the following year to force a pledge of tariff revision upon the Republican party in the campaign of 1908. In the struggle for revision, ending with the enactment of the Payne-Aldrich Act of 1909, the conservatives succeeded in preventing any serious reduction in schedules. This repudiation of party pledges gave strong impetus to the insurgent movement within the Republican party, and later to the formation of the Progressive party. The most notable change made by the Payne-Aldrich Act was the removal of the duty on hides. Duties on leather products were reduced in some instances, and a few minor reductions were made in other schedules. On the whole the old tariff situation was left practically unchanged. An innovation was the maximum minimum principle, by the terms of which the President might, for retaliatory purposes, add 25 per cent to the general tariff rates on products from particular countries. The provision proved of no practical value.

In 1913, with the Democrats in control of all branches of the government, a sweeping revision was put through under the name of the Underwood Act. The most important changes were in the iron and steel schedules, where the raw material and half manufactures were placed on the free list and the finished product suffered a corresponding reduction; free wool; gradual reduction of duty on sugar, with ultimate free sugar in 1916. The duty on sugar, reduced to 1¼ cents a pound, was retained in the revenue law of 1916.

Administrative Aspects. There is a marked difference in form between purely revenue tariffs, such as that of Great Britain, and protective tariffs like those of the United States and Germany. In the former only the few articles subject to duty are enumerated and unenumerated articles are admitted free. In the latter all articles that may claim free admission are expressly enumerated in the so-called "free list," and other articles are subject to duty either under the special schedules or under the so-called "drag-net clause," which imposes a certain rate of duty on unenumerated articles. The German tariff of 1902 enumerated nearly 1000 different classes of commodities, while in the American tariff of 1897 the free list alone contains nearly 250 separate items.

Another difference that has frequently characterized protective and revenue tariffs in the United States is that the duties in the former are mainly specific, i.e., based on the quantities or the number of units of the commodities imported, while in the latter they are mainly ad valorem, i.e., a certain per cent of the value of the commodities imported. The preference of protectionists for specific duties is to be explained partly by the greater certainty of such duties, since they cannot be evaded by undervaluations, and partly by their conviction that since protection rather than revenue is the object sought, the ordinary canons of taxation, which prescribe that taxes shall be in proportion to the value of the property taxed, may be disregarded. The identification of specific duties with protection appears to be confined to the United States, since even in free-trade England all the duties now imposed are specific. The administrative advantage of such duties, which are practically self-assessing, need scarcely be dwelt upon.

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TARIFF LAWS. See Tariff.

TARIFFS, Railway. See Railways.

TARIJA, tȧ-rē′hȧ. A department of south Bolivia (Map: Bolivia, E 8). Its boundaries are ill defined. Area (est.), 33,000 square miles. The surface in the western part (one-third of the area) is very mountainous, and in the east is flat, resembling the Chaco of Paraguay, of which it is a continuation. There are extensive forests and large stretches of grazing land. The chief river is the Pilcomayo. The principal industries are agriculture and stock raising, both undeveloped. Extensive mineral resources, especially silver, are unworked. The population is sparse and mostly in the mountainous region. The completion of the La Quiaca-Uyuni railway will afford the department a better outlet and produce a rapid development of the region. Pop., 1900, 102,887; 1914 (est.), 146,099. Capital, Tarija (q.v.).

TARIJA. The capital town of the Department of Tarija, Bolivia, on the upper course of the Vermejo, 180 miles south of Sucre, near the border of Argentina, with which it has extensive trade (Map: Bolivia, E 8). The climate is pleasant. Pop., 1914 (est.), 7817.

TARIK, tä′rēk, Ibn Ziad (?–c.720). The leader of the first Moslem invasion of Spain. He was a Berber, and had been converted to Mohammedanism by the Emir Musa, who made him Governor of Tangier. It was probably on April 30, 711, that Tarik landed at Gibraltar (i.e., *Djebel-Tarik*, the hill of Tarik) with a force of 7000 men. He speedily overran Andalusia, and on July 19, 711, the Visigothic King Roderick (q.v.) was defeated, near Vejer, or Jerez, de la Frontera. Musa, however, became jealous of his successful lieutenant, and joined him in the summer of 712 at Toledo with about 18,000 men. There were frequent quarrels between Musa and Tarik, until finally both were summoned to Damascus by the Caliph Solyman. Musa was disgraced, while of Tarik nothing further is known. Consult U. R. Burke, *History of Spain*, vol. i (New York, 1900), and *Cambridge Medieval History*, vol. ii (ib., 1913).

TARIM, tȧ-rēm′. The principal river of Chinese Turkestan (Map: China, D 3). It rises in the Karakorum Range in the extreme northern part of Kashmir, and flows north, east, and southeast through the great desert basin of Turkestan, emptying into the collection of lakes and marshes known as Lob Nor (q.v.) at the northern base of the Altyn-Tagh. Its length is estimated at over 1000 miles, including the upper course, which is generally called the Yarkand-Darya. After leaving the lofty glaciers of the Karakorum it pierces the Kuen-lun Mountains, and then descends to the plain, where it passes the city of Yarkand. Farther north it receives two large tributaries, the Aksu from the north and the Khotan-Darya from the south, below whose confluence the united stream is known as the Tarim proper. It soon divides into two arms, which flow parallel for a long distance. Receiving no more tributaries, it decreases rapidly in volume by evaporation and by being used for irrigation. As it enters the Lob Nor region, however, the Tarim receives the Cherchen from the Tibetan plateau and another large affluent from the north. Consult Ellsworth Huntington, *The Pulse of Asia* (Boston, 1907), and S. A. Hedin, *Central Asia and Tibet* (New York, 1908).

TARKINGTON, (Newton) Booth (1869–). An American novelist, born in Indianapolis, Ind., and one of the group of Hoosier (Indiana) writers, which included also, notably, Edward Eggleston and James Whitcomb Riley and Meredith Nicholson. In 1893 he graduated from Princeton University, and thereafter devoted himself chiefly to literature, although in 1903 he served in the Indiana Legislature. His first published novel, *The Gentleman from Indiana* (1899), is in part a realistic study of life in a small mid-western town, in part a romance. It gained and held popular fancy. *Monsieur Beaucaire* (1900) is a spirited and artistically written little romance of eighteenth-century England. In *The Two Vanrevels* (1902) Tarkington returned to social life in an Indiana town for his setting, portraying it with plenty of romantic sentiment and a dash of melodrama. The short stories *In the Arena* (1905) are studies of American political conditions of the day. In 1905 appeared also *The Conquest of Canaan*, with its very American hero, who lived down a bad reputation and became mayor of his town, and *The Beautiful Lady*, a pleasing romantic trifle with a Parisian setting. Romantic also is his *Guest of Quesnay* (1908), a tale with a strong diffusion of fantasy, and agreeably set in the highways and byways of rural France. *Penrod* (1914) is an amusing and unmerciful, yet withal sympathetic, study of a small boy, and *Seventeen* (1916) treats of a very young man in the same style. *The Turmoil* (1915) is a novel concerned with the influence of a city's industrial progress on its social life. Among other of Tarkington's books are: *Cherry* (1903); *His Own People* (1907); *Beasley's Christmas Party* (1909); *Beauty and the Jacobin* (1911); *The Flirt* (1913). With Harry Leon Wilson (q.v.) Tarkington wrote several plays, including *The Man from Home* (1907); and the dramatized *Monsieur Beaucaire* was produced with great success by Lewis Waller (q.v.). He was elected to membership in the National Institute of Arts and Letters. Consult F. T. Cooper, *Some American Story Tellers* (New York, 1911).

TÁRLAC, tär′läk. A province of Luzon, Philippine Islands (Map: Philippine Islands, C 3). Area, 1205 square miles. The eastern part is level, while the western portion comprises the slope of the Cordillera de Cabusilán. The main highway and the railroad traverse the province from north to south. Rice and sugar cane are the principal agricultural products, though some tobacco and corn are raised in the higher altitudes. The forests of the province are of great value; oranges, lemons, and bananas are produced in great variety. The languages are Tagalog, Pampango, and Pangasinán. The capital is Tárlac (q.v.). Pop., 1903, 135,107.

TÁRLAC. The capital town of the Province of Tárlac, Luzon, Philippines, on the right bank of the river of the same name, a tributary of the Agno, 73 miles northwest of Manila (Map: Philippine Islands, C 3). It is on the Manila and Dagupán Railroad, and has excellent road connection with surrounding towns. Pop., 1903, 12,340.

TARLATAN, tär′lȧ-*tan* (probably from Milanese It. *tarlantanna*, linsey-woolsey). A thin, gauzelike fabric of cotton. It is usually dyed or printed in colors, and is often of a rather coarse quality.

TARLETON, tärl′*to*n, Sir Banastre (1754–1833). An English soldier in the American Revolutionary War, born in Liverpool, and educated at Oxford. In 1776 he took part in Clinton's operations against Fort Moultrie (q.v.). Later in the year, under Sir William Erskine, he served in the successful operations in the vicinity of New York, and early in 1777 was with Cornwallis in New Jersey. With the army under Howe, the commander in chief, he took part in the battles of Brandywine and Germantown and the occupation of Philadelphia. In January, 1778, he was promoted captain, and in the following year was made lieutenant colonel of the British legion, a force of cavalry and light infantry, with which he very substantially aided the British cause in the South until the fall of Yorktown in October, 1781. He was an able and intrepid cavalry leader, but gained a reputation for cruelty until Tarleton's quarter came to mean general butchery. Dispatched by Cornwallis, he defeated with great slaughter the superior force of Lieutenant Colonel Buford at Waxhaw Creek, May 29, 1780; he routed a part of General Gates's force at Camden, August 16, and defeated General Sumter at Catawba Fords, August 18. On Jan. 17, 1781 he was defeated by General Morgan at Cowpens. He was with Cornwallis at the final surrender and returned to England in 1782. Representing the opposition, he was elected to represent Liverpool in Parliament in 1790, and there he remained, excepting a brief interruption in 1806–07, until 1812. He was made major general (1794), Governor in Berwick and Holy Island (1808), general (1812), and Baronet (1815). He wrote a *History of the Campaigns of 1780 and 1781 in the Southern Provinces of North America* (1787), a work marred by vanity and partisanship.

TARL'TON, Richard (?–1588). An English comedian of Queen Elizabeth's time. Little is known of his life, but he is said to have been born in Shropshire and to have been at one time keeper of a public house. As an actor he became in 1583 one of the Queen's players who were called the Grooms of the Chamber. A *platt* (or plot) exists of the second part of a play named *The Seven Deadlie Sinns*, as arranged by Tarlton, the dialogue of which was probably largely extemporized. He won such reputation for his constant jesting that his name was attached to many of the witticisms of the day, as well as to ballads and other pieces whose authors thus aimed to profit by his popularity. A collection of jokes called *Tarlton's Jests* was published a few years after his death; republished as edited by Halliwell for the Shakespeare Society in 1844, with *Tarlton's Newes out of Purgatorie*, which had appeared in 1590, in the form of a message from the dead actor in the other world. He is said to have been the Yorick referred to in *Hamlet*.

TARN, tärn. A department of south France, in Languedoc (Map: France, S., G 5). Area, 2231 square miles; pop., 1901, 332,093; 1911, 324,090. The surface is in general elevated and well wooded, and is watered by the river Tarn. In the south and southeast are offshoots of the Cévennes. Coal, iron, copper, and lead are mined and there are lucrative deposits of gypsum and porcelain clay. The vine is extensively cultivated, and there are manufactures of spirituous liquors, woolens, cottons, and silks, iron, leather, and paper. Albi is the capital.

TARN-ET-GARONNE, -ȧ-gȧ'rŏn'. A department of south France, formed mainly out of the old Province of Guienne (Map: France, S., F 4). Area, 1441 square miles; pop., 1901, 195,669; 1911, 182,537. The surface is marked by plateaus with an average altitude of 1000 feet, the highest hills not rising above 1600 feet. The principal rivers are the Garonne and its affluents, the Tarn and Aveyron. Cereals are raised in great quantities, and the grapevine and mulberry are extensively cultivated. Mules and poultry are raised; coal and iron are mined; marble is quarried, and there are manufactures of woolens, linens, silk, iron, cutlery, and beet sugar. Capital, Montauban.

TARNIER, tȧr'nyā', Héphane (1828–97). A French gynæcologist. Born at Aiserey (Côte-d'Or), he received his medical education at Paris, where he became agrégé and chief gynæcologist of the Hôpital de la Maternité in 1867. In 1884 he succeeded Pajot in the Ecole de Médecin, and in 1888 was appointed professor of gynæcology of the Faculté de Médecin at Paris. In 1892 he became a member of the Academy of Medicine, whose president he was in 1891, and in 1892 he was elected president of the Obstetrical Society, which he had helped to found. Tarnier was one of the leading French gynæcologists of his time, especially successful in his fight against puerperal fever. His best-known work is *Traité de l'art des accouchements* (1878–1901).

TARNOPOL, tär'nō-pōl. A town of Galicia, Austria, 76 miles east-southeast of Lemberg, on the Sereth (Map: Austria, J 2). Among the industrial establishments are refineries for spirits, breweries, and steam mills. It suffered severely during the Russian invasions in 1914 and 1915. (See War in Europe.) Pop. (commune), 1910, 33,853, about half Poles and half Jews.

TARNOW, tär'nōv. A town of Galicia, Austria, 137 miles west of Lemberg, on the Dunajec, near its confluence with the Biala (Map: Austria, G 1). The chief manufactures are of agricultural implements; there are steam, flour, and saw mills. Tarnow was captured but later evacuated by the Russians in the Great War which began in 1914. (See War in Europe.) Pop. (commune), 1900, 33,974; 1910, 36,731.

TARNOWSKI, tär-nôf'skē, Stanislav, Count (1837–). A Polish historian of literature, born at Dzikov, Galicia. He studied in Cracow and Vienna, spent nearly two years in confinement because implicated in the revolt of 1863, was elected to the Galician Diet and the Austrian Reichsrat in 1867, and subsequently devoted himself entirely to literary studies. In 1871 he was appointed professor of Polish literature at the University of Cracow. In 1885 he became a member of the Austrian House of Lords, and in 1890 president of the Cracow Academy of Sciences. With Szujski he established the conservative *Przeglad Polski*, in which he published many of his literary monographs, distinguished by thoroughness, keen judgment, and elegance of style. His writings include essays *On the Polish Novel in the Nineteenth Century* and *On the Decadence of Polish Literature in the Eighteenth Century*, *On the Comedies of Fredro*, *Schiller's Dramas*, *Shakespeare in Poland*, but his principal works are *Studies in the History of Polish Literature* (1886–92) and *History of Polish Literature*, in six volumes (*Historya literatury polskiej*, Cracow, 1900 et seq.).

TARO, tä'rō (Polynesian name), or **TARA** (*Colocasia antiquorum esculenta*). A plant of the family Araceæ, cultivated for its roots, which are a leading article of food in the South Sea Islands. The tuberous roots, which are from 12 to 16 inches in length, are washed to remove their acidity and boiled or roasted, the rind being first scraped off. In Hawaii the cooked root is fermented, the product being called poi. The young leaves are used like spinach and the young shoots like asparagus. See Cocco; Elephant's Ear.

TARO (*Colocasia antiquorum esculenta*).

TARPAN, tär′pän. The Mongolian name for the wild ass, kiang, or dziggetai, of the high plateaus of Central Asia. See Ass.

TARPEIA. See Tarpeian Rock.

TARPEIAN (tär-pē′yan) **ROCK** (Lat. *Rupes Tarpeia*). A portion of the southern part of the Capitoline Hill in Rome. (See Capitol.) According to tradition, in the time of Romulus, Tarpeia, daughter of Tarpeius, governor of the Roman citadel on the Capitoline, covetous of the golden ornaments of the Sabine soldiery, and tempted by their consent to give her what they wore on their left arms, opened a gate of the citadel to the Sabine King, Titus Tatius, who had come to avenge the rape of the Sabine women. The Sabines crushed Tarpeia to death beneath their shields, and she was buried in the part of the hill which bears her name. From early times criminals were frequently put to death by being hurled from the Tarpeian rock. Consult the article "Tarpeius," in Friedrich Lübker, *Reallexikon des klassischen Altertums* (8th ed., Leipzig, 1914).

TAR′PON (from the North American Indian name), or Tarpum. A great herring-like fish (*Tarpon atlanticus* or *Megalops thrissoides*) of the West Indies and neighboring waters, which, with a few other species scattered about the tropical world, represents the isospondylous family Elopidæ. This fish is regarded by many anglers as affording sport with a rod and line superior to that given by any other fish. The tarpon (see Colored Plate of American Game Fishes, accompanying article Trout) has something the shape of a salmon, and great power in swimming and leaping. It is often 6 feet in length and may weigh 100 pounds. It preys upon other fishes and small fry. The flesh is poor and not much valued as food, but the great silvery cycloid scales are much used in ornamental work. Another species of the family (*Elops saurus*) is about half as large; it is abundant about all tropical coasts, and is known under a great variety of names.

TARPON FISHING. The sport of angling for tarpon (q.v.) with rod and line is the most skillful and exciting which America affords. The angler goes in a small boat some distance from shore, with an experienced man to row it, and uses a heavy rod, 7½ to 8 feet long, with a multiplying reel, 200–250 yards of linen line, and a spoon bait. When a fish weighing perhaps 100 pounds seizes this, and begins those rushes and mighty leaps which have given the silver king the just title of greatest of game fishes, the power and science of the angler are both tested in the highest degree. Excellent tarpon fishing may usually be obtained all around the southern coast of Florida and its reefs; and also along the coast of Texas. Consult American books mentioned under Fish; and Angling.

TARQUIN′II. The name of an ancient Etruscan city. See Corneto.

TARQUIN′IUS. The family name of two kings of Rome. With the legends regarding them, the fortunes of the city are closely interwoven. 1. Demaratus, a Corinthian noble, emigrated to Tarquinii, in Etruria, where he married an Etruscan wife. A son, Lucumo, married into a noble Etruscan family, and emigrated to Rome, where he was hospitably received and soon after admitted to the rights of citizenship, as Lucius Tarquinius Priscus. The Roman monarch, Ancus Marcius, appointed him guardian of his children; on the death of Ancus (616 B.C.), the Senate and the citizens unanimously elected Tarquinius to the throne. He forced the 12 sovereign cities of Etruria to recognize his supremacy. To him also are ascribed the construction of the magnificent cloacæ, or sewers; the laying out of the Circus Maximus; the building of shops (*tabernæ veteres*) adjoining the Forum; the institution of the Great or Roman Games; and the foundation of the Capitoline temple. He was assassinated in 578 B.C., at the instigation of the sons of Ancus Marcius, who considered themselves entitled to the throne. Their crime did not avail them, for Servius Tullius was elected to the vacant throne. 2. Lucius Tarquinius Superbus, son of (1), having murdered his father-in-law, Servius Tullius (q.v.), is represented as audaciously usurping the throne (534 B.C.); but as the whole drift of his legislative policy was to abolish the reforms of Servius, the real significance of this part of his career lies in the fact that it indicates a successful reaction, on the side of the patricians, against the more liberal and progressive policy of the preceding age. That the younger Tarquinius, at least, is an historical character, seems to be pretty generally allowed. By intrigues he obtained or consolidated the Roman hegemony in Latium. He offered sacrifice in the name of all the Latins at the Alban Mount; fused the contingents of the Latins with the Roman legion; put to death as traitors such of their chiefs as opposed him; and, at the head of the combined forces, successfully attacked the Volscians. On his return he completed the building of the temple of Jupiter Capitolinus, which the elder Tarquinius had begun, and deposited in the vaults the Sibylline Books. (See Sibyl.) But his lavish expenditure both in war and peace necessitated the imposition of heavy taxes, and the patience both of plebs and patricians was beginning to give way. During a war against the Rutuli Tarquinius laid siege to the town of Ardea. Here in the Roman camp occurred the famous dispute between Sextus Tarquinius, the son of the King, and Collatinus, about the virtues of their respective wives, which led to the rape of Lucretia (q.v.). L. Junius Brutus (q.v.) carried the news of the outrage to Rome and called upon the people to rise against the tyrant, who was deposed by the Senate; finally, the army before Ardea revolted, Tarquinius and his sons were obliged to flee, and an aristocratic republic was constituted at Rome (509 B.C.). Three different attempts were made to restore Tarquinius by force: first, by his own Etruscan kinsmen of Tarquinii; second, by Lars Porsena (q.v.) of Clusium; third, by his son-in-law, Octavius Mamilius. All these, according to the legend, failed; and at length Tarquinius, utterly beaten, retired to Cumæ, where he died. The expulsion of the Tarquinius has been interpreted as a revolt of Romans and Sabines against Etruscan domination of Rome. Consult: Livy, i, 34–41, 46–60; Dionysius of Halicarnassus, iii, 46–73, v, i–vi, 21; Sir G. C. Lewis, *Credibility of Early Roman History* (London, 1855); W. Ihne, *Early Rome*, vol. i (New York, 1878); E. Pais, *Storia di Roma*, vol. i (Rome, 1898); id., *Storia critica di Roma*, vol. i (ib., 1913); and the article "Tarquinius" in Friedrich Lübker, *Reallexikon des klassischen Altertums* (8th ed., Leipzig, 1914).

TARR, Ralph Stockman (1864–1912). An American geographer, born at Gloucester, Mass. He was educated at Lawrence Scientific School, Harvard, and after 1897 was professor of dynamic geology and physical geography at Cornell, where he had been an assistant professor for five years. Besides acting as associate editor of the *Bulletin of the American Geographical Society* and the *Journal of Geography*, he published: *Economic Geology of the United States* (1893); *Physical Geography of New York State* (1902); *New Physical Geography* (1903); *Geography of Science* (1905), with C. A. McMurry; and the posthumous *College Physiography* (1914) and *Alaskan Glacier Studies* (1914), with Lawrence Martin. Tarr contributed to the New International Encyclopædia.

TARRAGON, tăr′ȧ-gŏn. A garden herb. See Artemisia.

TARRAGONA, tăr′rȧ-gō′nȧ (Lat. *Tarraco*). A seaport of Spain, capital of the province of the same name, in Cataluña, situated on the Mediterranean at the mouth of the Francolí, 63 miles southwest of Barcelona (Map: Spain, F 2). On the land side it is bordered by the beautiful Campo de Tarragona, whose agricultural products form an important part of its trade. The local industries embrace manufactures of alcohol, liquors, soap, flour, silks, paper, and salted fish. Since 1892 it has been an important port of entry. The town contains a normal school for both sexes, a museum of archæology, and several hospitals. The nucleus of the old city is situated on a steep hill, now crowned by the cathedral and the Bishop's Palace. Pop., 1900, 26,281; 1910, 23,289. The city was probably founded as a Greek colony. Under the Romans it enjoyed a prominent position from the time of the Scipios, being at one time a residence of Augustus. It gave its name to the Province of Hispania Tarraconensis. From this period still survive a portion of the ancient wall, with cyclopean remains, an amphitheatre, the ruins of the palaces of Augustus and of Pontius Pilate, and an aqueduct still in use. The city was destroyed by the West Goth Euric (475). It was taken by the Arabs in 713 and partially destroyed, but was restored by Abd ur Rahman (780). In the twelfth century it was taken by the Christians and became an archiepiscopal see. In 1811 it underwent a siege and sack by the French under Suchet.

TARRASA, tȧr-rä′sȧ. A town in the Province of Barcelona, in Cataluña, Spain, 22 miles northwest of the city of Barcelona, on the Barcelona-Lérida line of the Northern Railway. It is an important industrial centre, with manufactures of cotton and woolen cloths. The Romanesque churches of San Pedro and San Miguel date from the Christian reconquest, but most of its structures are modern, including a large royal college, industrial schools, chamber of commerce, and two theatres. Pop., 1900, 15,872; 1910, 22,679.

TARRASCH, tär′räsh, Siegbert (1862–). A German chess master, born in Breslau. He studied medicine at Berlin and Halle, and practiced his profession in Nuremberg, where in 1883 he won his mastership in chess. His success in chess continued, and at the international tournaments in Breslau (1889), Manchester (1890), and Dresden (1892), he won the first prize with only a single game lost. At the tournament held in 1898 at Vienna he tied with the American, Pillsbury, for first prize, winning on the play-off; was sixth at the International Masters' Tournament held at Monte Carlo in 1903, and again won first place in the tournament at Ostend in 1907. He became distinguished for careful play and ingenious combinations. He published: *300 Schachpartien, gespielt und erläutert von Tarrasch* (1894); *Der Schachwettkampf Marshall-Tarrasch* (1897); *Das Champion-Turnier zu Ostende* (1907); *Das Grossmeisterturnier zu St. Petersburg im Jahre 1904* (1914).

TAR′RYTOWN. A village in Westchester Co., N. Y., 25 miles north of New York City; on the east side of Tappan Bay, an expansion of the Hudson River, and on the New York Central Railroad (Map: New York, B 2). It is situated on ground rising from the river and is a residential place. The vicinity of the village, which has been made famous by Washington Irving (see Sleepy Hollow), is of great interest because of its connection with the history of the Revolutionary period. Irving's burial place is in Sleepy Hollow Cemetery, about three-fourths of a mile north of the village. The Dutch Church, dating from 1685, and the Philipse Manor House, built from 1683, are the most noteworthy of the older buildings. Other features of Tarrytown include Miss Mason's School, familiarly known as the Castle, the Tarrytown Lyceum, the Institution of Mercy (Roman Catholic), and Irving Institute. Drill and automobile works are the leading industrial establishments. Pop., 1900, 4770; 1910, 5600.

The name Tarrytown is derived from the Dutch word terwen, meaning wheat, on account of the quantity of that grain raised in the neighborhood. In 1683 Vredryk Flypse (Frederick Philipse) moved here and 10 years later secured manorial rights to the adjacent territory. Major André was captured here on Sept. 23, 1780. About two miles south of the village, at Irvington, is Sunnyside, the home of Washington Irving. Consult E. M. Bacon, *Chronicles of Tarrytown and Sleepy Hollow* (New York, 1897), and H. W. Mabie, "Tarrytown," in L. P. Powell (ed.), *Historic Towns of the Middle States* (ib., 1899).

TARSHISH, tär′shĭsh. According to the Old Testament, a region which was the resort of Phœnician commerce, and the source of valuable mineral products. The earliest mention is in Genesis, x. 4, where it is associated with lands probably identical with Crete, Cyprus, and Rhodes. Its special trade was with Tyre, which seems to have been there a colonial factory (cf. Isa. xxii; Ezek. xxvii. 12, 25). Certain texts, however, seem to oppose this western location. "Ships of Tarshish" are mentioned as starting from Solomon's port at Ezion-geber (q.v.) on the Red Sea (1 Kings x. 22; xxii. 48); while the Chronicler (2 Chron. ix. 21; xx. 36–37) makes them go to Tarshish from that point. Hence has arisen the view that the Hebrews and Phœnicians circumnavigated Africa, or else that there was an Oriental land of Tarshish in addition to the Occidental one. Ship of Tarshish, however, is now generally supposed to mean some kind of large vessel designed for distant voyages. Tarshish is, as a rule, identified with the Tartessus of Herodotus (iv, 152), Strabo (ii, 158), and other Greeks, at the mouth of the Guadalquivir, near Cadiz; and the southern part of Spain in general is largely accepted as the region of Tarshish. The location in Spain would agree with the products assigned to Tarshish, silver, iron, lead, while the tin may have been brought thither from the British Isles. Also the jewel called the stone of Tarshish, or simply a tarshish (translated beryl in Ex. xxviii. 20, and elsewhere), may represent one of the numerous precious stones found in Spain. See OPHIR. Consult: Z. Bochart, *Geographia Sacra* (Caen, 1646); A. Ritter, *Comparative Geography*, vol. i (Eng. trans., Edinburgh, 1886); Hugo Winckler, *Forschungen*, vol. i (Leipzig, 1893) T. K. Cheyne and W. M. Müller, in *Orientalische Litteraturzeitung*, vol. iii (Leipzig, 1900); Johannes Dahse, "Ein zweites Goldland Salomos," in *Zeitschrift für Ethnologie*, vol. xliii (Berlin, 1911).

TARSIA, tär′sē-á, or **INTARSIA** (It., from Lat. *interserere*, to insert, equivalent to the Eng. *inlay* and the Fr. *marquetry*). Tarsia is the term applied particularly to Italian inlays of the fourteenth, fifteenth, and sixteenth centuries. Consult F. H. Jackson, *Intarsia and Marquetry* (London, 1903). See INLAY; MARQUETRY.

TARSIER, tär′sĭ-ēr (Fr. *tarsier*, from Neo-Lat. *Tarsius*, from *tarsus*, from Gk. *ταρσός*, board surface), or MALMAG. A genus of small East Indian animals (*Tarsius*), closely related to the lemurs, but set apart in a family Tarsiidæ, which inhabit trees in the Malayan and Philippine Archipelago and have the general habits of lemurs. Seven species are recognized. The best known of these, *Tarsius philippensis*, is confined to the islands of Samar and Mindanao, is nowhere common, is nocturnal, and feeds upon insects and small reptiles. In size it is about as large as a rat, has a large, broad head, with very large eyes, teeth of a generalized type, very long half-naked hind legs and short forelegs, and the long bony toes end in large pads beneath the terminal joints. The tail is long and tufted at the end. It moves by long leaps from bough to bough. The wide-spread scientific name *Tarsius spectrum* is undeterminable. Cf. GALAGO and MOUSE LEMUR; and consult authorities and Plate under LEMUR.

TARSIPES, tär′sĭ-pēz. See PHALANGER.

TAR′SUS (Lat., from Gk. *Ταρσός*, *Tarsos*, *Ταρσοί*, *Tarsoi*). The chief city of ancient Cilicia (q.v.), and of eastern Asia Minor, situated on both sides of the navigable river Cydnus, in the midst of a beautiful and productive plain, about 10 miles from the sea (Map: Turkey in Asia, C 3). Tarsus commanded the pass over Mount Taurus, the Cilician Gates, which formed the only means of communication with northern and western Asia Minor, and in almost equal measure the route to northern Syria and the East by the Amanian or Syrian Gates. The first mention of the place as Tarzi is on the Black Obelisk of Shalmaneser II, about the middle of the ninth century B.C., where its capture by the Assyrians is recorded. It was the capital of the Kingdom of Cilicia, which was long ruled, under Persian suzerainty, by a line of kings who bore the hereditary name of Syennesis, and later was the residence of a Persian satrap. With the conquest of Alexander the Great, it passed into Greek hands, and during the following period was usually in the power of the Seleucidæ of Syria. At the end of that century it passed under the Roman supremacy, and upon the organization of the Province of Cilicia (64 B.C.) it became the capital of that province. Later, Mark Antony made it a free city; here in 38 B.C. he was visited by Cleopatra. Under the Empire the free city seems to have enjoyed a popular form of government with a property qualification for the franchise. This gives additional point to the claim of the Apostle Paul —a native of this place—to be a citizen of Tarsus, as that implied a certain social position. All Cilicia passed under the control of the Arabs in 660 A.D. In 964–966 Nicephorus II Phocas (q.v.) conquered Cilicia for the Byzantine Empire. Tarsus was a place of consequence even in Byzantine times, but suffered from its proximity to the Syrian frontier. In the eleventh to the thirteenth century the city formed a part of Lesser Armenia. About the beginning of the sixteenth century it passed under Turkish control. The modern town, though large, with a population of about 25,000, is dirty and mean, containing no vestige of its ancient splendor, and but few visible ancient ruins. The most conspicuous ruin is the large concrete foundation of a Roman building, popularly called the Tomb of Sardanapalus. Consult W. M. Ramsay, "Cilicia, Tarsus, and the Great Taurus Pass," in *Geographical Journal* (London, 1903), and id., *Cities of St. Paul* (New York, 1907).

TARSUS, THEODORE OF. See THEODORE OF TARSUS.

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